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Draft Environmental Assessment and Draft Finding of No Significant Impact for the Palisades Nuclear Plant Reauthorization of Power Operations Project

Draft Environmental Assessment and Draft Finding of No Significant Impact for Comment

Docket Number: 050-0255

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Cooperating Agency:

U.S. Department of Energy

Environmental Center of Expertise

Environmental Center of Expertise
Division of Rulemaking, Environmental, and Financial Support
Office of Nuclear Material Safety and Safeguards

COMMENTS ON DRAFT REPORT

Proposed Actions

The U.S. Nuclear Regulatory Commission (NRC or Commission) granting of Holtec Decommissioning International, LLC's, and Holtec Palisades, LLC's, interdependent, connected licensing and regulatory requests (see Table 1-1 of this environmental assessment [EA]) that if approved, would collectively support reauthorizing refueling and power operations of Palisades Nuclear Plant (Palisades), through March 24, 2031 which is the end of the current operating license term under the Palisades Renewed Facility Operating License No. DPR-20. Palisades is located in Van Buren County, Michigan.

The U.S. Department of Energy (DOE) Loan Program Office's (LPO's) Federal action, that if approved, would provide Federal financial assistance for refueling and resumption of power generation activities at Palisades pursuant to Holtec's loan guarantee agreement with DOE that was issued pursuant to the Energy Policy Act of 2005.

Type of Statement

Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI)

Agency Contact

Mary Richmond; Laura Willingham
U.S. Nuclear Regulatory Commission (NRC)
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001
Email: Mary.Richmond@nrc.gov; Laura.Willingham@nrc.gov

Comments: Any interested party may submit comments on this draft EA and draft FONSI. The public commenting process affords an opportunity for public input on NRC decision-making and allows the public an opportunity to comment on alternatives and on the NRC's analysis of potential environmental effects. Public commenting allows the NRC to make better informed decisions.

The deadline for submitting comments on this draft EA is 30 days after the date that it is published in the *Federal Register*. Comments received after the expiration of the comment period will be considered if it is practical to do so, but assurance of consideration of late comments cannot be given. The NRC encourages electronic comment submission through the Federal Rulemaking website (https://www.regulations.gov) or via email to PalisadesRestartEnvironmental@nrc.gov. Please include Docket ID NRC-2024-0076 in your comment submission. The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC will post all comment submissions at https://www.regulations.gov, as well as enter the comment submissions into Agencywide Documents Access and Management System. The NRC does not routinely edit comment submissions to remove identifying or contact information.

If you are requesting or aggregating comments from other persons for submission to the NRC, then you should inform those persons not to include identifying or contact information that they do not want to be publicly disclosed in their comment submission. Your request should state that the NRC does not routinely edit comment submissions to remove such information before making the comment submissions available to the public or entering the comment into Agencywide Documents Access and Management System.

ABSTRACT

The Palisades Nuclear Plant (Palisades), located along the shoreline of Lake Michigan in Covert Township, Van Buren County, Michigan, consists of a single unit pressurized water nuclear reactor. Palisades permanently ceased operations on May 20, 2022. In accordance with the Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.82(a)(1)(TN249), Entergy Nuclear Operations, Inc., as the licensee who operated the facility prior to entering decommissioning, on June 13, 2022, submitted certifications to the U.S. Nuclear Regulatory Commission (NRC or Commission) for the permanent cessation of operations (May 20, 2022) and the permanent removal of fuel from the reactor vessel (June 10, 2022). As part of the transition from an operating reactor to a reactor in a decommissioned state, the NRC issued Amendments 266, 267, and 272 to the Palisades Renewed Facility Operating License (Palisades RFOL) to reflect the permanently defueled status (NRC 2018-TN10957, NRC 2018-TN10958, NRC 2022-TN10543). The current licensing status of Palisades is such that the Palisades RFOL exists and specifically affords authorization for decommissioning and associated activities, but not power operations.

Prior to submitting the Palisades 10 CFR 50.82(a)(1) certifications, Entergy submitted a license transfer request to make Holtec Palisades, LLC (Holtec Palisades) the licensed owner and to transfer licensed operational authority from Entergy to Holtec Decommissioning International, LLC (HDI)(Entergy 2020-TN10832). This transfer request was approved by the NRC staff, and the conforming license amendments were issued on June 28, 2022 (NRC 2022-TN10545). Subsequent to the cessation of power operations and the commencement of decommissioning at Palisades, HDI, the licensing authority during decommissioning, began to pursue a path to resume power operations. Throughout 2023 and 2024, HDI submitted a set of licensing and regulatory requests for NRC approval—the proposed actions before the NRC—to support reauthorizing power operations at Palisades through March 24, 2031, the end of the current operating license term under the Palisades RFOL.

This environmental assessment (EA) describes the environmental review conducted by the NRC staff for the set of licensing and regulatory requests submitted by HDI in support of the reauthorization of power operations at Palisades through March 24, 2031, the end of the current operating license term under the Palisades RFOL No. DPR-20. In addition to the set of licensing and regulatory requests related to the potential reauthorization of power operations at Palisades, Holtec submitted an application for a loan from the U.S. Department of Energy's (DOE's) Loan Program Office (LPO) to finance refueling and resumption of power generation activities of the Palisades' 800 megawatts electric (MWe) nuclear generating station. As such, DOE LPO is a cooperating agency for this environmental review.

This EA follows procedures specified in 10 CFR 51.30 (TN10253), "Environmental Assessment," and 10 CFR 51.31, "Determinations Based on Environmental Assessment," which are the NRC's regulations for preparing EAs to implement the National Environmental Policy Act of 1969 (TN661), as amended. The NRC staff concludes that the potential direct, indirect, and cumulative environmental impacts from the reauthorization of power operations at Palisades would not be significant and has determined that a draft Finding of No Significant Impact is warranted.

TABLE OF CONTENTS

ABSTRACT ..... **iii**

TABLE OF CONTENTS ..... **v**

LIST OF FIGURES ..... **xi**

LIST OF TABLES ..... **xiii**

ABBREVIATIONS AND ACRONYMS ..... **xv**

1 INTRODUCTION **1-1**

1.1 Proposed Federal Actions 1-2

1.1.1 Proposed Actions of the NRC 1-3

1.1.2 Proposed Action of the DOE 1-3

1.2 Purpose and Need 1-3

1.2.1 Purpose and Need Statement for NRC Actions 1-3

1.2.2 Purpose and Need Statement for DOE Action 1-4

1.2.3 Need for the Project 1-4

1.3 NEPA Process and NRC Environmental Review 1-4

1.3.1 Level of NEPA Review 1-4

1.3.2 Scoping and Public Involvement 1-5

1.3.3 Significance Determination 1-5

1.3.4 Analysis of Environmental Effects Related to the Proposed Agency Actions 1-6

1.3.5 Incorporation by Reference Approach 1-7

1.4 Regulatory Provisions, Permits, and Required Consultations 1-10

2 DESCRIPTION OF PLANT FACILITY AND ALTERNATIVES **2-1**

2.1 Description of Palisades Nuclear Plant 2-1

2.2 Alternatives 2-5

2.2.1 Alternatives Carried Forward for Further Analysis 2-6

2.2.1.1 No-Action Alternative 2-6

2.2.2 Alternatives Considered and Not Carried Forward for Further Analysis 2-6

2.2.2.1 Replacing Palisades Reactor with New Onsite Reactor 2-6

2.2.2.2 Replacing Palisades Reactor with Other Power Generation Technologies 2-7

2.2.2.3 Installing System Design Alternatives for Use with the Current Palisades Reactor 2-7

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS 3-1
3.1 Organizational Approach for Resource-Specific Environmental Impact Significance Determinations 3-1
3.1.1 The Affected Environment Related to the Proposed Federal Actions 3-1
3.1.2 Impacts from Preparations for Resumption of Power Operations 3-2
3.1.3 Impacts from the Resumption of Power Operations 3-5
3.1.4 Cumulative Effects Evaluation.....3-5
3.1.5 Climate Change and Greenhouse Gas Evaluation 3-6
3.2 Land Use and Visual Resources.....3-6
3.2.1 Affected Environment.....3-6
3.2.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-7
3.2.3 Environmental Impacts from the Resumption of Power Operations.....3-8
3.2.4 Cumulative Effects 3-8
3.3 Meteorology and Air Quality.....3-8
3.3.1 Affected Environment.....3-9
3.3.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-11
3.3.3 Environmental Impacts from the Resumption of Power Operations.....3-12
3.3.4 Cumulative Effects 3-13
3.4 Surface Water Resources.....3-14
3.4.1 Affected Environment.....3-14
3.4.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-17
3.4.3 Environmental Impacts from the Resumption of Power Operations.....3-18
3.4.4 Cumulative Effects 3-19
3.5 Geologic Environment and Groundwater Resources 3-20
3.5.1 Affected Environment.....3-20
3.5.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-24
3.5.3 Environmental Impacts from the Resumption of Power Operations.....3-24
3.5.4 Cumulative Effects 3-25
3.6 Terrestrial Ecology.....3-25
3.6.1 Affected Environment.....3-26
3.6.1.1 Site and Vicinity.....3-26
3.6.1.2 Important Species and Habitats.....3-27
3.6.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-30
3.6.3 Environmental Impacts from the Resumption of Power Operations.....3-31
3.6.4 Cumulative Effects 3-34
3.7 Aquatic Ecology.....3-34
3.7.1 Affected Environment.....3-35

3.7.1.1 Site and Vicinity 3-35
3.7.1.2 Important Species and Habitats 3-35
3.7.1.3 Invasive and Nuisance Species of Lake Michigan 3-36
3.7.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-37
3.7.2.1 Site and Vicinity 3-37
3.7.2.2 Important Aquatic Species and Habitats 3-37
3.7.3 Environmental Impacts from the Resumption of Power Operations 3-38
3.7.3.1 Site and Vicinity 3-38
3.7.3.2 Important Aquatic Species and Habitats 3-41
3.7.4 Cumulative Effects 3-41
3.8 Historic and Cultural Resources 3-42
3.8.1 Affected Environment 3-42
3.8.1.1 Area of Potential Effects 3-42
3.8.1.2 Cultural Background 3-43
3.8.1.3 Identified Historic Properties 3-44
3.8.1.4 Consultation 3-45
3.8.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-45
3.8.3 Environmental Impacts from the Resumption of Power Operations 3-46
3.8.4 Cumulative Effects 3-46
3.9 Socioeconomics 3-46
3.9.1 Affected Environment 3-47
3.9.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-48
3.9.3 Environmental Impacts from the Resumption of Power Operations 3-48
3.9.4 Cumulative Effects 3-49
3.10 Environmental Justice 3-49
3.10.1 Affected Environment 3-50
3.10.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-53
3.10.3 Environmental Impacts from the Resumption of Power Operations 3-53
3.10.4 Cumulative Effects 3-54
3.11 Radiological and Nonradiological Human Health 3-54
3.11.1 Radiological Human Health 3-54
3.11.1.1 Affected Environment 3-54
3.11.1.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-56
3.11.1.3 Environmental Impacts from the Resumption of Power Operation 3-56
3.11.1.4 Cumulative Effects 3-56
3.11.2 Nonradiological Human Health 3-57

3.11.2.1 Affected Environment 3-57
3.11.2.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-58
3.11.2.3 Environmental Impacts from the Resumption of Power Operation 3-58
3.11.2.4 Cumulative Effects....3-58
3.12 Waste Management....3-59
3.12.1 Affected Environment....3-59
3.12.2 Environmental Impacts from the Preparations for the Resumption of Power Operations 3-60
3.12.3 Environmental Impacts from the Resumption of Power Operations....3-61
3.12.4 Cumulative Effects 3-61
3.13 Uranium Fuel Cycle and Transportation....3-61
3.13.1 Affected Environment....3-62
3.13.2 Environmental Impacts from the Preparations for Resumption of Power Operations 3-62
3.13.3 Environmental Impacts from the Resumption of Power Operations....3-63
3.13.4 Cumulative Effects 3-63
3.14 Postulated Accidents 3-64
3.15 Decommissioning Impact Evaluation 3-65

4 CONCLUSIONS 4-1
4.1 Environmental Impacts of the Proposed Federal Actions....4-1
4.2 Comparison of Alternatives....4-6

5 DRAFT FINDING OF NO SIGNIFICANT IMPACT 5-1

6 REFERENCES 6-1

APPENDIX A LIST OF PREPARERS.... A-1

APPENDIX B COMMENTS RECEIVED THROUGH PUBLIC SCOPING.... B-1

APPENDIX C APPLICABLE LAWS, REGULATIONS AND OTHER REQUIREMENTS.... C-1

APPENDIX D AGENCIES, ORGANIZATIONS, INDIAN TRIBES, AND INDIVIDUALS CONTACTED D-1

APPENDIX E CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE E-1

APPENDIX F CLIMATE CHANGE AND GREENHOUSE GASES....F-1

APPENDIX G PROJECTS CONSIDERED IN CUMULATIVE EFFECTS G-1

APPENDIX H DISCUSSION OF CANCER RISKS AT AND AROUND PALISADES NUCLEAR PLANT H-1

APPENDIX I SUPPLEMENTAL INFORMATION PERTINENT TO SECTION 106 CONSULTATION AND THE HISTORIC AND CULTURAL RESOURCES REVIEW I-1

APPENDIX J ECOLOGY ANALYSES AND TABLES J-1

LIST OF FIGURES

Figure 2-1 Palisades Nuclear Plant 50 mi Radius Map....2-2
Figure 2-2 A Satellite Image Showing the Palisades Nuclear Plant Site Boundary in Southwest Michigan....2-3
Figure 2-3 Palisades Nuclear Plant Site Layout....2-4
Figure 3-1 Location of Select Ground-Disturbing Activities at Palisades Nuclear Plant Related to the Preparations for the Resumption of Power Operations....3-3
Figure 3-2 General Locations of Preparation of Resumptions of Power Operations Activities at Palisades Nuclear Plant....3-4
Figure 3-3 Stormwater Drainage System Map at Palisades Nuclear Plant....3-16
Figure 3-4 Michigan Critical Dune Areas and National Wetlands Inventory Wetlands within the Palisades Nuclear Plant Site Boundary....3-27
Figure 3-5 Area of Potential Effects and 1 mi Buffer Area at the Palisades Nuclear Plant Site....3-43
Figure 3-6 Environmental Justice 50 mi Affected Environment....3-52

LIST OF TABLES

Table 1-1 Licensing and Regulatory Actions for Palisades Nuclear Plant Post Decommissioning....1-3
Table 1-2 List of Related Environmental Documents 1-8
Table 3-1 Land Disturbing Activities Related to the Preparations for Resumption of Power Operations at Palisades Nuclear Plant....3-2
Table 3-2 Emissions Estimates from Truck Deliveries at the Palisades Nuclear Plant over the 18-Month Period of Preparation Activities in Metric Tons 3-12
Table 3-3 Total Annual Emissions Reported by Palisades Nuclear Plant for Operations In Metric Tons per Year 3-13
Table 3-4 Tritium Releases and Elevated Detection in Onsite Groundwater at Palisades Nuclear Plant, 2009–2024 3-21
Table 3-5 Federally Listed Species Under U.S. Endangered Species Act Evaluated for Palisades Nuclear Plant....3-29
Table 3-6 Demographic Profile of the Population in the Region of Influence of Palisades Nuclear Plant in 2020 3-47
Table 3-7 Estimated Income Information for the Socioeconomic Region of Influence of Palisades Nuclear Plant, 2018–2022, 5-Year Estimates 3-48
Table 3-8 Housing in the Region of Influence of Palisades Nuclear Plant, 2018–2022, 5-Year Estimate 3-48
Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant....4-2

ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
µg/L	microgram(s) per liter
ac	acre(s)
ACHP	Advisory Council on Historic Preservation
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
APE	area of potential effect
AST	above ground storage tank
BCE	Before Common Era
bhp	break horsepower
BMP	best management practice
BRE	blast resistant enclosure
BTA	best technology available
CAA	Clean Air Act
CatEX	categorical exclusion
CBP	Community Benefits Plan
CCW	component cooling water
CDA	critical dune area
CE	Common Era
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
Ci	Curie(s)
cm	centimeter(s)
CO_2	carbon dioxide
CO_2eq	carbon dioxide equivalent
COL	combined license
CWA	Clean Water Act
CWIS	cooling-water intake structures
CZMA	Coastal Zone Management Act

DOE	U.S. Department of Energy
DOI	U.S. Department of Interior
DOT	U.S. Department of Transportation
EA	environmental assessment
EF	Enhanced Fujita
EIS	environmental impact statement
EJ	environmental justice
Entergy	Entergy Nuclear Operations, Inc.
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act of 1973, as amended
FES	final environmental statement
FONSI	Finding of No Significant Impact
fps	foot/feet per second
ft	foot (feet)
ft^3	cubic foot/feet
FWS	U.S. Fish and Wildlife Service
GHG	greenhouse gas
GPI	Groundwater Protection Initiative
gpm	gallon(s) per minute
GWd	gigawatt-day(s);
ha	hectare(s)
HAP	hazardous air pollutant
HDI	Holtec Decommissioning International, LLC
Holtec	Holtec Decommissioning International, LLC; Holtec Palisades, LLC; Palisades Energy, LLC
Holtec Palisades	Holtec Palisades, LLC
HPS	Health Physics Society
hr	hour(s)
in.	inch(es)
IPaC	Information for Planning and Consultation

ISFSI	independent spent fuel storage installation
KBB	Karner blue butterfly
kg	kilogram(s)
kg/ha	kilogram(s) per hectare
km	kilometer(s)
km^3	cubic kilometer(s)
LAR	License Amendment Request
lb	pound(s)
lb/ac	pound(s) per acre
LLRW	low-level radioactive waste
LPO	U.S. Department of Energy Loan Program Office
LR	license renewal
m	meter(s)
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MDNR	Michigan Department of Natural Resources
mi	mile(s)
mi^3	cubic mile(s)
Michigan EGLE	Michigan Department of Environment, Great Lakes, and Energy
Michigan SHPO	Michigan State Historic Preservation Office
MMBtu	million British thermal unit(s)
mph	mile(s) per hour
mrem	millirem(s)
MSL	mean sea level
mSv	millisievert(s)
MT	metric ton(s)
MTu	metric ton(s) uranium
MW	megawatt(s)
MWe	megawatt(s) electric
N&S Report	New and Significant Report (from Holtec Decommissioning International, LLC [HDI])
NEPA	National Environmental Policy Act of 1969, as amended
NH_3	anhydrous ammonia

NHPA	National Historic Preservation Act of 1966, as amended
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC or Commission	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NRR	Office of Nuclear Reactor Regulation
NWI	National Wetlands Inventory
OSHA	Occupational Safety and Health Administration
Palisades	Palisades Nuclear Plant
Palisades RFOL	Palisades Renewed Facility Operating License
pCi/L	picoCurie(s) per liter
PFAS	polyfluoroalkyl substances
PM	particulate matter
PPA	power purchase agreement
PRA	probabilistic risk assessment
PSDAR	Post-Shutdown Decommissioning Activities Report
RAIs	requests for additional information
RCIs	requests for confirmatory information
rem	roentgen equivalent(s) man
REMP	radiological environmental monitoring program
ROI	region(s) of influence
SAMA	Severe Accident Mitigation Alternatives
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act of 1974
SEIS	supplemental environmental impact statement
SLMMU	Southern Lake Michigan Management Unit
SMR	small modular reactor
SNF	spent nuclear fuel
SO_2	sulfur dioxide

SPCC-PIPP	spill prevention, control, and countermeasures and pollution incident prevention plan
SWPPP	stormwater pollution prevention plan
TEDE	total effective dose equivalent
TPY	ton(s) per year
TRO	total residual oxidant
TSCA	Toxic Substances Control Act
UFSAR	Updated Final Safety Analysis Report
U.S.C.	*United States Code*
USACE	U.S. Army Corps of Engineers
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VAC	volt(s) alternating current
VOC	volatile organic compound
wt%	weight percent

1 INTRODUCTION

The Palisades Nuclear Plant (Palisades), located along the shoreline of Lake Michigan in Covert Township, Van Buren County, Michigan, consists of a single unit pressurized water nuclear reactor designed by Combustion Engineering (with a turbine generator designed by Westinghouse Electric Corporation). The U.S. Atomic Energy Commission originally granted Palisades a provisional operating license for operation on March 24, 1971, with the U.S. Nuclear Regulatory Commission (NRC or Commission) granting a full-term operating license on February 21, 1991, (NRC 1991-TN11017) and subsequently issuing a Palisades Renewed Facility Operating License (Palisades RFOL) No. DPR-20, on January 17, 2007, with the term expiring on March 24, 2031 (NRC 2007-TN11052).

On June 13, 2022, the licensee at the time, Entergy Nuclear Operations, Inc. (Entergy), submitted certifications under Title 10 of the *Code of Federal Regulations* (10 CFR) 50.82(a)(1) (TN249) that operation had permanently ceased on May 20, 2022 and that fuel had been permanently removed from the reactor on June 10, 2022 (Entergy 2022-TN10542). In accordance with 10 CFR 50.82(a)(2), the docketing of these certifications means that "the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel."

As part of the transition from an operating reactor to a reactor in decommissioning, the NRC issued amendments changing the operating license, which included technical specifications, to reflect the authorities and requirements for a reactor in decommissioning (NRC 2022-TN10543). Among other things, the amendments removed language from the license regarding the authority to operate the reactor and the technical specifications for an operating reactor that were not relevant to decommissioning. However, even after these amendments became effective during the decommissioning period, the license is still referred to as a Palisades RFOL in the license itself, and it continues to be a 10 CFR Part 50 operating license in accordance with 10 CFR 50.51(b).

About 18 months before submitting the Palisades 10 CFR 50.82(a)(1) certifications, Entergy submitted a license transfer request on behalf of itself, Entergy Nuclear Palisades, LLC, Holtec International, and Holtec Decommissioning International, LLC (HDI), to make Holtec Palisades, LLC (Holtec Palisades) the licensed owner of Palisades and to transfer licensed operational authority for Palisades from Entergy to HDI (Entergy 2020-TN10832). As a result of the transfer (NRC 2022-TN10545), which closed after Palisades had entered decommissioning, HDI (licensed operator) and Holtec Palisades (licensed owner) became the current license holders for Palisades. After the transfer, HDI assumed responsibility for compliance with NRC regulations and the current licensing bases and would implement any changes under applicable regulatory requirements and practices.

Subsequent to the cessation of power operations and the commencement of decommissioning at Palisades, HDI began to pursue a path to resume power operations. On February 1, 2023, (updated on March 13, 2023) HDI (on behalf of Holtec Palisades) submitted a letter to the NRC outlining a proposed regulatory path for the reauthorization of power operations at Palisades (Holtec 2023-TN10549, Holtec 2023-TN10595). Throughout 2023 and 2024, HDI engaged with the NRC and submitted a set of requests for NRC approval to support the reauthorization of power operations at Palisades through March 24, 2031, the end of the current Palisades RFOL. The set of requests include:

- The September 28, 2023, request for an exemption (Holtec 2023-TN10538) from the 10 CFR 50.82(a)(2) (TN249) restriction that prohibits reactor power operations and emplacement or retention of fuel in the reactor vessel to allow for a one-time rescission of the docketed 10 CFR 50.82(a)(1) certifications.
- The December 6, 2023 license transfer request (HDI 2023-TN10838) for Palisades, which seeks NRC consent to, and a conforming amendment for, a transfer of operating authority from HDI to Palisades Energy, LLC under the Palisades RFOL No. DPR-20 and the general license for the Palisades Independent Spent Fuel Storage Installation.
- Approval of requisite license amendment requests (LARs) to the Palisades RFOL—the identified requisite LARs are listed inTable 1-1 (see Section 1.1.1 of this environmental assessment [EA]).

Hereinafter, Holtec Palisades (licensed owner), HDI (current licensed operator), and Palisades Energy, LLC (planned licensed operator upon approval of December 6, 2023 transfer request) are collectively referred to as Holtec. This EA will generally refer to Holtec without specifying which company, unless necessary.

The exemption to 10 CFR 50.82(a)(2) would allow rescission of the 10 CFR 50.82(a)(1) certifications on the same date that the operating authority license transfer and the requisite LARs would be implemented, if approved. It is on that date that Palisades would transition from a facility in decommissioning to a facility authorized for reactor power operations under Palisades' RFOL.

Collectively, the requested NRC approvals identified above and in Table 1-1 (see Section 1.1.1 of this EA), including any revisions or supplements thereto or other regulatory or licensing requests submitted to the NRC that are necessary to reauthorize power operations of Palisades, define the scope of the proposed NRC Federal actions for the potential reauthorization of power operations under Palisades' RFOL.

For the NRC staff, evaluation of the exemption, transfer, and LARs occurs simultaneously for both safety and environmental reviews through the Office of Nuclear Reactor Regulation (NRR) and the Office of Nuclear Material Safety and Safeguards, respectively. In parallel with this environmental review, the NRC staff in NRR are conducting a detailed safety evaluation of the exemption, transfer, and amendment requests.

1.1 Proposed Federal Actions

In addition to the set of licensing and regulatory requests Holtec submitted to the NRC related to the potential reauthorization of power operations at Palisades, Holtec submitted an application for an approximate $1.52 billion loan from the U.S. Department of Energy's (DOE) Loan Program Office (LPO), and on March 27, 2024, DOE's LPO announced a conditional commitment of up to $1.52 billion for a loan guarantee to Holtec to finance the restoration and resumption of service of the Palisades 800 megawatts electric (MWe) nuclear generating station.

Given that the two agencies' Federal actions are related and both require an environmental review under the National Environmental Policy Act of 1969, as amended (NEPA) (42 *United States Code* [U.S.C.] 4321 et seq. [TN661])—among other requirements—the NRC and DOE LPO have signed a joint Memorandum of Understanding reflecting the lead and cooperating roles of the agencies (DOE/NRC 2024-TN10597). The NRC is the lead agency. The DOE LPO

is a NEPA cooperating agency with the NRC for the environmental review for the exemption request, a license transfer request, and the LARs (DOE 2024-TN10598). At the conclusion of the NRC environmental review, DOE would publish a separate Record of Decision or Finding of No Significant Impact (FONSI), as appropriate. The following section describes the separate, but related, proposed agency actions.

1.1.1 Proposed Actions of the NRC

The NRC's proposed actions are decisions on whether to grant or deny Holtec's interdependent, connected licensing and regulatory requests (see Table 1-1 below), including any revisions or supplements thereto or other regulatory or licensing requests submitted to the NRC that are necessary to reauthorize power operations of Palisades, that if approved, would collectively support the reauthorizing of power operations at Palisades and refueling of the Palisades reactor.

Table 1-1 Licensing and Regulatory Actions for Palisades Nuclear Plant Post Decommissioning

Document Description	ADAMS Accession No.
Request for Exemption from Certain Termination of License Requirements of 10 CFR 50.82, dated September 28, 2023.	ML23271A140
Application for Order Consenting to Transfer of Control of License and Conforming License Amendments, dated December 6, 2023.	ML23340A161
Request to Revise Operating License and Technical Specifications to Support Resumption of Power Operations, dated December 14, 2023.	ML23348A148
Request to Revise the Administrative Technical Specifications to Support Resumption of Power Operations, dated February 9, 2024.	ML24040A089
Request to Reinstate the Palisades Emergency Plan to Support Resumption of Power Operations, dated May 1, 2024.	ML24122C666
Request to Update the Main Steam Line Break Analysis Methodology, dated May 24, 2024.	ML24145A145

ADAMS = Agencywide Documents Access and Management System; CFR = *Code of Federal Regulations*; Palisades = Palisades Nuclear Plant.

1.1.2 Proposed Action of the DOE

The DOE LPO's Federal action is a decision on providing Federal financial assistance for refueling and resumption of power generation activities at Palisades pursuant to Holtec's loan guarantee agreement with DOE that was issued pursuant to the Energy Policy Act of 2005.

1.2 Purpose and Need

1.2.1 Purpose and Need Statement for NRC Actions

The purpose and need for approval of the proposed NRC Federal actions (identified in Table 1-1 above), collectively supporting the reauthorization of power operations and refueling of the reactor under the existing Palisades' RFOL, is to provide an option that allows for baseload clean energy power generation capability within the term of the Palisades' RFOL to meet current system generating needs (HDI 2024-TN10670: RAI-GEN-2).

1.2.2 Purpose and Need Statement for DOE Action

The purpose and need for DOE's proposed action (Federal financial assistance in the form of a loan guarantee), is to implement DOE's authority under Title XVII of Energy Policy Act of 2005, which was reauthorized, amended and revised by the Inflation Reduction Act of 2022 to create the Energy Infrastructure Reinvestment Program (Section 1706). The purpose of the Energy Infrastructure Reinvestment Program is to finance projects and facilities in the United States that retool, repower, repurpose, or replace energy infrastructure that has ceased operations or enable operating energy infrastructure to avoid, reduce, utilize, or sequester air pollutants or anthropogenic emissions of greenhouse gases (GHGs) (42 U.S.C. 16517(a)(2)-TN10779).

1.2.3 Need for the Project

Regarding the need for clean energy, Holtec cites the State of Michigan's Public Acts of 2023, Act No. 235 (enrolled Senate Bill 271) (State of Michigan 2023-TN10671), which establishes a clean energy standard for electric providers to provide at least 80 percent clean energy by 2035 and 100 percent by 2040. Michigan's Act No. 235 defines clean energy as including a system that "Generates electricity or steam without emitting greenhouse gas, including nuclear generation."

In September 2023, Palisades Energy, LLC, and Wolverine Power Cooperative formalized a power purchase agreement (PPA) under which Wolverine Power Cooperative agreed to purchase up to two-thirds of the output from Palisades and the balance would be purchased by Hoosier Energy for the foreseeable future. This PPA is the economic impetus for Holtec's request to restart Palisades. The PPA also provides the option to include expected power output from the planned small modular reactors (SMRs) at Palisades (Holtec 2023-TN10540).

As opposed to being a regulated supplier providing wholesale power for dispatch by the independent system operator, the PPA would make Palisades a merchant generator and therefore not be directly subject to Michigan's integrated resource planning process or a Certificate of Need ruling by the Michigan Public Service Commission (HDI 2024-TN10670: RAI-GEN-2). Holtec also states that repowering of Palisades will greatly enhance electric reliability by generating consistent and carbon-free energy in Michigan and will decrease Michigan's reliance on energy imports (Holtec 2023-TN10540).

1.3 NEPA Process and NRC Environmental Review

1.3.1 Level of NEPA Review

While Holtec concluded that the proposed NRC actions specified in Table 1-1 of this EA meet the categorical exclusion (CatEX) criteria (Holtec 2023-TN10538), the NRC staff, after reviewing the criteria in 10 CFR 51.20, 10 CFR 51.21, and 10 CFR 51.22, and internal guidance, have determined that an EA with scoping, and a draft comment period to ensure public participation to the greatest extent possible, is appropriate. This is based on:

- The licensing and regulatory requests are connected (i.e., interdependent) actions that should be considered together as part of the NEPA review.
- The proposed Federal actions are either not collectively covered by the criteria for using a CatEX in 10 CFR 51.22 or (in the case of the license transfer request) do not fall within the factual basis underlying the corresponding CatEX in 10 CFR 51.22.

- The proposed Federal actions are not specifically covered by the criteria for an environmental impact statement (EIS) as described in 10 CFR 51.20 without knowing the significance of potential impacts from the proposed Federal actions.

1.3.2 Scoping and Public Involvement

To provide concise and informative environmental documents, the NRC scoping process involves (1) defining the proposed action(s); (2) determining the scope of the environmental document and identifying potentially significant issues to be analyzed in depth; and (3) identifying and eliminating from detailed study issues that are expected to have negligible impact or have been covered by prior environmental review(s), thereby narrowing the discussion of these issues to, as applicable, a brief presentation highlighting why they will not have a significant effect on the human environment or summarizing the prior environmental review's coverage of the issue and providing a reference to a source elsewhere for additional information. As part of the scoping process, the NRC seeks public input on the range of issues and alternatives that should be considered for a project. A summary of the Palisades' scoping process is in Appendix B.

1.3.3 Significance Determination

An EA is a decisional document for an action that either is not likely to have a significant effect or for which the significance of the effects is unknown. The EA decisional document is used to support the NRC's determination of whether to issue a FONSI or prepare an EIS. In considering whether an adverse effect of the proposed Federal actions is significant, the NRC staff examined both the context (local versus global) of the action and the intensity (magnitude) of the effect.

Context refers to the characteristics of the geographic area, for example the proximity to unique or sensitive resources or communities with environmental justice (EJ) concerns. Depending on the scope of the action, the potential global, national, regional, and local contexts are also considered as well as the duration, including short-and long-term effects.

Intensity refers to the impact severity. The analysis of the intensity of effects considers many factors, including those outlined in the Council on Environmental Quality (CEQ) implementing regulations of NEPA (40 CFR 1501.3-TN4876).

Each impacted resource area is therefore evaluated with a rationale provided to explain the determination whether the impact(s) would be "SIGNIFICANT" or would be "NOT SIGNIFICANT." If impacts from the proposed Federal actions are determined to be not significant, a FONSI is prepared, whereas, if the impacts are determined to be significant, an EIS is prepared.

In addition to these impact thresholds under NEPA, there are effects determination definitions that are applicable specifically for the Endangered Species Act of 1973, as amended (ESA) (TN1010) and the National Historic Preservation Act of 1966, as amended (NHPA) (TN4157).

The ESA effects determination for federally listed species are as follows:

- No effect: Federally listed species or critical habitat will not be affected, directly or indirectly.
- May affect but is not likely to adversely affect: All effects on federally listed species or critical habitat are beneficial, insignificant, or discountable.
- May affect and is likely to adversely affect: An adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action and the effect is not: discountable, insignificant, or beneficial.

The implementing regulations for NHPA Section 106 define specific criteria for identifying an adverse effect (36 CFR 800.5 and 36 CFR 800.6 [TN513]) on a historic property:

- No historic properties affected: No historic properties in the project area because they are less than 50 years old or were determined to be not eligible for listing in the National Registry of Historic Places.
- No adverse effect: Historic properties were identified within the project area of potential (APE) effects, but the criteria of adverse effects in 36 CFR 800.5(a)(1) are not met.
- Adverse effect: Historic properties were identified within the project APE, and the criteria of adverse effects in 36 CFR 800.5(a)(1) are met.

1.3.4 Analysis of Environmental Effects Related to the Proposed Agency Actions

The environmental effects of a proposed Federal action(s) are determined by comparing the environmental conditions at the point in time prior to the commencement of the proposed Federal action(s), known as the environmental baseline or affected environment, with those expected environmental conditions following the commencement of the Federal action(s). The affected environment for the potential reauthorization of power operations at Palisades is the current decommissioning state at Palisades prior to implementing any of the activities related to the preparation for the resumption of power operations. The corresponding impact determination analysis for each resource area comprises the impacts in relation to the affected environment from both the activities related to the *preparations for the resumption of power operations* and those related to the *resumption of power operations*. The impact significance determination includes the following evaluations for each analyzed resource area in Section 3:

- *Affected Environment*—provides a brief description of the affected environment.
- *Impacts from the Preparations for the Resumption of Power Operations*—description of the environmental effects related to the preparations for the resumption of power operations.
- *Impacts from Resumption of Power Operations*—description of the environmental effects from the resumption of power operations for the remainder of the term of the Palisades RFOL.
- *Cumulative Effects*—each resource area will describe the incremental effects of the proposed actions when added to the environmental effects of other past, present, and reasonably foreseeable actions.

Additionally, the environmental effects of decommissioning activities and climate change are discussed for each analyzed resource area in Section 3.15 and Appendix F, respectively, of this EA.

1.3.5 Incorporation by Reference Approach

Incorporation by reference is a tool that Federal agencies can use to improve the efficiency of their environmental review process to aid in the preparation of analytical, concise, and informative environmental documents. Incorporation by reference integrates material that is essential to the NEPA analysis, such as including planning studies, analyses, or other relevant information, into environmental documents by reference. The effect will be to cut down on bulk without impeding agency and public review of the action (40 CFR Part 1501-TN4876).

The NRC and other Federal agencies have prepared other NEPA and technical documents that contain information relevant to this environmental review. Table 1-2 of this EA provides a brief description of the related NEPA documents issued by the NRC and other Federal agencies that are being used to support this EA. This table also lists other technical or professional studies and analyses prepared by Federal, State, Tribal, and local agencies or private interests that provide information that is relied upon, in whole or in part, to support this EA. These documents, or portions thereof, are incorporated by reference as appropriate in Sections 2 and 3 of this EA.

To ensure that the EA stands alone and provides sufficient analysis to allow the decision-maker to arrive at a conclusion, the NRC staff adhered to three principles, identified in CEQ regulations in 40 CFR 1501.12 (40 CFR Part 1501-TN4876) and NRC guidance (NRC 2020-TN6710: Appendix A), when using the incorporation by reference process:

1. *Citation Specificity, Public Availability*: Prior to incorporating by reference any document in this EA, the NRC staff assured that each document is publicly available. The NRC staff provided links to documents incorporated by reference in Table 1-2 (below) and the references section in the EA. In instances where parts of a document are incorporated by reference in the EA, the pertinent section(s), figures, and tables of the document are cited, where applicable.
2. *Summarize and Independently Verify*: Prior to incorporating by reference, the NRC staff independently evaluated and verified the reliability of the information that is incorporated by reference. A brief summary of the content incorporated by reference, in the context of the analysis at hand, along with the NRC staff's independent evaluation, is provided in a manner that does not result in a loss of comprehension to the reader in each resource area evaluated. The NRC does not incorporate by reference conclusions from an applicant's environmental documents.
3. *New Information and Relevance to Proposed Federal Action*: In its evaluation, the NRC staff identifies and discusses any new circumstances or information relevant to the environmental analysis and which bears on the proposed Federal actions or its potential impacts that were not considered in the documents being incorporated by reference.

This EA provides a brief summary at the beginning of the resource area in Section 3 that identifies the material subject to incorporation by reference, as well as provides a summary in the discussion of the material and its relevance to the current environmental review that adheres to the three principles.

Table 1-2 List of Related Environmental Documents

Document	General Applicability	Reference
U.S. Atomic Energy Commission. Final Environmental Statement related to operation of Palisades Nuclear Generating Plant, Docket No. 50-255, June 1972. ADAMS Accession No.: ML18346A120.[(a)]	The FES was prepared by the U.S. Atomic Energy Commission. The action evaluated was issuance of an operating license for the full power operation of Palisades. On November 20, 1971, the applicant was granted Amendment No. 1 to the Interim Provisional License No. DPR-20 to operate the Palisades at power level of 20% of the rated power level. On March 10, 1972, the applicant was granted Amendment No. 2 to DPR-20 to operate Palisades at 60% of the rated power level. The FES evaluates the environmental impacts of operations at Palisades with some analyses still relevant, such as impingement.	1972 FES AEC 1972-TN10603
NRC. 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NUREG-1437, Volumes 1 and 2. ADAMS Accession Nos.: ML040690705, ML040690738.[(a)]	The GEIS was prepared to identify and evaluate environmental issues for license renewal and determine which issues could result in the same or similar impact at all nuclear power plants and which issues could result in different levels of impact. Many of the analyses presented in the GEIS may be relevant to proposed Federal actions at Palisades.	1996 LR GEIS NRC 1996-TN288
NRC. 2006. Generic Environmental Impact Statement for Nuclear Plants, Supplement 27, Regarding Palisades Nuclear Plant, Final Report. NUREG-1437, Supplement 27, October 2006. ADAMS Accession No.: ML062710300.[(a)]	The SEIS was prepared in response to an application submitted to the NRC to renew the operating license for Palisades for an additional 20 years. The SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. Many of the analyses presented in the SEIS may be relevant to proposed Federal actions at Palisades.	2006 SEIS NRC 2006-TN7346
NRC. 2014. Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel. Final Report, NUREG-2157. ADAMS Package Accession No. ML14198A440.[(a)]	The Continued Storage GEIS was prepared to identify and review environmental issues for the storage of spent nuclear fuel at at-reactor and away-from-reactor storage locations. These impacts were determined to be generic between all potential locations.	Continued Storage GEIS NRC 2014-TN4117
NRC. 2024. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NUREG-1437, Volume 1–3, Revision 2, Washington, D.C. ADAMS Accession No.: ML24087A133.[(a)]	This GEIS was prepared to identify and evaluate environmental issues for license renewal and determine which could result in the same or similar impact at all nuclear power plants and which issues could result in different levels of impact. Many of the analyses presented in the GEIS may be relevant to proposed Federal actions at Palisades.	2024 LR GEIS NRC 2024-TN10161

Table 1-2 List of Related Environmental Documents (Continued)

Documents	General Applicability	Reference
NRC. 2024. Environmental Evaluation of Accident Tolerant Fuels with Increased Enrichment and Higher Burnup Levels, Final Report. NUREG-2266. ADAMS Accession No. ML24207A210.[(a)]	NUREG-2266 was prepared to assist reviewers during licensing amendment requests to provide a generic evaluation for accident tolerant fuels and fuels that have higher enrichment or burnup beyond currently licensed limits. The document quantifies impacts for up to enrichment levels of 8 weight percent U-235 and burnup levels to 80 GWd/MTU and demonstrates that 10 CFR Part 51 Tables S-3 and S-4 are still bounding. Although Holtec is not proposing to use accident tolerant fuels or increased enrichment or burnups as part of its requests related to resumption of operations, the staff relied on NUREG-2266 as it contains the latest analysis and also bounds Holtec's proposal.	Evaluation of Accident Tolerant Fuels NRC 2024-TN10333
DOE. 2024. Holtec Palisades Community Benefits.[(a)]	This document presents DOE's comprehensive community strategy aimed at supporting the repowering of the Palisades.	Community Benefits Plan DOE 2024-TN10833
Entergy. 2021. Updated Final Safety Analysis Report - Revision 35, Palisades Nuclear Plant. ADAMS Accession Package No. ML21125A285.[(b)]	Palisades updated final safety analysis report.	UFSAR Revision 35 Entergy 2021-TN10998
Holtec. 2023. Enclosure 2 of Letter from Holtec to NRC, dated September 28, 2023, regarding "Request for Exemption from Certain Termination of License Requirements of 10 CFR 50.82." ADAMS Accession No.: ML23271A140.[(b)]	The exemption request submittal includes "Enclosure 2," which is the "Environmental New and Significant Review Proposed Resumption of Power Operations Palisades Nuclear Plant." This report provides an update from Holtec on potentially new and significant information since the 2006 SEIS (NRC 2006-TN7346).	N&S Report Holtec 2023-TN10538
Holtec. 2024. Letter from Holtec International to NRC, dated October 4, 2024, regarding "Response to Requests for Additional Information Regarding the Proposed Reauthorization of Power Operations of Palisades Nuclear Plant under Renewed Facility Operating License Number DPR-20." ADAMS Accession No. ML24278A027.[(b)]	Responses from Holtec on NRC submitted requests for additional information regarding Palisades.	Holtec RAI response HDI 2024-TN10670
Holtec. 2024. Email from J. Britting, Holtec Palisades, to M. Richmond, NRC, dated September 12, 2024, regarding "Palisades Reauthorization of Power Operations - Environmental Audit Draft	Responses from Holtec on NRC submitted requests for confirmatory information regarding Palisades.	Holtec RCI response HDI 2024-TN10669

Table 1-2 List of Related Environmental Documents (Continued)

Documents	General Applicability	Reference
RCIs." ADAMS Accession No. ML24260A354.[(b)]		
Holtec. 2024. Response to Requests for Confirmatory Information Regarding the Proposed Reauthorization of Power Operations of Palisades Nuclear Plant under Renewed Facility Operating License Number DPR-20. ADAMS Accession No. ML24319A053.[(b)]	Second set of responses from Holtec on NRC submitted requests for confirmatory information regarding Palisades.	Holtec second RCI response HDI 2024-TN10843
SEARCH. Technical Report: Phase 1 Archaeological Survey of the Palisades Nuclear Power Plant, Van Buren County, Michigan. Prepared for Enercon, prepared by SEARCH. SEARCH project number: 240030. August 2024. ADAMS Accession No. ML25023A165.[(b)]	Updated archaeological survey report for the Palisades site. The report provides updated cultural resource information and archaeological site information.	SEARCH Archaeological Report SEARCH 2024-TN10846
SEARCH. Technical Report: Architectural History Survey of Palisades Nuclear Plant, Van Buren County, Michigan. Prepared for Enercon, prepared by SEARCH. SEARCH project number: 240140. October 2024. ADAMS Accession No. ML25021A126.[(b)]	Updated architectural survey report for the Palisades site. The report provides updated historical building/structural information and context.	SEARCH Architectural Report Theriot and Travisano 2024-TN10847

ADAMS = Agencywide Documents Access and Management System; CFR = *Code of Federal Regulations*; Entergy = Entergy Nuclear Operations, Inc.; FES = Final Environmental Statement; GEIS = generic environmental impact statement; GWd = gigawatt-day(s); Holtec = Holtec Decommissioning International, LLC, Holtec Palisades, LLC, and Palisades Energy, LLC; LR = license renewal; N&S Report = HDI New and Significant Report; NEPA = National Environmental Policy Act; NRC = U.S. Nuclear Regulatory Commission; Palisades = Palisades Nuclear Plant; RCIs = requests for confirmatory information; SEIS = supplemental environmental impact statement.

(a) NEPA documents prepared by Federal agencies.

(b) Special technical, professional studies and analyses prepared by Federal, State, Tribal, and local agencies; or stakeholders with private interests.

1.4 Regulatory Provisions, Permits, and Required Consultations

Appendix C to this EA lists each environmental regulatory requirement, permit, and consultation necessary for the resumption of power operations at Palisades. The NRC staff is performing the consultations required under the ESA (TN1010) and NHPA (TN4157).

2 DESCRIPTION OF PLANT FACILITY AND ALTERNATIVES

2.1 Description of Palisades Nuclear Plant

Section 2.1 of the 2006 SEIS (NRC 2006-TN7346) provides a detailed description of Palisades and the surrounding location and is incorporated here by reference to define facility parameters that remain relevant to the Palisades site. Palisades is located on 432 acres (ac) (175 hectares [ha]) in Covert Township, Van Buren County, Michigan, on the eastern shoreline of Lake Michigan, about 4.5 miles (mi) (7 kilometers [km]) from South Haven, Michigan and includes approximately 1 mi (1.6 km) of lake frontage (Figure 2-1 and Figure 2-2 of this EA). The Palisades site extends approximately 1 mi (1.6 km) inland between Lake Michigan and the Blue Star Memorial Highway and adjacent Interstate Highway 196. The nearest population center is the township of Covert, which is approximately 2.5 mi (4 km) southeast of the Palisades site. Van Buren State Park is located immediately to the north of the Palisades site, and Van Buren Trail State Park is located northeast of the site. The local terrain consists of wooded sand dunes along the lakeshore, and the area surrounding the plant is largely rural.

Section 2.1.1 of the 2006 SEIS further describes that the local terrain consists of a gentle upward sloping beach at an elevation of about 580 ft (177 m) above mean sea level (MSL) that rises sharply into sand dunes at an elevation of approximately 780 ft (238 m) above MSL and then drops off abruptly to about 610 ft (186 m) MSL at the eastern site boundary. The dunes are relatively stable topographic features with occasional blowout caused by wind action. The majority of the land area is heavily wooded, with occasional wetlands. Besides the transmission line and corridor, the facilities at Palisades are only publicly visible from Lake Michigan and the beach areas to the north and south of the plant boundary.

As described in Section 2.2.1 of the 2006 SEIS (NRC 2006-TN7346), plant facilities are located about 2,500 ft (760 m) from both the northern and southern boundaries of the industrial zoned, 432 ac (175 ha) Palisades site. Buildings and other structures occupy approximately 80 ac (32 ha). These include the power generation and administration area (20 ac [8 ha]), transmission corridors and switchyard (30 ac [12 ha]), warehouse area (7 ac [2.8 ha]), cooling towers (4 ac [1.6 ha]), and other supporting buildings and waste storage (7 ac [2.8 ha]).

The steam supply system for Palisades is a pressurized water reactor consisting of a reactor primary coolant system and associated auxiliary systems. The reactor, steam generators, and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. Palisades relies on two sources of water: raw water from Lake Michigan and potable water from the South Haven Municipal Water Authority. The water withdrawn from Lake Michigan is via a pipeline from a submerged intake crib structure located 3,300 feet (ft) (1,005 meters [m]) offshore in water about 35 ft (11 m) deep (NRC 2006-TN7346; Section 2.1.3) (Figure 2-3 of this EA).

Originally, the crib was designed for a once-through cooling-water flow rate but was converted to a closed-cycle cooling system in 1971 with reduced intake flow (Consumers Power et al. 1971-TN10607). Historic photographs and maps provided in Appendix I to this EA highlight the various stages of construction and land disturbance at Palisades during this era. Water flows from the intake crib through an 11 ft (3.4 m) diameter pipe to the onshore intake structure where it passes through trash racks constructed of steeply sloped bars to prevent entry of coarse debris. Debris accumulated on the trash racks are removed by a mechanical rake or scoop. The

water then flows through vertical 0.375 inches (in.) (0.95 centimeters [cm]) mesh traveling screens for removal of finer debris. The traveling screens are cleaned by rotating and backwashing the screens as needed (in automatic or manual operation) and sluicing the debris to a collection basket. The accumulated debris are disposed of in accordance with the Palisades National Pollutant Discharge Elimination System (NPDES) permit (MDEQ 2014-TN10665).

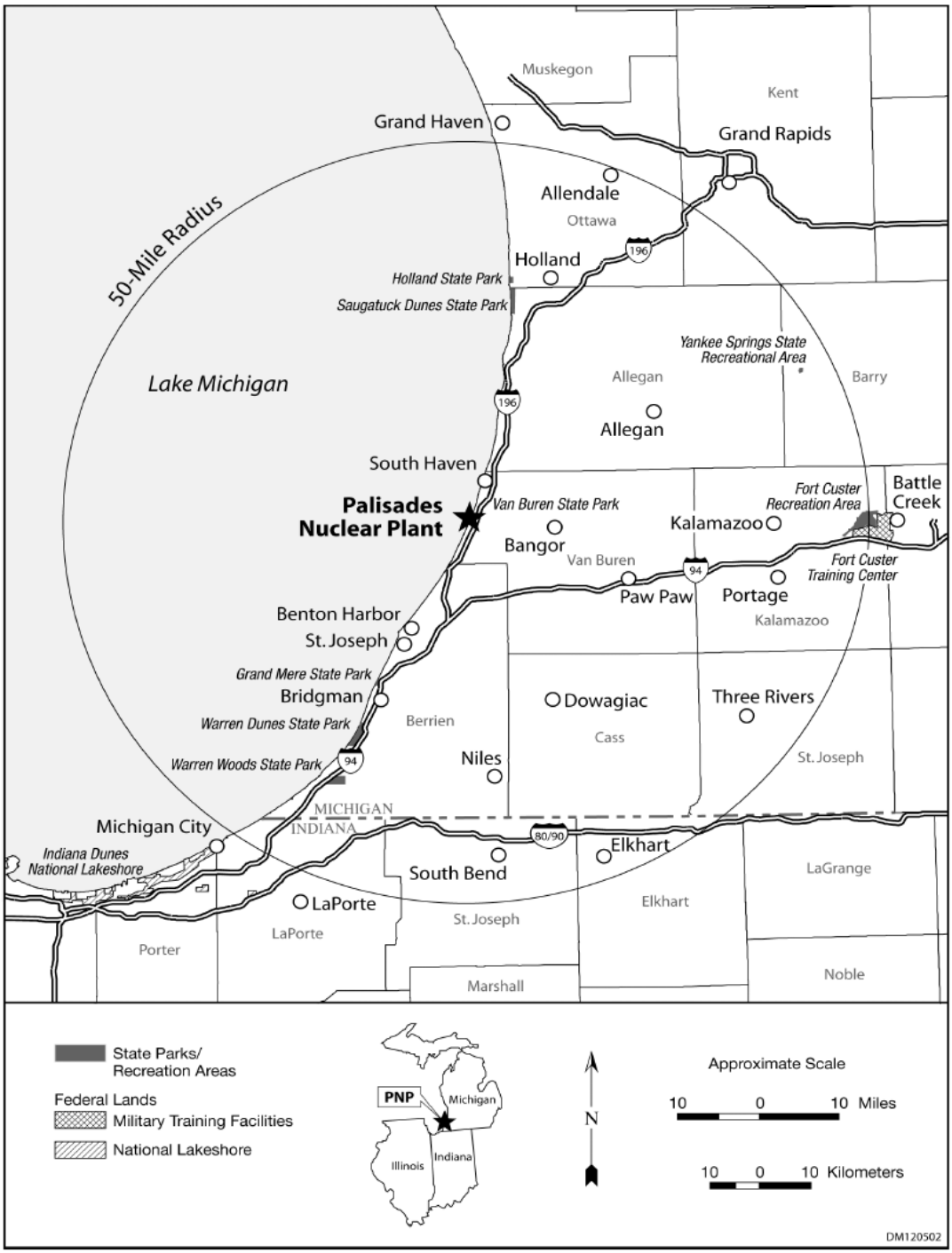

Figure 2-1 Palisades Nuclear Plant 50 mi (80 km) Radius Map. Source: NRC 2006-TN7346.

Figure 2-2 A Satellite Image Showing the Palisades Nuclear Plant Site Boundary in Southwest Michigan. Source Data: HDI 2024-TN10670: RAI-GEN-1.

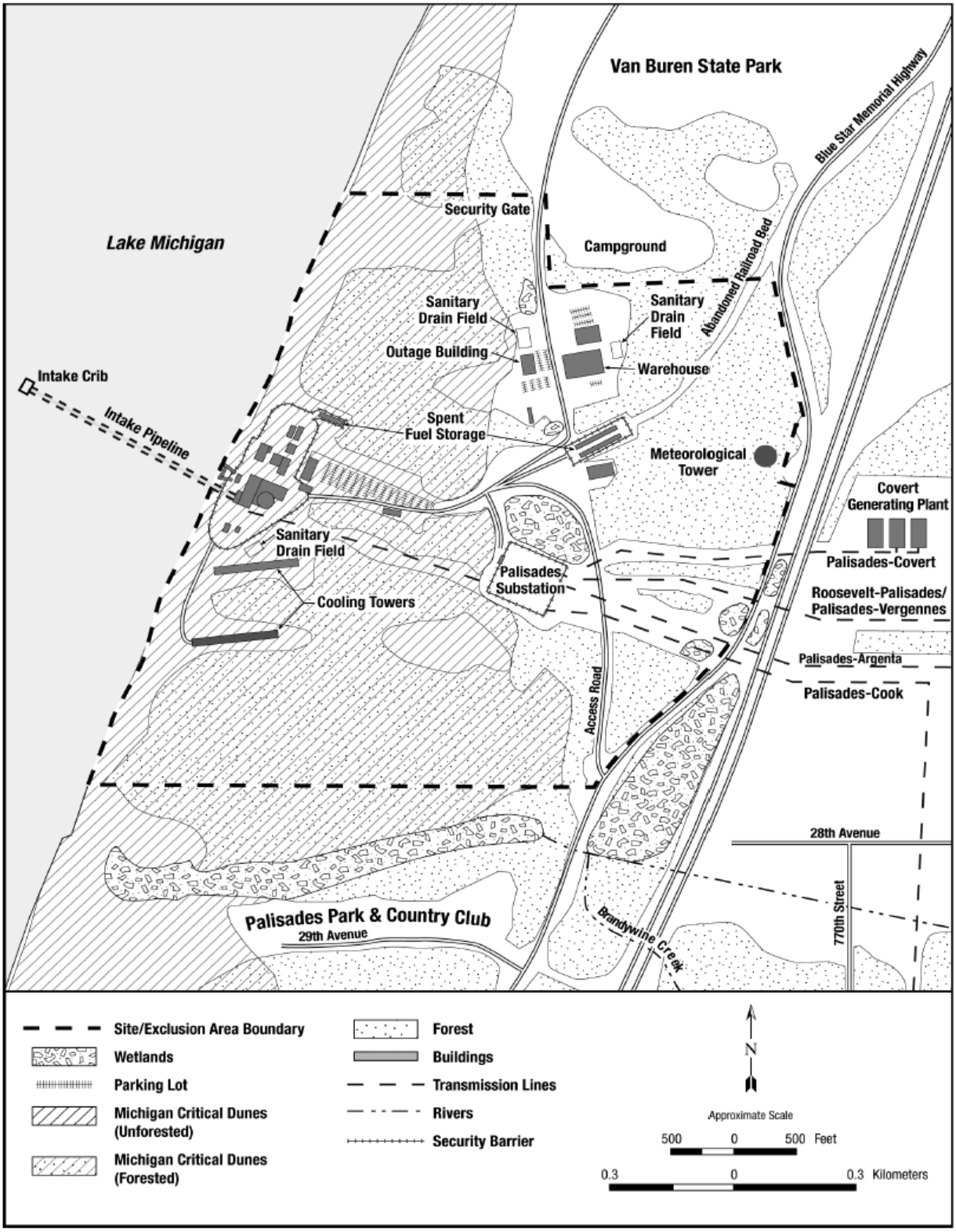

Figure 2-3 Palisades Nuclear Plant Site Layout. Source: NRC 2006-TN7346.

The NRC staff reviewed Holtec's New and Significant Report (N&S Report) (Holtec 2023-TN10538) and verified information to identify changes to Palisades since the 2006 SEIS. Section 3.1 of the N&S Report states that a review of aerial imagery between 2006 and 2021 shows no major changes to onsite or offsite land use and that the general character of the surrounding area has remained largely the same.

Changes to major systems include the replacement of spent fuel racks in the spent fuel pool and replacement of the cooling towers (Holtec 2023-TN10538). In 2012, cooling tower A was replaced with a pultruded fiberglass design, SPX Marley cooling tower with a reduced number of cells. Whereas the previous design contained 18 cells, the replacement tower includes 16 cells. In 2017, cooling tower B was also replaced with a pultruded fiberglass design, SPX Marley cooling tower, but maintained 18 cells. The replacement towers are crossflow mechanical draft cooling towers, designed for a 32 degrees Fahrenheit (°F) (17.8 degrees Celsius [°C]) range and a maximum sound level of 90 A-weighted decibels at 3 ft (0.9 m) from the equipment (HDI 2023-TN10712; Holtec 2023-TN10538). The replacement towers included drift eliminators with a guaranteed drift rate of 0.001 percent of the circulating water flow rate (HDI 2024-TN10670: RAI-TE-1).

Additional changes that have occurred onsite between 2006–2022 include:

- installation of an auxiliary feedwater pump and associated piping and valves
- cross-connect between water storage tank T-939 and the condensate storage tank T-2
- new security emergency diesel generator
- two new Diverse and Flexible Coping Strategies storage buildings

2.2 Alternatives

For EAs, NRC regulations in 10 CFR 51.30(a)(1)(ii) (TN250) call for a brief discussion of alternatives as required by NEPA.[1] NEPA Section 102(2)(F) requires Federal agencies to, "consistent with the provisions of this Act, study, develop, and describe technically and economically feasible alternatives," and Section 102(2)(H) requires Federal agencies to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." Although NEPA Section 102(2)(C) provides requirements for EISs rather than EAs, the NRC's consideration of alternatives in this EA was influenced by that section. NEPA Section 102(2)(C) specifies consideration of a "reasonable range of alternatives" that are "technically and economically feasible, and meet the purpose and need of the proposal" (TN661). Additionally LIC-203, "Procedural Guidance for Categorical Exclusions, Environmental Assessments, and Considering Environmental Issues" (NRC 2020-TN6399), guides the NRC staff to consider a no-action alternative as part of the range of reasonable alternatives in EAs. In Section 2.2.1 and Section 2.2.2 of this EA, the NRC staff provide a description of those alternatives carried forward for further analysis in Section 4.2 and those considered and not carried forward.

[1] NEPA Section 51.30(a)(1)(ii) specifically references the requirements of NEPA Section 102(2)(E). However, NEPA has been substantially amended since the last revision to 10 CFR 51.30. The contents of NEPA Section 102(2)(E) were moved to Section 102(2)(H) and a new Section 102(2)(F) on the consideration of alternatives was added.

2.2.1 Alternatives Carried Forward for Further Analysis

2.2.1.1 No-Action Alternative

Under the no-action alternative, the NRC would not approve the exemption request, license transfer request, and LARs for Palisades. In this scenario, Palisades would not be reauthorized for refueling the reactor or resuming power operations and would continue to function as a plant in decommissioning as outlined in the Post-Shutdown Decommissioning Activities Report (PSDAR) (Holtec 2020-TN10539). The no-action alternative would not meet the purpose and need of the proposed Federal actions to provide an option for baseload power and contribute to Michigan's clean energy goal. Holtec has not indicated how the energy demand underlying the purpose and need would be met for the power that would have otherwise been generated by resuming operations at Palisades. If it becomes necessary for utilities or other power suppliers to build other nuclear or non-nuclear power generation facilities to meet the demand, building those facilities would result in additional environmental impacts related to land disturbance and operation of construction equipment that would not be necessary if the already built Palisades is restarted.

Section 3 in this EA describes how the potential environmental impacts of the proposed Federal actions would be minimal, and any avoidance of environmental impacts from selecting the no-action alternative instead of the proposed Federal actions would therefore also be minimal. Additionally, environmental impacts from any land disturbance and operation of construction equipment to build other power generation facilities needed to offset the capabilities of the Palisades facilities could potentially be substantial. However, the no-action alternative is carried forward for analysis in Section 4.2 in order to meet procedural requirements.

2.2.2 Alternatives Considered and Not Carried Forward for Further Analysis

2.2.2.1 Replacing Palisades Reactor with New Onsite Reactor

One alternative would be to continue decommissioning the existing Palisades reactor and build a new reactor in its place to generate the needed power. Because decommissioning would require several years, the delay needed to finish decommissioning and remove the existing facilities before beginning to construct a new reactor may impede the timely implementation of the purpose and need of the proposed Federal action. This alternative would also require substantial construction costs beyond those needed to resume operation of the already built reactor. This alternative would reuse land that had been previously disturbed by the existing reactor, but it would still result in additional noise, emissions, and other impacts from building new facilities.

Another alternative would be to build a new reactor (and associated ancillary buildings) using other land within the Palisades site. As described in Section 2.2.1 of the 2006 SEIS (NRC 2006-TN7346), the site comprises approximately 432 ac (175 ha) of land, of which only about 80 ac (32 ha) are occupied by buildings and other permanent structures. The remaining land would be available to build a new reactor. Construction of the new reactor would not have to wait for decommissioning of the existing reactor, although building a new reactor would still take longer than resuming operation of an already built reactor. The new reactor could still use existing roads, transmission lines, and other support infrastructure already servicing the Palisades site. However, building a new reactor would still require substantial costs beyond those needed to resume operation of an already built reactor. Additionally, building the new reactor would require substantial additional ground disturbance not needed to put the existing reactor back in

operation. The unused lands on the Palisades site include sensitive dune, forest, shoreline, and wetland habitats. Using those lands to build a new reactor could result in loss or degradation of those habitats, as well as generate additional noise, emissions, and other impacts from building new facilities.

Neither of the alternatives described above were carried forward for detailed analysis because of the additional time and cost needed to build a new reactor and greater environmental impacts relative to resuming operation of the existing reactor.

2.2.2.2 Replacing Palisades Reactor with Other Power Generation Technologies

As stated in the purpose and need, the reauthorization of reactor power operations at Palisades would provide 800 MWe of additional “clean energy,” as defined by Michigan’s Public Acts of 2023, Act No. 235 (enrolled Senate Bill 271)(State of Michigan 2023-TN10671), to contribute to Michigan’s clean energy goals. It may be possible to generate the needed power using non-nuclear power generation technologies such as natural gas, solar, or wind. It may also be possible to generate the power by developing new nuclear facilities using technologies that differ from those previously used at Palisades, such as advanced nuclear designs or SMR technologies. Whether using non-nuclear or nuclear energy generation, implementing any of the possible alternatives would require building new power generation facilities. As noted in the section above, it would not be feasible to wait to fully decommission the existing Palisades reactor before building the alternative power generation facilities, but at least some of the new facilities could be built using other land within the Palisades site. It is however unclear whether enough land is available on the Palisades site to accommodate land-extensive power generation methods such as wind or solar. Otherwise, the new power generation facilities could be built on other sites capable of supplying energy to Michigan’s population, although those sites may not be served by the existing infrastructure already servicing the Palisades site such as transmission lines and roads. Using alternative power generation fuels or technologies to generate the additional energy would therefore result in substantial additional environmental impacts not needed to resume operation of the existing reactor, especially those related to additional land use, ground disturbance, and use of construction equipment.

None of the alternatives described above were carried forward for detailed analysis because of the additional time and cost needed to build the alternative facilities and greater environmental impacts relative to resuming operation of the existing reactor.

2.2.2.3 Installing System Design Alternatives for Use with the Current Palisades Reactor

System design alternatives would involve fitting the existing Palisades reactor with alternative system designs for processes such as heat dissipation, circulating water, and transmission systems. However, the systems already in place at the reactor meet regulatory requirements (e.g., U.S. Environmental Protection Agency (EPA) 316(b) [TN662]). As described in Chapter 3 of this EA, the NRC staff has determined that the environmental impacts from resuming operation of the existing facilities, with their existing systems, as called for in the proposed Federal action would be minimal. There is therefore no reason to carry any such alternatives forward for more detailed analysis.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1 Organizational Approach for Resource-Specific Environmental Impact Significance Determinations

This section provides the organizational structure for the environmental impact significance determination analysis for each of the identified resource areas. As described in Section 1.3.2 of this EA, the NRC scoping process was used to identify issues and environmental resource areas that are not anticipated to have a potential for significant impact or have been covered by prior environmental review(s). This process narrows the discussion of these issues to a summary of the analysis conducted, and brief discussion of why the resource area will not have a significant effect on the human environment or, if applicable, includes a reference to their coverage elsewhere. Based on the results of the NRC's scoping process, the NRC staff focused the EA analysis on resource areas with the potential for significant environmental impacts. The resource areas listed below were identified during scoping to not have the potential for significant impacts or were covered by prior environmental review(s). Therefore, the NRC staff provides a brief discussion of these resource areas in Section 3 of this EA.

- Land Use and Visual Resources (Section 3.2)
- Nonradiological Human Health (Section 3.11.2)
- Waste Management (Section 3.12)
- Uranium Fuel Cycle (Section 3.13)
- Postulated Accidents (Section 3.14)

Additionally, in response to the number of the public comments received during the NRC's scoping process concerning thyroid cancer in the vicinity of Palisades, the NRC staff developed Appendix H of this EA regarding cancer risks at and around Palisades.

3.1.1 The Affected Environment Related to the Proposed Federal Actions

As described in Section 1.3.4 of this EA, the environmental baseline or affected environment for Palisades and the proposed Federal actions under the NRC staff's evaluation are the environmental conditions at the point in time prior to the commencement of the project. Palisades is currently in a decommissioning state. Therefore, the affected environment will be defined for each resource area given this temporal baseline. In some instances, such as describing the built environment, much of the information from the 2006 SEIS (NRC 2006-TN7346) may be incorporated by reference, where appropriate. Whereas, for some resource areas, such as air quality or socioeconomics, current data is included as necessary for the evaluation.

Transition to decommissioning resulted in Holtec reducing the number of workers employed at Palisades from approximately 550 employees in 2022 to 218 employees in 2023 (HDI 2024-TN10670: RAI-SE-1). Holtec also removed two structures in the plant protected area during decommissioning because the buildings exhibited poor structural integrity (Holtec 2023-TN10538). Holtec continues to conduct routine herbicide application (HDI 2024-TN10670: RAI-GEN-1).

While this decommissioning state reflects the current affected environment at Palisades, each resource area includes a specific, and relevant, discussion on various aspects of the affected environment to make an environmental significance determination for:

- Impacts or effects related to the activities for preparations for the resumption of power operations, described in Section 3.1.2 of this EA.

- Impacts or effects related to the resumption of power operations, described in Section 3.1.3 of this EA.
- Cumulative effects, described in Section 3.1.4 of this EA.
- Climate change and GHG evaluation, described in Section 3.1.5 and Appendix F of this EA.
- Activities related to the return to decommissioning, described in Section 3.15 of this EA.

3.1.2 Impacts from Preparations for Resumption of Power Operations

When considering the impacts related to the preparations for the resumption of power operations, Holtec provided a list of the associated activities to be completed for the resumption of power operations (HDI 2024-TN10670: RAI-GEN-1). Several of the activities involve ground disturbance that have the potential to affect environment resources and are listed in Table 3-1 and presented in Figure 3-1 below. The identified potential land disturbances are in previously disturbed areas (Figure 3-2 of this EA). Appendix I to this EA provides a set of historical photographs documenting the previous disturbance. The NRC staff considered these activities when determining the related environmental impacts.

Table 3-1 Land Disturbing Activities Related to the Preparations for Resumption of Power Operations at Palisades Nuclear Plant (HDI 2024-TN10670: RAI-GEN-1, HDI 2024-TN10856)

Activities	Acre[(a)]
Complete the security infrastructure changes including new barrier/wall, new intrusion detection, new/relocated ballistic resistant enclosures, and new security search detectors.	4
Replace 18 power cables from load centers to cooling tower stepdown transformers. Trench dimensions are estimated to be 50 in. wide and 27 in. deep.	3
Design and construct a new south radioactive material storage building inside the security protected area boundary. It is anticipated that the excavation depth will be a minimum of 42 in. deep.	1
Expand access road at south end of protected area. The project includes a road lane inside the new security barrier and a road lane outside the security barrier for a total of approximately 85 ft in width. The deepest point into the previously disturbed critical dune will be approximately 45 vertical ft and is located on the east end of the roadway.	2
Repair underground pipe, leaking condensate storage tank (T-2) piping, and leaking Utility Water Storage Tank (T-91) piping.	0.2
Construction of Digital Staging Testing Building (associated with the Digital Electrohydraulic Control Software and computer hardware control system replacement). The building is planned to be a single story building approximately 40 ft wide × 80 ft long and 20 ft tall located between the steam generator mausoleum and spare transformer pad. The building is expected to be erected upon a concrete pad foundation with a planned excavation depth of approximately 1 ft.	0.1
New BREs constructed within the protected area. Five outdoor BREs between 30 to 40 ft tall (above grade) will be erected. Shallow (3–6 in.) foundations, footprint is estimated to be 30 ft × 30 ft. All BREs are planned to be within the protected area, with three of the BREs along the west side of the Palisades site.	0.1
Routine maintenance of the stormwater outfalls which may involve removal of sediment.	0.1
Stormwater outfalls pipe replacement and riprap movement which could require staging of riprap and placing the same riprap back to the stormwater outfalls.	0.5

BRE = blast resistant encloser; VAC = volt(s) alternating current.

(a) Total acreage of disturbance for each activity includes any associated laydown area(s). Activities may not be mutually exclusive and may overlap.

Figure 3-1 Location of Select Ground-Disturbing Activities at Palisades Nuclear Plant Related to the Preparations for the Resumption of Power Operations. Adapted From: HDI 2024-TN10670: RAI-GEN-1.

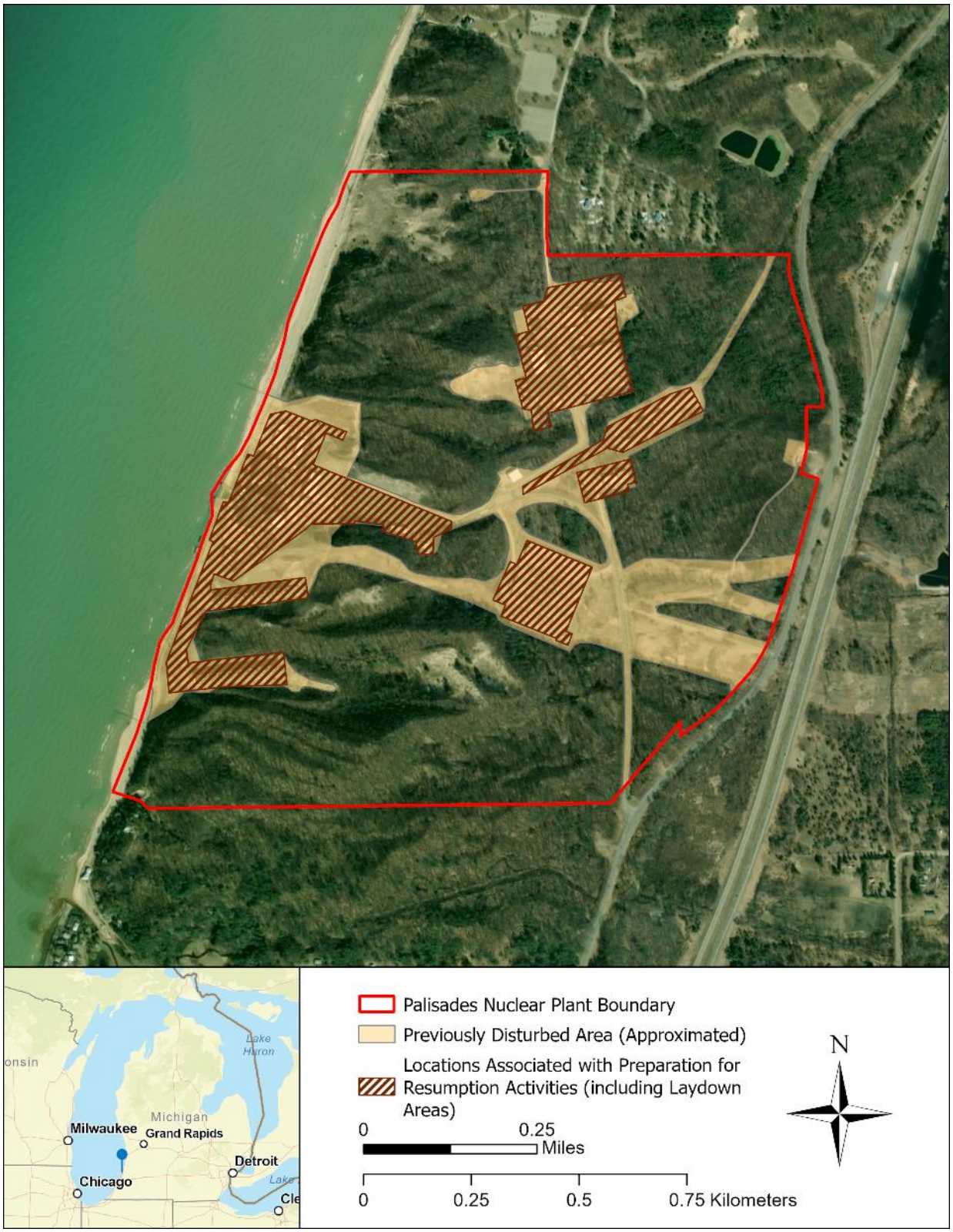

Figure 3-2 General Locations (Including Laydown Areas) of Preparation of Resumptions of Power Operations Activities at Palisades Nuclear Plant. Adapted From: HDI 2024-TN10670: RAI-GEN-1.

Other outdoor activities that do not involve land disturbance or preclude any significant environmental impact include maintenance and inspections, upgrades to heating, ventilation, and air conditioning units, building renovation, evaluation for removal of sediment in the mixing basin, reinstallation of the main transformer and associated metering, and installation of mobile personnel buildings. Temporary laydown areas will be required for preparation activities associated with inspections, procurement, building renovations and upgrades (e.g., Feedwater Purity Building renovation), cooling system expansion joint replacement, valve maintenance, and construction activities (Figure 3-2).

Holtec also plans to complete numerous indoor activities in preparation for reactor operations (HDI 2024-TN10670: RAI-GEN-1). These include maintenance activities, replacement of both component cooling-water (CCW) heat exchangers and other equipment, cooling system chemical decontamination, and inspections.

3.1.3 Impacts from the Resumption of Power Operations

Reactor operations would resume at Palisades if the NRC approves the exemption request, license transfer request, and LARs. These approvals would permit Holtec to transition Palisades from a facility in decommissioning to an operating facility under the Palisades RFOL. Holtec plans to resume reactor operational activities using the same management practices in use prior to decommissioning (Holtec 2023-TN10538).

When evaluating the potential environmental impacts from the *resumption of power operations*, the NRC staff reviewed and incorporated by reference analyses completed in the 2006 SEIS (NRC 2006-TN7346), and other relevant environmental review documents, where appropriate. These previous NEPA analyses help support the independent significance determinations for the proposed Federal actions discussed in this EA. In many instances, the NRC staff's impact determination of SMALL[2] in the 2006 SEIS for a particular resource area informed the NRC staff's basis for a "NOT SIGNIFICANT" determination for that resource area in this EA.

The NRC staff's impact determinations in this EA also considered any new and relevant information that could affect the analysis for each resource area, including other relevant NEPA documents such as NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" Revision 2 (2024 LR GEIS) (NRC 2024-TN10161).

3.1.4 Cumulative Effects Evaluation

Cumulative effects are the effects on the environment resulting from the incremental effects of the Federal actions when added to the effects of other past, present, and reasonably foreseeable actions on a particular resource area. The cumulative effects evaluation accounts for both geographic (spatial) and time (temporal) considerations of past, present, and reasonably foreseeable actions. Appendix G, Table G-1 of this EA identifies other past, present, and reasonably foreseeable projects and actions the NRC staff considered when determining cumulative environmental effects. The NRC staff considered projects and actions within a 50 mi (80 km) radius of the Palisades site, except when specifically stated otherwise. Past actions

[2] The NRC staff typically characterizes environmental impacts as SMALL as follows (NRC 2012-TN5527, NRC 2012-TN5528): Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. In assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the agency's regulations are considered SMALL.

include NRC past actions, e.g., licensing of operations, which are included in the cumulative effects analysis. The NRC staff's analyses of the potential cumulative effects of the proposed Federal actions when added to the effects of other past, present, and reasonably foreseeable actions are presented within each resource area section of this EA.

3.1.5 Climate Change and Greenhouse Gas Evaluation

The NRC staff's evaluation considers climate change impacts through the remainder of the term of the Palisades RFOL. The climate change evaluation includes a description of how the baseline environment, defined in Section 3, might change as a result of climate change along with a discussion of how the impacts discussed in Sections 3 and 4 would either increase, decrease or remain the same in this new baseline environment. Potential climate change and GHG impacts are evaluated and described in Appendix F to this EA.

3.2 Land Use and Visual Resources

The NRC staff evaluated land use and visual resource information in related environmental documents to determine the potential environmental effects from the proposed Federal actions at the Palisades site. Portions of the following documents relevant to the subject area are incorporated by reference in support of the NRC staff's land use and visual resource significance effects determination (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.1.1, External Appearance and Setting; 2.2.1, Land Use
- 2023 N&S Report (Holtec 2023-TN10538): Section 3.1, Land Use
- 2024 LR GEIS (NRC 2024-TN10161): Section 4.2.1, Environmental Consequences of the Proposed Action – Continued Operation and Refurbishment Activities

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.2.1 Affected Environment

As described in the 2006 SEIS (NRC 2006-TN7346), Palisades is located in a predominantly rural area, characterized by agriculture land, woods and sand dunes along the lakeshore of Lake Michigan. Palisades is bordered by Van Buren State Park on the north and a privately owned residential and lakefront recreational community, Palisades Park Country Club, on the south (see Figure 2-3 of this EA).

Palisades is also located within Michigan's coastal zone and includes sandy beaches on the shoreline of Lake Michigan that play a role in the preservation and wildlife habitat quality of the critical dune area. The movement of sand via littoral drift from surrounding shoreline areas is important for maintaining the structure of replenishing the beach. Site observations by the NRC ecologists in 2024 noted that the adjacent beaches lakeward of the developed areas on the Palisades site were armored against erosion and subsequently narrowed relative to the beaches fronting undeveloped lands on the site. The unarmored beaches at the Palisades site are relatively robust and wider in comparison.

Beach erosion and replenishment are covered under the Coastal Zone Management Act of 1972, as amended (CZMA) administered by Michigan's Coastal Management Program. Section 307(c)(3)(A) of the CZMA (16 U.S.C. 1456(c)(3)(A))(TN1243), requires that an applicant

for a Federal license or permit, conducting an activity affecting any land or water use or natural resource of the coastal zone, provide in the application to the licensing agency (in this case, the NRC) a certification that the proposed activity complies with the enforceable policies of the state of Michigan's coastal zone management program. Per 15 CFR 930.51(b) (TN4475), the term "federal license or permit" includes certain specified types of renewals and major amendments that affect a coastal use or resource.

In order to meet this requirement, Holtec requested the Michigan Department of Environment, Great Lakes, and Energy (Michigan EGLE), Water Resources Division, affirm that the current Palisades CZMA Consistency Certification (Certification), issued on June 14, 2005, for the renewal of the Palisades facility operating license remains valid. In their response, Michigan EGLE outlined conditions to be met for the Certification to remain valid and provided current information on the requirements included in the 2005 Certification (HDI 2024-TN10670: RAI-GEN-3). As described in 15 CFR 930.51(b)(3), the determination hinges on whether the activity authorized by the amended license or permit would affect any coastal use or resource in a way that is substantially different than the description or understanding of effects at the time of the original activity. Consequently, the term of the 2005 Certification would continue through the expiration of the Palisades' RFOL unless the NRC determines that the amendment would affect the coastal use or resource in substantially different ways when compared to the original activity. The NRC has determined that the Federal actions would not be substantially different from the description or understanding of the effects at the time of the original activity. This conclusion is based on the NRC staff's review of the preparations for and the resumption of power operations as documented in the conclusions for Sections 3.2, 3.3, and 3.4.

As described in Section 2.2.1 of the 2006 SEIS, the plant facilities are located about 2,500 ft (760 m) from both the northern and southern boundaries of the industrial zoned, 432 ac (175 ha) Palisades site. A number of buildings and other permanent structures occupy approximately 80 ac (32 ha) of the Palisades site. These include the power generation and administration area (20 ac [8 ha]), transmission corridors and switchyard (30 ac [12 ha]), warehouse area (7 ac [2.8 ha]), cooling towers (4 ac [1.6 ha]), and other supporting buildings and waste storage (7 ac [2.8 ha]).

Information regarding changes to facilities at Palisades were provided as part of the applicant's 2023 N&S Report. Since the 2006 SEIS, two new Diverse and Flexible Coping Strategies buildings were constructed and two buildings were removed due to poor structural conditions (Holtec 2023-TN10538: Section 3.1). The NRC staff notes that in addition to facility changes, vapor plumes from cooling towers are not a part of the current visual landscape. The resumption of power operations, and operation of the cooling towers, would result in the occasional reappearance of vapor plumes under certain atmospheric conditions. Vapor plumes are more frequently seen in winter months, or during the night and early morning when temperatures are lower, and humidity levels rise. Winds off the lake can cause plumes to dissipate close to the ground.

3.2.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

Preparations for the resumption of power operations activities, summarized in Section 3.1.2, were reviewed to determine any land use or visual resource impacts. The construction of two new buildings, access road expansion, new security fence, and other ongoing industrial activities, would be consistent with the designated industrial use and appearance of the existing nuclear power plant site. The NRC has also concluded that activities in support of the

resumption of power operations would not affect any coastal use or resource in a substantially different way than during previous power operations (per 15 CFR 930.51(b)(3) [TN4475]; HDI 2024-TN10670: RAI-GEN-3). Based on this, the NRC staff has determined the proposed Federal actions would not alter the industrial land use and visual appearance of Palisades and would be NOT SIGNIFICANT.

3.2.3 Environmental Impacts from the Resumption of Power Operations

Environmental impacts from the resumption of power operations would result only from activities at or in immediate proximity to existing facilities on previously disturbed land within the industrial areas of the Palisades site on land zoned for industrial use. Activities in support of the proposed Federal actions (e.g., periodic vegetation clearing, landscaping, and other routine maintenance activities) would be consistent with the designated industrial use and appearance of the nuclear power plant site and would be similar to those that occurred at the nuclear plant during previous operation. Therefore, industrial activity would remain unchanged.

The Palisades plant is located on the shores of Lake Michigan. The visual appearance has been well established and remains unchanged from previous operation during decommissioning. The resumption of power operations, however, would also include the occasional reappearance of vapor plumes from the cooling towers. As explained in Section 3.2.1 of this EA, vapor plumes are more frequently seen in winter months, or during the night and early morning when temperatures are lower and humidity levels rise.

The NRC staff has concluded that activities in support of the resumption of power operations would not affect any coastal areas or resource in a substantially different way than during previous power operations (15 CFR 930.51(b)(3) [TN4475]; HDI 2024-TN10670: RAI-GEN-3). Therefore, the NRC staff has determined the proposed Federal actions would not alter the industrial land use and visual appearance of Palisades and, therefore, would be NOT SIGNIFICANT.

3.2.4 Cumulative Effects

Appendix G, Table G-1 identifies other past, present, and reasonably foreseeable actions that could result in cumulative effects. The addition of SMRs on the Palisades site would be consistent with the existing industrial land use and appearance of Palisades. SMR operation could generate additional vapor plumes if the proposed SMR technology requires building additional cooling towers.

As discussed in Sections 3.2.2 and 3.2.3 of this EA, the proposed Federal actions would have not have a noticeable effect on the industrial use and visual appearance beyond what has been previously experienced. SMRs, if constructed onsite, would be consistent with the existing industrial use and appearance of Palisades. Therefore, the NRC staff has determined that incremental land use and visual effects of the proposed Federal actions when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.3 Meteorology and Air Quality

The NRC staff evaluated previous environmental documents and analyses with regard to meteorology and air quality along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental

documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for meteorology and air quality (see Table 1-2):

- 2006 SEIS (NRC 2006-TN7346): Section 2.2.4, Air Quality
- N&S Report (Holtec 2023-TN10538): Table 3.7-2, PNP Annual Emissions (Pounds Per Year); Table 4.3-2, Comparison of Category 1 and 2 Terrestrial Resources Issues Over Time and Applicability to PNP
- 2024 LR GEIS (NRC 2024-TN10161): Section 4.6.1.1.4, Cooling Tower Impacts on Terrestrial Plants
- Holtec RAI Response (HDI 2024-TN10670): RAI-GEN-1 (Detailed list of activities related to the Federal actions); RAI-GEN-3 (Environmental authorizations necessary for the proposed actions); RAI-MET-1 (Recent climatological data); RAI-MET-5 (Construction equipment emissions); RAI-MET-6 (Annual pollutant emissions since 2022); RAI-TE-1 (Cooling system changes)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.3.1 Affected Environment

In defining the affected environment for air quality and meteorology, the NRC staff assessed previous environmental documents, incorporating by reference where relevant, along with current data.

Regional Climatology

As described in the 2006 SEIS (NRC 2006-TN7346), the Palisades site is in the humid continental climate region zone, characterized by the dominance of tropical air masses in summer and polar air masses in winter. Heavy snow occurs during winter with polar air masses bringing moisture from the Great Lakes.

Temperature

Seasonal changes between summer and winter are very large, with an average seasonal temperature change of 46.4°F (25.8°C) occurring during 2000–2023. Normal monthly temperature ranges from 16.6 to 35.1°F (-8.6 to 1.7°C) in January and 66.8 to 77.7°F (19.3 to 25.4°C) in July (NOAA 2024-TN10785).

Normal Precipitation

Recent climate data from the National Oceanic and Atmospheric Administration (NOAA) was used to characterize the affected environment. Normal monthly precipitation during 2000–2023 ranged from 0.45 to 11.9 in. (1.1 to 30.2 cm) (NOAA 2024-TN10767). Local precipitation occurs throughout the year, with a typical increase in rainfall in summer. Precipitation ranges from 0.45 to 5.7 in. (1.1 to 14.5 cm) in winter months (November–March), between 0.6 to 11.9 in. (1.5 to 30.2 cm) during summer and fall months (May–October) and between 0.6 to 7.2 in (1.5 to 18.3 cm) during the month of April (NOAA 2024-TN10767).

Extreme Weather

There were 87 thunderstorm events were reported from 2000 to 2023 in Van Buren County with a total damage of 5.6 million dollars (NOAA 2024-TN10768). Three Enhanced Fujita (EF) scale tornadoes of EF0 and one EF1 tornado occurred during the period between 2000 to 2023. An EF0 tornado developed during June 2010 with thunderstorms in southern Lake Michigan which moved northeast into Van Buren and Kalamazoo Counties causing damage of approximately 100,000 dollars (NOAA 2024-TN10770). Three flood events were recorded during this period, with the most recent one occurring near South Haven on April 17, 2013 causing damage over 32 million dollars (NOAA 2024-TN10769).

On-site Meteorological Monitoring

Holtec monitors 15-minute averages of wind speed, wind direction, standard deviations of wind direction (θ) and ambient temperature at 33 and 197 ft (10 and 60 m). The meteorological equipment at the Palisades site is periodically checked by onsite personnel while daily inspections are performed by remote computer and instrumentation is calibrated semiannually. The monitoring program procedure and quality assurance documents are maintained by the applicant within Holtec Procedure EM-33 (HDI 2024-TN10670: RAI-MET-1).

Winds are predominant from northwest and southwest during 2022 through 2023 at 197 ft (60 m) height. High wind speeds are more frequent during winter months and very low wind speeds are observed during summer months. The average wind speed showed a decreasing trend at both 33 ft (10 m) and 197 ft (60 m) heights from 1983 through 2023. An average wind speed of 7.67 miles per hour (mph) (3.43 m/s) was noted at 10 m and 13.6 mph (6.1 m/s) at 60 m during the period of 1983 to 2023. The atmospheric conditions were 25 percent unstable (A–C), 59 percent neutral (D–E), and 16 percent stable (F–G) during 2023. Stability frequencies are noted to shift toward the unstable classes in recent years (HDI 2024-TN10670: RAI-MET-1).

The Palisades site experiences considerable cloud cover during most of the year, which can influence air dispersion of radioactive releases as cloud cover generally creates a more stable atmosphere with less atmospheric mixing. The vent release height for radioactive releases is 191 ft (58.1 m). The relative air dispersion (χ/Q) for routine releases were determined to be 1.8×10^{-6} at the site boundary, which is about 0.5 mi (0.8 km) from the release point. Short-term χ/Q was estimated as 1.55×10^{-4} for 0 to 2 hours and 4×10^{-5} for 0 to 8 hours at the exclusion area boundary of 2,641 ft (805 m) (Entergy 2016-TN10765: Chapter 2).

Regional Air Quality

Palisades falls within the South Bend-Elkhart (Indiana)-Benton Harbor (Michigan) Interstate Air Quality Control Region. Van Buren County, Michigan, where the plant is located, is in attainment for all criteria pollutants. Berrien County in the south and Allegan and Muskegon Counties in the north are currently in moderate non-attainment for the 8-hour ozone standard of 2015 (40 CFR Part 81-TN7226). Porter County in Indiana to the south of the Palisades site is also a non-attainment area for ozone standard of 2015. Ionia County is a maintenance area for lead standard of 2008. LaPorte County in Indiana to the south of the Palisades site, is a maintenance area for the 24-hour sulfur dioxide standard of 1971 and the 8-hour ozone standard of 1997. There are no Prevention of Significant Deterioration Class I areas located within 100 mi (161 km) radius of the Palisades site.

Major emission point sources in Van Buren County include a natural gas fired 1,176 MW power plant and a pharmaceutical laboratory that operates gas boiler and emergency diesel generators. The Kalamazoo County has major point sources such as a pharmaceutical manufacturer, a paper mill, university, and aluminum industry. The Allegan County has two major natural gas compressor stations, a paper mill, and an animal slaughterhouse. There are landfills and a major natural compressor station in Berrien County (MEGLE 2024-TN10766).

The major emission sectors for nitrogen oxides (NO_x) in these four counties are vehicular traffic (41 percent), railroad, marine vessels and nonroad vehicles (15 percent), industrial and commercial fuel combustion (17 percent) and residential heating (10 percent) based on a 2020 emissions inventory emissions (EPA 2024-TN10668).

The de minimis emissions for ozone precursors, particulate matter $(PM)_{2.5}$, and sulfur dioxide (SO_2) are 100 tons per year (TPY) and 25 TPY for lead in moderate non-attainment areas and maintenance areas. The de minimis emission rates provides thresholds below which no conformity determination is required for criteria pollutants. The NRC staff uses the thresholds for maintenance areas when determining the impacts from criteria pollutant emissions to understand whether the project could potentially further degrade the air quality in a non-attainment area or maintenance area. While Van Buren County is in attainment for all criteria pollutants, where the Palisades site is located, there are surrounding locations which are in non-attainment or maintenance areas for ozone, lead, and sulfur dioxide.

Gases found in the Earth's atmosphere that trap heat and play a role in the Earth's climate are collectively termed GHG. Climate change is a subject of national and international interest because of how it changes the affected environment. Commission Order CLI-09-21 (NRC 2009 TN6406) provides the current direction to the NRC staff to include the consideration of the impacts of the emissions of CO_2 and other GHGs that drive climate change in its environmental reviews for major licensing actions. The GHG emissions estimates from a 1,000 MWe reactor and the scaling calculations for Palisades are presented in Appendix F. The NRC staff estimated the GHG emissions, using the assumptions discussed in Appendix F, of the proposed actions, 1,444,739 MT CO_2(eq)—this includes emissions from preparation activities and resumption of operations. The total life-cycle emissions (which also include decommissioning) were estimated to be about 1,474,000 MT CO_2(eq).

3.3.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

The activities related to the preparations for the resumption of power operations, summarized in Section 3.1.2 of this EA, were reviewed to determine any impacts related to meteorology and air quality. The identified activities include the upgrade or replacement of existing equipment and facilities. These activities will include some ground-disturbing activities and employ construction equipment and heavy-duty trucks that burn diesel. The applicant estimated 3,000 truck deliveries over an 18-month period during the preparations for the resumptions of power operations (HDI 2024-TN10670: RAI-GEN-1). An estimate of truck emissions was performed assuming each truck would travel a total of 1,000 mi (1,609 km) (NRC 1975-TN216: Table S-5). Table 3-2 below shows the estimates calculated and verified by NRC staff using emission factors for diesel trucks provided by the U.S. Department of Transportation (DOT 2024-TN10673). There will be slight emissions from other construction activities, such as maintenance activities and required endurance testing. However, these activities are periodic and will not significantly impact the local air quality. It is expected, and as confirmed during NRC's audit, that the applicant would use best management practices (BMPs) to reduce fugitive

dust, such as watering (NRC 2024-TN10842). Additionally, it is anticipated that emissions from onsite sources operating during the preparations for the resumption or power operations, such as the oil boilers, would be similar to emissions during the period of decommissioning in 2023 (Table 3-3). GHG emissions estimates during the preparation for resumption of power operations are presented in Appendix F of this EA. The NRC staff anticipate combustion and fugitive emissions from preparation activities would be NOT SIGNIFICANT.

Table 3-2 Emissions Estimates from Truck Deliveries at the Palisades Nuclear Plant over the 18-Month Period of Preparation Activities in Metric Tons

Pollutant	Emission Factor (gram/mile)	Emissions (MT)
VOC	0.181	0.543
CO	1.592	4.776
NO_x	2.711	8.133
$PM_{2.5}$	0.058	0.174
CO_2	1,387.0	4,161.0

CO = carbon monoxide; CO_2 = carbon dioxide; MT = metric ton(s); NO_x = nitrogen oxides; PM = particulate matter; VOC = volatile organic compound.

3.3.3 Environmental Impacts from the Resumption of Power Operations

Cooling Towers

The Palisades site has two banks of 65 ft (20 m) high mechanical draft cooling towers on the southern side of the plant, which replaced the original cooling towers in 2012 and 2017 (section 2.1 of this EA). Cooling towers produce condensate plumes along with their associated drift. The replacement towers have drift eliminators that have a drift rate not to exceed 0.001 percent of the circulating water flow rate (HDI 2024-TN10670: RAI-TE-1). In the 2024 LR GEIS (NRC 2024-TN10161), the NRC staff noted that all observable effects on vegetation from the cooling tower plume ceased after the plant stopped adding sulfuric acid to the cooling water prior to the initial license renewal for Palisades, and noted that there were no anticipated additional impacts associated with cooling tower drift from the original towers. There are no planned modifications to the cooling towers as part of the resumption of power operations (Holtec 2023-TN10538). Since there would be no significant changes in the manner in which the cooling towers are operated (e.g., cooling-water chemistry), and Palisades has replaced the original cooling towers with new towers with drift eliminators, there would be no significant impact from the operations of the cooling towers.

Emissions from Normal Operations

Palisades currently holds a source-wide operating permit (permit no. MI-ROP-B2934-2019a) to install and operate the emission sources (HDI 2024-TN10670: RAI-MET-5, RAI-GEN-1). An air permit renewal application was submitted by Holtec to the Michigan EGLE and is pending approval (HDI 2024-TN10670: RAI-GEN-3). No additional emission equipment units are expected for the resumption of power operations. The Palisades site will operate three fuel oil fired boilers for evaporation heating (21 million British thermal units/hour [MMBtu]/hr), plant heating (23.3 MMBtu/hr), and office heating (2.5 MMBtu/hr). The Palisades site will also operate two emergency diesel fired generators (21.8 MMBtu/hr) with a stack height of 50 ft (15.2 m) above the ground. Palisades will perform routine testing of another diesel fired emergency generator (17.5 MMBTu/hr), 800 break horsepower (bhp) emergency diesel engine for auxiliary feedwater system, two 175 bhp emergency fire pumps, and two 10 bhp emergency air

compressors. Based on the draft permit requirements, the renewal permit, if issued, will require that the applicant shall not exceed the sulfur content of 1.5 percent in fuel oil feed. The two boilers will have a stack height of 100 ft (30.5 m) above the ground with no pollutant control equipment.

Palisades is subject to 40 CFR Part 70 (TN5488), because the potential to emit NO_x and SO_2 exceeds 100 TPY. Palisades is a minor source of hazardous air pollutant (HAP) emissions because the potential to emit any single HAP regulated by Section 112 of the Federal Clean Air Act is less than 10 TPY, and the potential to emit of all HAPs combined are less than 25 TPY. No emission units at Palisades are currently subject to the Prevention of Significant Deterioration regulations of 40 CFR 52.21 (TN4498), because the process equipment was installed prior to June 19, 1978 (MEGLE 2022-TN10667). The annual emissions reported during 2018, 2022, and 2023 are provided in Table 3-3 below. The NRC staff notes that Palisades shut down in May 2022, therefore the emissions from 2022 are representative of air emissions during partial operation and decommissioning, while 2023 is representative of air emissions during decommissioning. The NO_x emissions from fossil fuel combustion are relatively higher than other pollutants, but still much below than the threshold of 100 TPY. Additional contribution to ozone formation from NO_x and VOC emissions should be insignificant. The Palisades site has surrounding counties which are in maintenance status for lead and sulfur dioxide. However, these emissions are very small from the Palisades site. Emissions of hazardous compound are also negligible (HDI 2024-TN10670: RAI-MET-6).

Table 3-3 Total Annual Emissions Reported by Palisades Nuclear Plant for Operations In Metric Tons per Year. Sources: Holtec 2023-TN10538; HDI 2024-TN10670: RAI-MET-6.

Year	NH_3	CO	Lead	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
2018	0.043	1.5	7×10^{-5}	6.2	0.51	0.32	0.006	0.31
2022	0.040	0.84	6×10^{-5}	3.4	0.30	0.18	0.009	0.16
2023	0.076	0.54	1×10^{-5}	2.6	0.23	0.15	0.015	0.03

CO = carbon monoxide; NH_3 = anhydrous ammonia; NO_x = nitrogen oxides; PM = particulate matter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

The NRC staff's independent analysis of the Palisades cooling towers and emissions from normal operations, including GHG emissions presented in Appendix F, determined that the impacts related to the resumption of power operations would be NOT SIGNIFICANT.

3.3.4 Cumulative Effects

Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental effects of the proposed Federal actions. Key past and present actions affecting air quality in the affected area include ongoing operations of fossil fuel fired power plants, mining activities, redevelopment and highway construction activities, industries including refinery, paper mill, pharmaceutical, food processing, metal fabrication, airports, and landfills. Future actions including highway construction and construction and operation of SMRs will affect the regional air quality. The 2020 National Emissions Inventory shows 1992 tons of NO_x emissions, 990 tons of $PM_{2.5}$ emissions, and 9,652 tons of VOC emissions in Van Buren County (EPA 2024-TN10668). Palisades' NO_x emissions were estimated up to 8 TPY with much lower emissions for other criteria pollutants. Thus, Palisades' emissions contribution is very small (<0.4 percent) compared to the existing emissions inventory in the region. The NRC staff determined that the incremental effects of the

proposed Federal actions related to meteorology and air quality when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.4 Surface Water Resources

The NRC staff evaluated previous environmental documents and analyses with regard to surface water resources, along with their relevance to potential environmental effects of the proposed Federal actions at Palisades. Portions of the following environmental documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for surface water resources (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.1.3, Cooling and Auxiliary Water Systems; 2.2.2, Water Use
- 2024 LR GEIS (NRC 2024-TN10161): Section 3.5.1, Surface Water Resources
- N&S Report (Holtec 2023-TN10538): Section 3.2, Water Resources Holtec
- RAI Response (HDI 2024-TN10670): RAI-GEN-1 (Detailed list of activities related to the Federal actions); RAI-GEN-3 (Environmental authorizations necessary for the proposed actions); RAI-SE-1 (Temporary workforce); RAI-SE-2 (Description and breakdown of projected plant employment); RAI-SW-11 (Changes to CCW system heat exchangers)
- Holtec RCI Response (HDI 2024-TN10669): RCI-SW-5, 6, and 7 (Confirmation of water-resources baseline condition – water use); RCI-SW-3 (Confirmation of water-resources baseline condition – intake structure); RCI-SW-10 (Confirmation of water-resources baseline condition – stormwater)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.4.1 Affected Environment

Section 2.1 of this EA describes the location, layout, and cooling system of Palisades, including the intake and discharge structures and source of plant water use. Additional details of the cooling and auxiliary water system are described in the 2006 SEIS (NRC 2006-TN7346). The 2006 SEIS describes that Palisades relied on potable water from South Haven Municipal Water Authority and raw water from Lake Michigan. The raw water from Lake Michigan was primarily used during power operations for waste heat removal from the nuclear plant and steam plant auxiliary systems but also was used for feedwater to produce demineralized water for the cooling loops. Water was withdrawn from Lake Michigan via a pipeline from a submerged intake crib structure, 35 ft (11 m) deep (NRC 2006-TN7346), located offshore and into an onshore intake structure, which included three service water pumps and trash racks. The affected environment described in the 2006 SEIS provides information related to the pre-decommissioning condition at Palisades during previous power operations. Many of the systems in use during the 2006 SEIS have remained and would be used during the resumption of power operations.

Surface Water Use

Following cessation of operations at Palisades, surface water use at the plant has decreased. The decrease was mainly related to the following: (1) cooling water no longer needed for power

production; current cooling is used only for the spent fuel pool (HDI 2024-TN10669: RCI-SW-5, 6, and 7) and (2) the reduction in potable and sanitary water use because the workforce decreased from approximately 550 in 2022 to 218 in 2023 and 449 currently (HDI 2024-TN10670: RAI-SE-1, RAI-SE-2). Currently, Palisades withdraws approximately 6,000 gallons per minute (gpm) of water from Lake Michigan for spent fuel pool cooling (HDI 2024-TN10669: RCI-SW-5, 6, and 7). This water is returned to Lake Michigan. Palisades uses approximately 2.8 gpm (16,000 cubic ft [ft^3] per month) (10.6 lpm and 450 m^3) of potable water from South Haven Municipal Water Authority (HDI 2024-TN10669: RCI-SW-5, 6, and 7).

The cooling tower basins were drained after Palisades ceased operations (HDI 2024-TN10669: RCI-SW-10). Currently, rainwater may accumulate in the basins during storms. The cooling tower basins drain by gravity. Each cooling tower basin holds 158,500 ft^3 (4,488 m^3) of water (HDI 2024-TN10856). In addition, supply lines to the cooling towers, cooling tower water deck, return pipes to the condenser, supply water boxes, condenser tubes, and discharge water box hold additional water. The total volume of the circulating water system from the circulating water pumps to the condenser outlet water boxes is approximately 604,000 ft^3 (17,100 m^3) or 4.5 million gallons (17 million liters) (HDI 2024-TN10856).

The intake structure is inspected annually for integrity and other environmental conditions including zebra mussel buildup (HDI 2024-TN10669: RCI-SW-3). No dredging is currently performed at the intake structure.

Surface Water Quality

Following cessation of operations at Palisades, cooling-water discharge decreased with associated reduction in heat and pollutant loads. Palisades discharges stormwater, wastewater, and treated water under NPDES permit no. MI0001457, which expired October 1, 2018 (MDEQ 2014-TN10665), but has been administratively renewed following a renewal application on June 11, 2018 (HDI 2024-TN10670: RAI-GEN-3). A public hearing on the draft of the renewed NPDES permit (MEGLE 2023-TN10739) was held by Michigan EGLE on October 1, 2024 (MEGLE 2024-TN10787). The renewed NPDES permit, if issued, will be valid through October 1, 2028. Palisades also has a Michigan EGLE-issued Storm Water Management Industrial Site Certification, I-18257, that expired on July 1, 2016 (HDI 2024-TN10670: RAI-GEN-3). Holtec has requested Michigan EGLE to issue a Clean Water Act (CWA) Section 401 water quality certification or a waiver from the water quality certification requirement. Michigan EGLE is currently reviewing Holtec's request.

On October 30, 2023, a noncompliance of the NPDES permit occurred due to overapplication of sodium hypochlorite in the service water system that resulted in an exceedance of total residual oxidant (TRO) permit limit of a daily maximum of 300 µg/L because of one TRO sample measuring 360 µg/L (HDI 2023-TN10674). The daily average TRO limit of 200 µg/L was not exceeded. Holtec notified Michigan EGLE and took corrective actions. The event was documented in Palisades' corrective action process (HDI 2023-TN10674).

Palisades does not use any retention or detention ponds (HDI 2024-TN10669: RCI-SW-5, 6, and 7). Sanitary wastewater is treated and disposed at septic drain fields. Solids are periodically removed from the septic drain fields and disposed offsite at licensed facilities.

The topography of the Palisades site has a local high between the two cooling tower banks (HDI 2024-TN10669: RCI-SW-10). This topographic configuration supports surface runoff from cooling tower B area to the south toward grassy and wooded areas. There are no catch basins,

or stormwater drains near or on the south side of cooling tower B. Stormwater for the rest of the Palisades site is drained by a stormwater drainage system that eventually discharges into Lake Michigan (Figure 3-3 below). There are two stormwater outfalls on the south side of the discharge structure, just north of the old barge slip area. There are three stormwater outfalls on the north side of the discharge structure. Palisades maintains a stormwater pollution prevention plan to manage discharge of stormwater from the plant site to Lake Michigan (Holtec 2023-TN10538). Palisades also manages inadvertent releases of oil, salt, and other polluting materials under its spill prevention, control, and countermeasures and pollution incident prevention plan (SPCC-PIPP).

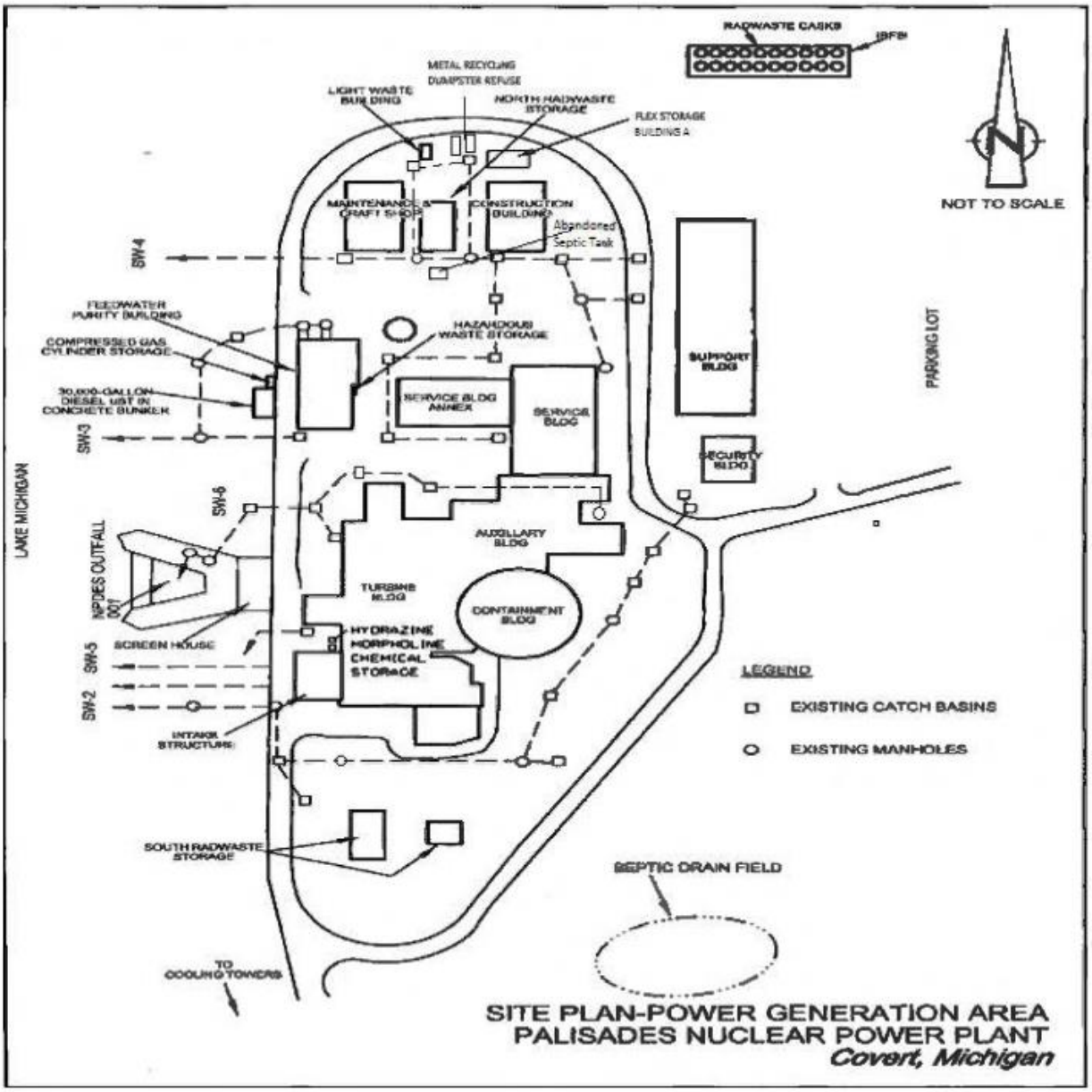

Figure 3-3 Stormwater Drainage System Map at Palisades Nuclear Plant. Source: HDI 2024-TN10670: RAI-SW-4.

3.4.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

Activities related to the preparation for the resumption of power operations at Palisades are described in Section 3.1.2 of this EA. The ground-disturbing activities associated with preparation for resumption of power operations may have potential interfaces with the surface water environment. These interfaces could be related to water use for workers (potable and sanitary); dust suppression during preparations for installation of the new barrier/wall, power cable replacement for cooling towers, expansion of the access road, and installing other buildings and enclosures; and stormwater outfalls' pipes replacement. Holtec expects site employment levels to peak at 1,600 workers during the preparations for resumption of power operations (HDI 2024-TN10670: RAI-SE-1). The peak workforce would be similar to that expected for refueling outages and therefore the potable and sanitary water use by workers would be similar to refueling outages during previous power operations. The activities related to preparation for resumption of power operations are similar to activities associated with license renewal for a plant's non-cooling system, and impacts to surface water use from non-cooling systems were generically determined to be small by the NRC staff in the 2024 LR GEIS (NRC 2024-TN10161). The expansion of the access road requires a permit from Michigan EGLE under the Sand Dunes Protection and Management of Michigan's Natural Resources and Environmental Protection Act (HDI 2024-TN10670: RAI-GEN-1; Michigan Compiled Law 353-TN10693). The stormwater outfalls' pipes replacement would be performed under the existing dredging permit no. WRP020704. The activities are limited in areal extent (see Table 3-1 in Section 3.1.2 of this EA) and therefore any water needed for dust suppression is expected to be minor.

In preparation for resumption of power operations, the cooling tower basins would be filled using water obtained from Lake Michigan (HDI 2024-TN10669: RCI-SW-10). The volume of water needed to fill these basins and other components of the circulating water system is approximately 4.5 million gallons (17 million liters) (HDI 2024-TN10856). This volume is insignificant compared to water availability in Lake Michigan, which has a volume of approximately 1,180 cubic miles (mi^3) or 1.3×10^9 million gallons (4,918 cubic kilometers [km^3] or 4.9×10^9 million liters) (GLC 2024-TN10738). Therefore, the impact of this water use on surface water resources would be minor. In addition, Palisades would continue to withdraw 6,000 gpm (23,000 lpm) water from Lake Michigan to support spent fuel pool cooling (HDI 2024-TN10669: RCI-SW-5, 6, and 7). Water withdrawn to support spent fuel pool cooling would continue to be returned to Lake Michigan and therefore would result in no consumptive water use. Therefore, the impact of this water use on surface water resources would be minor.

The activities in preparation for resumption of power operations may affect surface water quality by potentially altering drainage patterns, resulting in greater surface runoff from the locations of these activities, and transporting sediment and other pollutants with surface runoff to Lake Michigan. These activities are similar to activities associated with license renewal for a plant's non-cooling system and impacts to surface water quality from non-cooling systems, if performed using BMPs, were generically determined to be small by the NRC staff in the 2024 LR GEIS (NRC 2024-TN10161). As stated, these activities are limited in areal extent (see Table 3-1 in Section 3.1.2 of this EA). These activities would be performed under NPDES permit MI0001457 which is currently undergoing renewal (HDI 2024-TN10670: RAI-GEN-3), following the stormwater pollution prevention plan (SWPPP), and employing BMPs. These measures will assure adverse impacts on surface water quality would be minor.

As part of the preparations for resumption of power operations Holtec is considering replacement of both CCW heat exchangers. The potential impacts of the proposed CCW heat exchangers on surface water resources are evaluated in Section 3.4.3.

Based on information in the review of Holtec's N&S Report (Holtec 2023-TN10538), Holtec's responses to NRC's requests for additional information (RAI) (HDI 2024-TN10670) and requests for confirmatory information (RCI) (HDI 2024-TN10669), public scoping (Appendix B), and the assessment described above, surface water resource impacts related to the activities from the preparations for resumption of power operations would be NOT SIGNIFICANT.

3.4.3 Environmental Impacts from the Resumption of Power Operations

Holtec expects site employment to be 600 workers during and after the resumption of power operations (HDI 2024-TN10670: RAI-SE-1). The potable and sanitary water use for the operation workforce would be similar to that during the previous power operations, as described in the 2006 SEIS (NRC 2006-TN7346). As noted in the N&S Report, the potable water would continue to be obtained from the South Haven Municipal Water Authority (Holtec 2023-TN10538). This surface water use is similar to anticipated activities associated with license renewal for a plant's non-cooling system, and impacts to surface water use from non-cooling systems during power operations were generically determined to be small by the NRC staff in the 2024 LR GEIS (NRC 2024-TN10161).

Upon resumption of power operations, raw water would be withdrawn from Lake Michigan for Palisades' service water system and the circulating water system (Holtec 2023-TN10538). During normal operations, a total of 92,000 gpm[3] (40,000 gpm from each of two dilution water pumps and 6,000 gpm from each of two service water pumps) would be withdrawn (HDI 2024-TN10669: RCI-SW-5, 6, and 7). The evaporative loss in the cooling tower would be 12,000 gpm and the remaining 80,000 gpm of the withdrawn water would be returned to Lake Michigan. Over a year of operations, the evaporative loss would be less than 0.001 percent of the water volume of Lake Michigan. As described in Section 3.4.2 of this EA, there is no consumptive water use associated with the proposed CCW heat exchangers. The NRC staff has concluded that the plant water use following resumption of reactor power operation would be similar to Palisades' previous power operation. In the 2006 SEIS, the NRC staff determined that all cooling system-related surface water use impacts for power operations at Palisades were small (NRC 2006-TN7346).

During power operations, impacts to surface water quality from plant discharges would be regulated under Palisades' renewed NPDES permit that is awaiting final approval (MEGLE 2023-TN10739). Under the renewed NPDES permit, Palisades is expected to maintain a stormwater pollution prevention plan for managing stormwater discharge to Lake Michigan. The NRC staff also expects that inadvertent release of polluting materials would continue to be managed under the SPCC-PIPP. Sanitary wastewater is expected to be treated at the existing septic fields and solids periodically disposed at appropriately licensed offsite facilities. Because there would not be any changes to power generation capacity and the circulating water system, the NRC staff expects that the thermal discharges to Lake Michigan would be comparable to previous power operations. In the 2006 SEIS, the NRC staff determined that all cooling system-related surface water quality impacts for power operations at Palisades were small (NRC 2006-TN7346).

[3] There are three 6,000 gpm service water pumps at Palisades, two of which are normally in service (HDI 2024-TN10669: RCI-SW-5, 6, and 7). Altogether, the two 40,000 gpm dilution water pumps and the three 6,000 gpm service water pumps provide a 98,000 gpm water withdrawal capacity.

Holtec is considering replacement of both CCW heat exchangers before resuming power operations at Palisades (HDI 2024-TN10670: RAI-SW-11). Palisades uses two existing CCW heat exchangers, each of which has a nominal 50 percent cooling capacity. The CCW system is the secondary, closed cooling loop that uses service water and is the intermediate cooling system between the radioactively contaminated systems and the tertiary, open loop service water system that comprises the ultimate heat sink. The existing system requires both CCW heat exchangers to be in service due to flow rate limitations. The proposed CCW heat exchangers will each have a nominal 100 percent capacity, which allows operational flexibility. Holtec would not make any changes to the service water side of the CCW heat exchangers and therefore no changes to the interface to the surface water environment are expected. There is no change to the heat loads that are serviced by the proposed CCW heat exchangers. The total service water flow rate is also not expected to change; the service water flow may be through one or both proposed CCW heat exchangers depending on whether one or both proposed CCW heat exchangers are in use. There is no consumptive water use associated with the CCW heat exchangers. Therefore the proposed CCW heat exchangers would not affect surface water resources.

Based on information in the review of Holtec's N&S Report (Holtec 2023-TN10538), Holtec's responses to NRC's RAIs (HDI 2024-TN10670) and RCIs (HDI 2024-TN10669), public scoping (Appendix B to the EA), and the assessment described above, surface water resource impacts related to the resumption of power operations would be NOT SIGNIFICANT.

3.4.4 Cumulative Effects

Appendix G, Table G-1 of the EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental effects of the proposed Federal actions. The actions or projects in the vicinity of Palisades that may affect surface water resources include:

- future onsite construction (a new spent fuel pad and future SMRs)
- potential subsequent license renewal (SLR) of Palisades
- continued operation of energy generation facilities
- construction, upgrade, and rebuilding of power transmission infrastructure
- continued operation of existing mines
- residential, commercial, and industrial development
- continued operation of water supply and wastewater treatment facilities
- cleanup of contaminated sites
- continued operation and upgrade of transportation infrastructure
- continued recreational activities

For the identified projects, any effects of existing surface water use and impacts on surface water quality are being permitted and managed under appropriate regulations. Foreseeable water use and water quality impacts would be managed under the Federal and State permits and regulations, as appropriate. Therefore, the NRC staff has determined that the incremental effects of the proposed Federal actions related to surface water resources when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.5 Geologic Environment and Groundwater Resources

The NRC staff evaluated previous environmental documents and analyses with regard to the geologic environment and groundwater resources along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for groundwater resources and geologic environment (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Section 4.5, Groundwater Use and Quality
- N&S Report (Holtec 2023-TN10538): Sections: 3.2.1.1, Groundwater Use; 3.2.1.2, Groundwater Quality
- Holtec RAI Response (HDI 2024-TN10670): RAI-GEN-1 (Detailed list of activities related to the Federal actions)
- Holtec Second RCI responses (HDI 2024-TN10843): RCI-GW-2a (Confirmation of information provided in the HDI's "Updated Hydrogeologic Investigation Report: Palisades Nuclear Power Plant Covert, Michigan," dated September 14, 2023)
- UFSAR Revision 35 (Entergy 2021-TN10998): Section 2.3.2, Glacial Geology

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.5.1 Affected Environment

UFSAR Revision 35 provides a relevant discussion of the geologic conditions at the Palisades site. Palisades is located in southwest Michigan in the Central Lowland Physiographic Province. Mississippian age (358.9–323.2 million years ago) Coldwater Shale underlies the region and was identified at 440 ft (130 m) above MSL within the vicinity of the containment building. Repeated glaciation during the Pleistocene (2.58 million to 11,700 years ago) resulted in extensive till and boulder clay deposits and eventually established the current boundaries of Lake Michigan (Entergy 2021-TN10998). Glacial deposits range from a few hundred feet to several hundred feet in thickness in the vicinity of the Palisades site. Sand dunes mantle the glacial deposits, rising from 582 ft (177.4 m) MSL on the shore of Lake Michigan to an elevation of 780 ft (237.7 m) MSL at the site of the containment vessel. The dunes are present 2 mi (3.2 km) north to 5 mi (8 km) south of Palisades. Glacial and post-glacial deposits have been classified into four distinct deposits at the Palisades site: (1) dune sand, (2) dense to very dense gray silty sand or sandy silt, (3) stiff gray clay, and (4) stiff to hard gray glacial till. Onsite, the dune sand is approximately 200–215 ft (60–65.5 m) thick, becoming dense to very dense below 590 ft (179.8 m) MSL. The glacial till layers are approximately 78–90 ft (24–27 m) thick and overlie the Coldwater Shale (Entergy 2021-TN10998). There are no noted geologic resources in the vicinity of Palisades.

Sand and gravel glacial outwash deposits are the primary source of groundwater supply in the region and groundwater is the main water supply source in Van Buren County. Groundwater present within the Coldwater Shale is of low yield and quality (Cummings et al. 1984-TN10676). There are 187 known active wells within 2 mi (3.2 km) of Palisades, the majority of which are domestic wells completed in unconsolidated glacial deposits (DTMB 2024-TN10677). Within the vicinity of the Palisades site, groundwater is unconfined within the dune sand and flows toward Lake Michigan (NMC 2005-TN10678). Field studies conducted at the site report groundwater

elevations range from 7–110 ft bgs (2.1–33.5 m bgs). Groundwater flow velocities range from 816–1,274 ft/year (249–388 m/year) in the upper dune sand and from 9–99 ft/year (2.7–30 m/year) in the deeper, silty sand unit above the clay (HDI 2024-TN10843). Due to the low permeability of the glacial till, vertical groundwater flow is limited. Historically, three groundwater wells were used for grounds maintenance and other miscellaneous uses at a combined capacity of 24 gpm (NMC 2005-TN10678). As discussed in the N&S Report, these production wells were disused in 2019 and no other groundwater was used at the site during operation or is currently used in the decommissioning phase (Holtec 2023-TN10538: Section 3.2.1.1). Domestic and landscaping water needs at the plant are fully met by municipal sources.

Palisades monitors 29 groundwater wells in support of the Industry Groundwater Protection Initiative (GPI)(NEI 2019-TN6775). Monitoring under National Emissions Inventory 07-07 continued after operations ceased at the plant (HDI 2024-TN10679). The wells are screened within the dune sand and sampled quarterly for gamma activity and tritium (Holtec 2023-TN10538). Between 2009 to 2022, Palisades reported experiencing 10 instances of elevated tritium detected in onsite wells (see Table 3-4 of this EA for details). From January 1, 2023 to June 26, 2024, tritium was detected in MW-2, MW-11, TW-17, and TW-18 at a maximum concentration of 1,441 picoCuries per liter (pCi/L) at TW-17 (HDI 2024-TN10679). Groundwater sample data from MW-2, MW-3, MW-11, and MW-13 indicate tritium releases have impacted onsite groundwater. However, tritium has not been detected in groundwater in the lower dune sand, indicating that impacted groundwater is within the upper 10–15 ft (3–4.6 m) of the aquifer (Holtec 2023-TN10538: Section 3.2.1.2).

Table 3-4 Tritium Releases and Elevated Detection in Onsite Groundwater at Palisades Nuclear Plant, 2009–2024. Sources: HDI 2024-TN10843: RCI-GW-2a and Holtec 2023-TN10538.

Date	Description of Release	Corrective Actions and Outcome
2009–2013	• Fluctuating tritium concentrations in well MW-3 (north of T-90 and T-91 tanks). Levels reported in the 2008 monitoring data (as reported in the 2008 Hydrogeologic Investigation Report) were stated to be “less than the EPA drinking water MCL of 20,000 pCi/L.” • Results indicated the source to be underground piping in the vicinity of the Auxiliary Building Addition.	• 18 temporary monitoring wells installed in 2009 to further identify the source of the tritium. • Investigative and pipe repair/replacement activities.
February 26, 2015	• Elevated tritium concentration in TW-7. • Source identified to be the Turbine Building drain tank line.	• Piping replaced. • Elevated tritium levels reduced by March 11, 2015.
March 2015	• Elevated tritium concentrations detected in MW-2 and MW-11. • Source determined to be associated with the February 2015 leak from the Turbine Building drain tank line.	• Elevated tritium levels reduced by September 2015 (MW-11) and February 2016 (MW-2). • Turbine Building drain system replaced as a cautionary measure.
November 2, 2016–December 27, 2016	• Elevated tritium concentrations detected at MW-11. • Source identified to be originating from the T-91 Utility Water Storage tanks.	• T-91 Utility Water Storage Tank and associated piping repaired. • Tritium concentrations decreased below EPA MCL.

Table 3-4 Tritium Releases and Elevated Detection in Onsite Groundwater at Palisades Nuclear Plant, 2009–2024. Sources: HDI 2024-TN10843: RCI-GW-2a and Holtec 2023-TN10538. (Continued)

Date	Description of Release	Corrective Actions and Outcome
2019	• Tritium detected in MW-11 at a concentration of 45,268 pCi/L in November 2019. • In 2020, tritium concentrations measured above the EPA MCL at MW-2, MW-3, MW-11, TW-2, TW-4, TW-6, TW-7, TW-10, TW-14, TW-17 and were elevated (e.g., at or just below EPA MCL) in MW-13 and TW-5. • Source determined to be previously discharged effluents that migrated to a storm drain near to MW-11 that normally discharges to the mixing basin.	• No action taken as no new significant dose pathway and release previously reported under a batch release process.
October 2019–January 2020	• Increasing tritium concentrations observed in 7 monitoring wells.	• Station preformed work to line the interior of the M-8 (plant heating boiler) and M-61 (evaporator heating boiler) boiler room sump and associated drain lines.
September 5, 2020	• The T-2 (condensate storage tank) level lowered unexpectedly. • Failure/leak identified in a buried condensate return pipe to the T-2. • Tritium concentrations were measured at 19,588 and 36,869 pCi/L at nearest monitoring well (MW-11) to T-2 on September 9, 2020, and October 8, 2020, respectively.	• Leaking pipe replaced with aboveground and indoor piping. • Isolated and drained the T-2 tank. • Tritium concentrations at MW-11 decreased below 800 pCi/L by November 2020. • Additional pipe repair planned as part of preparations for the resumption of power operations activities (HDI 2024-TN10670: RAI-GEN-1).
2021	• Tritium detected above EPA MCL in 6 wells at a maximum concentration of 49,197 pCi/L in TW-3.	• Station performed work to line the interior of the section of buried piping between the M-950 (service building boiler) room and the M-8/M-61 boiler room sump.
February 2022	• Tritium detected above its MCL in two wells with a maximum detection of 32,254 pCi/L in MW-2.	• Site corrective action process identified and isolated a leak between the Condensate Receiver Tanks T-20, T-38, and T-927 and the Condensate Receiver Tank T-2. • 2023 levels not detected above minimum detectable activity.

Table 3-4 Tritium Releases and Elevated Detection in Onsite Groundwater at Palisades Nuclear Plant, 2009–2024. Sources: HDI 2024-TN10843: RCI-GW-2a and Holtec 2023-TN10538. (Continued)

Date	Description of Release	Corrective Actions and Outcome
May 2022	• Elevated tritium detected in a water sample collected from the 1C switchgear sump within the protected area at a maximum concentration of 645,255 pCi/L. • Tritium was detected at a concentration of 10,370 pCi/L in May 2022 at GPI monitoring location TW-6. • Source determined to be a leak from a buried pipe, either the T-91 recirculation line or the T-87 to T-91 transfer line.	• Leaking section flushed, drained, and taken out of service. • Tritium levels in the sump decrease to levels <15,000 pCi/L. • A work request was generated to perform repairs to the system before it is put back in service. This involves capping the underground piping, installing aboveground piping, and rerouting radwaste through the aboveground pipes. • Pipe repair planned as part of preparations for the resumption of power operations activities (HDI 2024-TN10670: RAI-GEN-1).

EPA = U.S. Environmental Protection Agency; GPI = Groundwater Protection Initiative; MCL = maximum contaminant level; MW = monitoring well.

Additionally, between April and September 2018, the P-8D Auxiliary Feed Water Pump and associated piping was installed. This area is a known area of previous inadvertent radiological releases. Almost 700 gamma isotopic analyses were performed, of which 19 samples contained detectable Co-60 and/or Cs-137. This material was disposed of as radioactive waste (HDI 2024-TN10843: RCI-GW-2a).

Palisades discharges some radiological waste into Lake Michigan after dilution in the mixing basin in accordance with criteria established in 10 CFR Part 50, Appendix I (NRC 2006-TN7346). Annual Radiological Effluent Release Reports are submitted to the NRC (per 10 CFR 50.36a [TN249]) to report the quantities of radionuclides released from liquid and gaseous effluents (Entergy 2020-TN10683, Entergy 2021-TN10682, Entergy 2022-TN10681; HDI 2023-TN10680, HDI 2024-TN10679). The results of groundwater monitoring under the GPI are also reported in the Annual Radiological Effluent Release Reports. The NRC staff reviewed 5 years of available radiological release reports (2019–2023 monitoring results), in addition to radiological environmental monitoring program (REMP) results. REMP results are provided in Annual Radiological Environmental Operating Reports (Entergy 2020-TN10687, Entergy 2021-TN10686, Entergy 2022-TN10685; HDI 2023-TN10684, HDI 2024-TN10771).

The cessation of operations at Palisades resulted in a decrease in liquid effluent releases to Lake Michigan and to total tritium discharged via groundwater (Entergy 2022-TN10681; HDI 2023-TN10680, HDI 2024-TN10679). In 2023, Holtec estimated an activity of 1.82×10^{-3} Curies (Ci) was discharged from onsite groundwater to the lake, compared to 1.1682×10^{-1} Ci in 2021, Palisades' last full year in operation (HDI 2024-TN10679; Entergy 2022-TN10681). The tritium discharged via groundwater over the past 5 years represents a small portion (≤1 percent in any given year) of the total liquid tritium discharged from Palisades. None of the surface water and drinking water samples collected as part of the plant's REMP monitoring contained measurable radiological materials attributed to Palisades' effluents in the past 5 years (Entergy 2020-TN10687, Entergy 2021-TN10686, Entergy 2022-TN10685; HDI 2023-TN10684, HDI 2024-TN10771).

Holtec maintains a SPCC-PIPP for the management of inadvertent release of oil, salt, and polluting materials. Internal procedures are also in place for the storage, handling, cleanup, and disposal of chemicals at the Palisades site (Holtec 2023-TN10538). Additionally, a SWPPP that includes BMPs to prevent pollutants from entering stormwater, to direct the flow of stormwater, and to treat stormwater is maintained by the Palisades site.

3.5.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

There are potential environmental impacts for activities required to support the resumption of power at Palisades (HDI 2024-TN10670: RAI-GEN-1). Planned activities include underground pipe repairs to fix the leaking condensate storage tank (T-2) and the Utility Water Storage Tank (T-91) piping and the construction of two new buildings within the protected area. All planned disturbances for the preparations for the resumption of operations will occur in previously disturbed areas, reducing the impact to soil resources. The impact to groundwater resources from these activities is considered likely to be localized and of short duration. Any potential release of pollutants during ground disturbance will be mitigated through Holtec's SPCC-PIPP and SWPPP and associated BMPs. Although the maximum excavation depth of the new South Radiological Waste Storage facility has not been defined, any potential groundwater intrusion during excavation activities will be controlled and mitigated in accordance with State and Federal regulations and site procedures (HDI 2024-TN10843: RCI-GW-2a). Palisades implements an "as low as reasonably achievable" program in accordance with Federal regulations and all work activities are screened for appropriate radiological controls in accordance with occupational radiological control regulations (HDI 2024-TN10856). Domestic water is served by municipal sources, and groundwater consumption is not anticipated to be required for the resumption of power operations. Geologic resources would not be used or altered during the preparations for resumption of power operations at Palisades. For these reasons, the NRC staff concludes the impact on geologic resources and groundwater resources from the preparation of resumption of power operations would be NOT SIGNIFICANT.

3.5.3 Environmental Impacts from the Resumption of Power Operations

The impacts from operation under the Palisades RFOL is described in the 2006 SEIS (NRC 2006-TN7346). Since the 2006 SEIS was published, new issues applicable to the resumption of power operations at Palisades have been identified in the 2024 LR GEIS (NRC 2024-TN10161), including groundwater use and contamination (non-cooling system impacts) and radionuclides released to groundwater.

Current groundwater use at the Palisades site is different from that described in the 2006 SEIS (NRC 2006-TN7346). Groundwater use at the Palisades site was discontinued in 2019 and groundwater is not anticipated to be used during the resumption of power operations. There are no current or planned continuous contaminant plume extractions or other dewatering activities at Palisades (Holtec 2023-TN10538). Site-specific programs (e.g., SPCC-PIPP, SWPP, NPDES) and BMPs are and will continue to be utilized at the site to manage and reduce the occurrence of inadvertent releases of nonradiological contaminants.

Palisades monitors onsite groundwater in accordance with the GPI to ensure timely and effective management of situations involving inadvertent releases of licensed material to groundwater. Since decommissioning, tritium is the only radionuclide detected onsite in the dune-sand aquifer due to previous unplanned releases. Groundwater containing tritium discharges to Lake Michigan represents a small portion (typically ≤1 percent) of the total tritium

discharged to the lake via regulated batch liquid effluent releases. Although the total tritium discharged via groundwater to the lake decreased during decommissioning, planned activities (i.e., buried pipe repair) may mitigate potential increases in concentration of tritium in onsite groundwater during the resumption of power operations. No radiological material attributed to Palisades has been detected in drinking water or surface water samples near the plant, and there are no registered groundwater wells downgradient of groundwater flow from the Palisades site. For the reasons above, the NRC staff concludes that inadvertent releases of tritium have not substantially affected offsite groundwater quality or use near Palisades. Geologic resources would not be used or altered during the resumption of power operations at Palisades.

Based on the above, the NRC staff considers the impact on geologic resources and groundwater from the resumption of power operations would be NOT SIGNIFICANT.

3.5.4 Cumulative Effects

Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to environmental impacts of the proposed Federal actions.

Key past and present actions affecting groundwater resources include the planned construction of multiple SMRs and the potential SLR of Palisades. The SMRs are planned to be constructed within the Palisades site boundary and additional groundwater monitoring wells could be installed to supplement the current groundwater monitoring program (SMR 2024-TN10713). Excavation for the nuclear power block associated with the SMR modules may extend to a depth of approximately 140 ft (43 m) below grade (NRC 2018-TN7244), which would likely require the application of methods (e.g., grouting and dewatering) to stabilize the deep excavation during construction. The potential impacts of increased runoff and subsurface pollutant infiltration or discharge to nearby water bodies would be prevented or mitigated through implementation of BMPs and an SWPPP. It is unlikely that SMR operation would require the consumptive use of groundwater, and operational dewatering rates, if required, would be managed subject to applicable permitting requirements. The cumulative effects of SLR are expected to be consistent with conditions described and analyzed in the 2006 SEIS (NRC 2006-TN7346) and those described in Section 3.5.3 of this EA.

Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to groundwater resources when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.6 Terrestrial Ecology

The NRC staff evaluated previous environmental documents and analyses with regard to terrestrial ecology along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for terrestrial ecology (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.2.6, Terrestrial Resources; 2.2.7, Radiological Impacts; 3.0, Environmental Impacts of Refurbishment; 4.1, Cooling System; 4.2, Transmission Lines; 4.6, Threatened or Endangered Species
- N&S Report (Holtec 2023-TN10538): Sections: 2.1.1, General Plant Information; 3.3, Ecological Resources; 4.3.2, Terrestrial Resources; 4.3.3.1, SEIS Findings

- Holtec RAI Response (HDI 2024-TN10670): RAI-GEN-1 (Detailed list of activities related to the Federal actions); RAI-GEN-3 (Environmental authorizations necessary for the proposed actions); RAI-SE-1 (Temporary workforce); RAI-TE-1 (Cooling system changes)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.6.1 Affected Environment

In defining the affected environment for terrestrial ecology, the NRC staff assessed previous environmental documents, incorporating by reference where relevant, along with current data.

3.6.1.1 Site and Vicinity

Terrestrial and Wetland Habitats

The Palisades site and vicinity lie within the Michigan Lake Plain (EPA Level IV Ecoregion 56d) and the Southern Michigan/Northern Indiana Drift Plains (EPA Level III Ecoregion 56) (EPA 2010-TN10689). The EPA characterizes the Michigan Lake Plain as a sandy coastal strip with beaches, high dunes and dune ridges, swales, and mucky inter-dune depressions (EPA 2007-TN10688). The lake--moderated climate, along with the beach and dune plant habitats, differentiate it from other adjacent inland ecoregions to the east within the Southern Michigan/Northern Indiana Drift Plains. Descriptions of terrestrial habitats and species are provided in the 2006 SEIS (NRC 2006-TN7346) and in the N&S Report (Holtec 2023-TN10538). The 432 ac (174.8 ha) Palisades site consists of about 80 ac (32.4 ha) of developed lands. The remaining 389 ac (157.4 ha) of undeveloped lands are dominated by deciduous forests (about 239 ac [96.9 ha]), with smaller amounts of early successional habitats (43 ac [17.5 ha]), dunes and sandy habitats (16 ac [6.5 ha]), and wetlands (9 ac [3.6 ha]). Since the 2006 SEIS (NRC 2006-TN7346), both rows of cooling towers were replaced, in 2012 and 2017, respectively, within the same footprint (Holtec 2023-TN10538; Google Earth 2024-TN10690).

Only a few small and scattered wetlands occur on the Palisades site. The 2006 SEIS (NRC 2006-TN7346: p. 2-34) notes that onsite wetlands encompass a total area of 9 ac (3.6 ha). The NRC staff accessed the online National Wetlands Inventory (NWI) mapper on June 14, 2024 (FWS 2024-TN10691) and downloaded Michigan NWI data for analysis. The NWI mapper showed nine mapped wetlands onsite, totaling approximately 4.4 ac (1.8 ha). Four types were present on NWI: one freshwater emergent wetland (0.19 ac [0.08 ha]), four freshwater forested/shrub wetlands (1.95 ac [0.79 ha]), one freshwater pond (0.23 ac [0.09 ha]), and three beach areas inundated by Lake Michigan (2.01 ac [0.81 ha]). Figure 3-4 below shows the location of NWI mapped wetlands within the Palisades site boundary.

As described in Section 3.2 of this EA, the entire Palisades site is protected under CZMA (MEGLE 2020-TN10692). In a letter dated August 30, 2024 (HDI 2024-TN10670: RAI-GEN-3, Attachment 2), Michigan EGLE stated that the 2005 CZMA certification and conditions remain valid through the expiration of Palisades' operating license, if conditions outlined in the letter are met, and that it does not waive need for other permits.

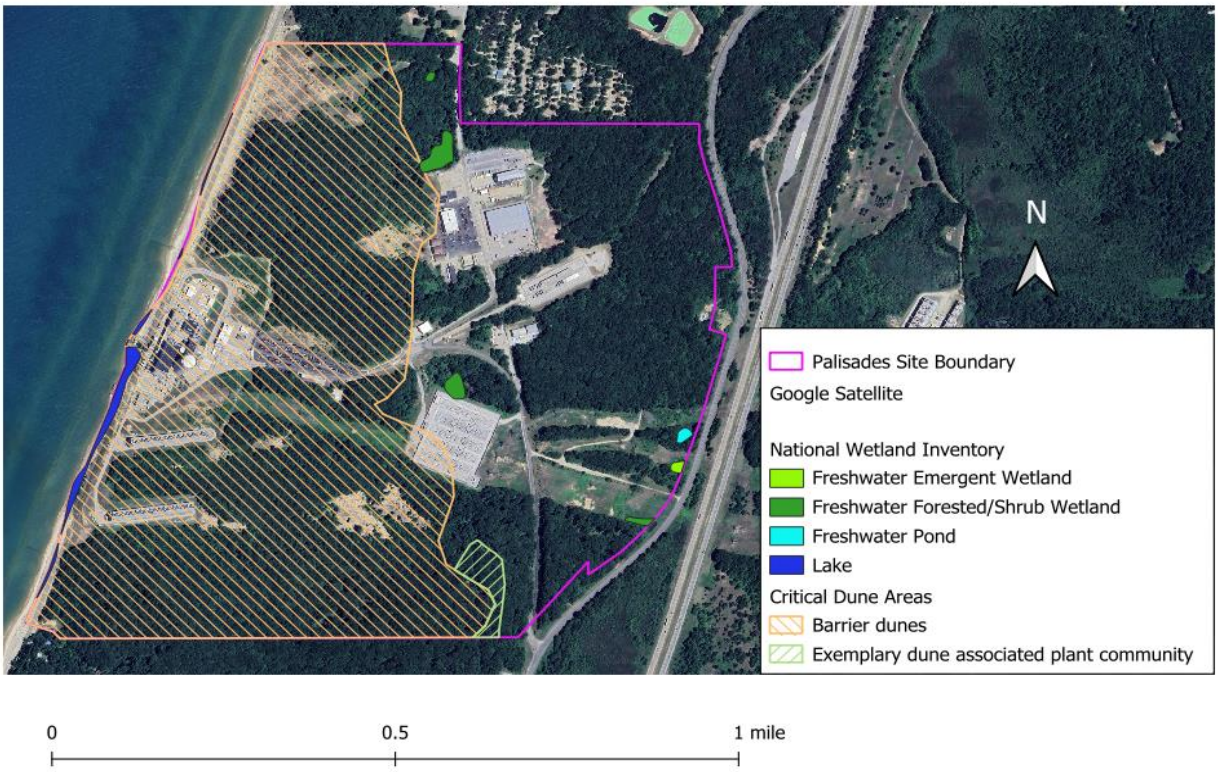

Figure 3-4 Michigan Critical Dune Areas and National Wetlands Inventory Wetlands within the Palisades Nuclear Plant Site Boundary. Data Sources: MEGLE 2023-TN10860; HDI 2024-TN10670: RAI-GEN-1.

Michigan regulates activities in designated critical dune areas (CDA) to protect coastal dunes along Lake Michigan, requiring a use permit for regulated activities within CDAs (Michigan Compiled Law § 353-TN10693). Regulated activities within CDAs include the construction of buildings, septic systems, water wells, driveways; excavation and filling; and vegetation removal (VBCD 2021-TN10694). The NRC staff downloaded information from Michigan EGLE (MDNR 1993-TN10695) and determined that the Palisades site has approximately 247 ac (100 ha) of designated CDAs. Palisades site CDAs are located west of the Palisades Power Plant Road (Figure 3-4 of this EA). Approximately 244 ac (98.8 ha) of the CDAs are barrier dunes, and 3 ac (1.2 ha) are an exemplary dune associated plant community outside of designated dune formations (PC-43, Mesic Southern Forest). The applicant has a current permit (MEGLE 2020-TN10696, expires 04/16/2025) from Michigan EGLE for maintenance dredging of sand along security fences, other security infrastructure, and stormwater outfall structures. This permit allows for placement of dredged material on the beach and covers any additional security measures to be placed or constructed within the existing security system's footprint area.

3.6.1.2 Important Species and Habitats

Table 2-2 of the 2006 SEIS (NRC 2006-TN7346) identifies and characterizes terrestrial species protected under Federal and State (Michigan) regulations as threatened or endangered. In the N&S Report, Holtec evaluated additional information about special status terrestrial species and habitats that could be affected by the resumption of power operations at Palisades (Holtec 2023-TN10538). The evaluations included species listed as threatened or endangered under the Federal ESA (16 U.S.C. 1531 et seq.-TN1010), species designated with a State-protected

status (Michigan Compiled Law Part 365-TN10704), eagles protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d-TN1447), and migratory birds protected under the Migratory Bird Treaty Act (16 U.S.C 703 et seq.-TN3331). The complete analyses for these important resources by the NRC staff are in Appendix J to this EA.

Federally Listed Species

The action area for purposes of assessing impacts to federally listed resources is defined as all areas that could be directly or indirectly affected by a Federal action and may include areas beyond the immediate area of the action (50 CFR Part 402-TN4312). For the present actions, the NRC staff defined the action area as the Palisades site, including the land covers and terrestrial habitats described in Section 3.6.1, plus a 6 mi (9.7 km) radius to reflect possible indirect effects on habitats in the surrounding landscape. The NRC staff independently accessed the U.S. Fish and Wildlife Service (FWS) Information for Planning and Consultation database on May 21, 2024, and received a list of 11 species listed as threatened, endangered, or candidate under the Federal ESA (FWS 2024-TN10697). The database indicated that no designated or proposed critical habitat occurs within the action area. The NRC staff conducted a desktop review of the Palisades action area, using available scientific literature and studies, results of past ESA Section 7 consultations related to the Palisades site, the applicant's N&S Report (Holtec 2023-TN10538), and other publicly available information. In addition, ecologists from the NRC staff visited the site for familiarization purposes on July 8–10, 2024, and other NRC environmental staff were on the site from September 11 to September 12, 2024. Table 3-5 below summarizes the current Federal status of these 11 species, past effects determinations by the NRC staff in the 2006 SEIS (NRC 2006-TN7346), and the NRCs 2024 effects determination for the proposed Federal actions. Appendix J, Section J.7 to this EA contains the NRC staff's biological evaluation.

During the NRC staff's environmental review for the 2006 SEIS (NRC 2006-TN7346), the staff evaluated the effects of Palisades operations on four federally listed species (Indiana bat [*Myotis sodalis*], Pitcher's thistle [*Cirsium pitcherii*]; Karner blue butterfly [*Lycaeides melissa samuelis*]; Mitchell's satyr butterfly [*Neonympha mitchellii mitchellii*] and one candidate species—eastern massasauga [*Sistrurus catenatus*]). In 2016, eastern massasauga was federally listed as threatened (81 FR 67193-TN10698). Of these five species, only Pitcher's thistle was then known to occur on the Palisades site, and the NRC effects determination was "may affect, not likely to adversely affect." In a letter dated May 15, 2006 (DOI 2006-TN10699), FWS agreed that the 2006 SEIS did not involve any major construction or physical alteration of the action area and concurred with the NRC staff's effect determinations for these species (summarized in Table 3-5 of this EA).

The 2006 SEIS did not consider six species that were either not designated under the ESA at that time or were federally listed but not expected to occur within the action area at that time (NMCCO 2005-TN10839): northern long-eared bat (*Myotis septentrionalis*, listed as threatened in 2015 [80 FR 17974-TN4216] and reclassified as endangered in 2023 [87 FR 73488-TN8545]), tricolored bat (proposed for listing as endangered in 2022 [87 FR 56381-TN8546]), rufa red knot (*Calidris canutus rufa*; listed as threatened in 2015 [79 FR 73706-TN4267]), piping plover (*Charadrius melodus*; listed as endangered in 1985 [50 FR 50726-TN5502]), whooping crane (*Grus americana*; designated experimental, not essential populations in 2001 [66 FR 33903-TN9652]), and monarch butterfly (proposed as threatened in December 2024 [89 FR 100662-TN10959]).

In its independent review (Appendix J to this EA), the NRC staff determined that two species are known to presently occur on the Palisades site (Pitcher's thistle and monarch butterfly). Habitat for the dune endemic Pitcher's thistle consists of open sand dune and low open beach ridges along shorelines of Lakes Michigan, Superior, and Huron (FWS 2024-TN10700). In the 1980s and 1990s, Pitcher's thistle was known to occur near the cooling towers but was not present at this location in 2005 (NRC 2006-TN7346). However, surveys reported in 2005 found 113 individuals on the northern end of the Palisades site, on stabilized dunes and flats just south of Van Buren State Park. Field surveys of potentially suitable dune habitat conducted by Holtec in 2024 identified the only Pitcher's thistle location onsite as an area in a forest clearing situated approximately 1,000 ft (300 m) east (inland) of the cooling towers (HDI 2024-TN10670: RAI-SE-1). The other species presently known to occur on the site, monarch butterfly, is dependent on milkweeds (primarily *Asclepias* spp.) for egg-laying and larval food (87 FR 26152-TN8591). During 2024 site visits, the NRC staff noted the presence of flying adult monarchs and widely scattered, occasional milkweed stems on vegetated dunes close to the beach and along the access road.

Table 3-5 Federally Listed Species Under U.S. Endangered Species Act Evaluated for Palisades Nuclear Plant

Common Name	*Species*	Current Federal Status[(a)]	Previous 2006 SEIS Effect Determination[(b)]	2024 NRC Effect Determination[(b)]
northern long-eared bat	*Myotis septentrionalis*	FE	n/a	NLAA
Indiana bat[(c)]	*Myotis sodalis*	FE	NLAA	NLAA
tricolored bat	*Perimyotis subflavus*	PFE	n/a	NLAA
rufa red knot[(d)]	*Calidris canutus rufa*	FT	n/a	NLAA
piping plover DPS[(c)]	*Charadrius melodus*	FE	n/a	NLAA
whooping crane	*Grus americana*	FE (NEP)	n/a	NE
eastern massasauga	*Sistrurus catenatus*	FT	NLAA	NLAA
Karner blue butterfly[(d)]	*Lycaeides melissa samuelis*	FE	NE	NE
Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*	FE	NLAA	NE
Monarch butterfly	*Danaus plexippus*	PFT	n/a	NLAA
Pitcher's thistle	*Pitcher's thistle*	FT	NLAA	NLAA

(a) Indicates protection status under the Endangered Species Act. FC = candidate for Federal listing; FE = federally endangered; FT = federally threatened; PFE = proposed for Federal listing as endangered; PFT = proposed for Federal listing as threatened; NEP = in the vicinity of the action area, this species is part of a nonessential experimental population.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and National Marine Fisheries Service Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NLAA = may affect, not likely to adversely affect. NE = No effect. n/a = not applicable, because the NRC staff did not evaluate this species in the 2006 SEIS (NRC 2006-TN7346).
(c) Species has designated critical habitat, but it does not overlap the action area (FWS 2024-TN10697). DPS = distinct population segment
(d) Species has proposed critical habitat, but it does not overlap the action area (FWS 2024-TN10697).

State-Listed Species

The ESA of the State of Michigan (Michigan Compiled Law Part 365-TN10704) specifies the State's responsibility for conserving, protecting, restoring, and propagating endangered and threatened species. In the N&S Report, Holtec presented a list of Federal and State-listed species that occur in Van Buren and Berrien Counties (Holtec 2023-TN10538). The NRC staff independently downloaded and reviewed these same county lists (MNFI 2024-TN10861, MNFI 2024-TN10862). Appendix J, Section J.1, Table J-1 of this EA summarizes habitat requirements of State threatened and endangered terrestrial bird, mammal, and plant species observed in Van Buren and Berrien Counties since 2000. Because Michigan Department of Natural Resources Director's Order No. FO-224.21 (MNRC/MDNR 2021-TN10703) provides specific protections for amphibians and reptiles, Appendix J, Section J.1, Table J-2 presents habitat requirements for amphibians and reptiles listed as threatened and endangered that have not been seen since 2000, as well as those that are listed as species of Special Concern. Two State-listed species have been observed at the Palisades site: the endangered prairie vole and the threatened eastern box turtle (HDI 2024-TN10670: RAI-GEN-3, Attachment 2).

Eagles and Migratory Birds

The 2006 SEIS (Section 2.2.6, incorporated by reference) stated that 113 bird species have been documented on the site. According to the FWS IPAC report, accessed May 21, 2024 (FWS 2024-TN10697), 21 Birds of Conservation Concern have to the potential to occur on site. Birds of Conservation Concern are bird species not designated as federally threatened or endangered that are of the highest conservation priority for the FWS. In addition, breeding bald eagles have the potential to occur on site (breeding period December 1–August 31), as do non-breeding golden eagles (FWS 2024-TN10697). Additional information on eagles and migratory birds is provided in Appendix J, Section J.2.

Invasive Species

Executive Order (EO) 13112 (64 FR 6183-TN4477), as amended by EO 13751 (81 FR 88609-88614), directs Federal agencies to not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species unless the Federal agency determine that the benefits of the action clearly outweigh the harm from invasive species and that all feasible and prudent measures to minimize risk of harm are taken (64 FR 6183-TN4477, Section 2). The Southwest by Southwest Corner Cooperative Invasive Species Management Area, which includes the location of the Palisades site, has identified 12 terrestrial species as specific targets for detecting and controlling if found (Van Buren CD 2024-TN10877): three insects, one fungal disease, and eight plants. All but the Asian long-horn beetle (*Anoplophora glabripennis*) are known to occur in Michigan, but it is unknown whether any of these other species occur on site. See Appendix J, Section J.3 for a full species list.

3.6.2 Environmental Impacts from the Preparations for Resumption of Power Operations

Preparations for resumption of power operations would occur over an anticipated 18-month period. Noise from equipment and vehicle traffic would increase over this time. The applicant estimated 3,000 truck deliveries over this period (HDI 2024-TN10670: RAI-GEN-1). Because the increased vehicular use and truck deliveries would only be temporary and would use previously established roadways, increased noise and traffic impacts to wildlife are expected to be minor. The estimated footprint of disturbance for proposed activities is shown in Figure 3-2 of this EA.

The applicant proposes specific preparation activities to prepare for resumption of operation (HDI 2024-TN10670: RAI-GEN-1). The NRC staff reviewed these activities and associated shapefiles provided by the applicant and conducted an independent analysis of the terrestrial habitats to be disturbed. The activities would disturb approximately 11 ac (4.5 ha) of sparsely vegetated land outside of existing built areas (HDI 2024-TN10670: RAI-GEN-1) (Table 3-1 of this EA). Preparation activities, including those in sparsely vegetated areas, are proposed only within areas of previously disturbed soils, mostly inside existing facilities and structures. Disturbance of a few small or narrow vegetated areas would be necessary to install new cables to the cooling towers, a security fence upgrade, and widening an access road along the southern edge of the secure area. The applicant would have to obtain relevant permits for work within CDAs and Lake Michigan waters and shorelines from Michigan EGLE and U.S. Army Corps of Engineers.

The applicant would continue routine application of commercial herbicides and other pesticides as necessary to maintain the grounds. Use would be limited to ground-based application in accordance with herbicide labels at labeled rates by certified applicators, as described in nonradiological reports from 2019 to 2023 (Entergy 2020-TN10708, Entergy 2021-TN10707, Entergy 2022-TN10709; HDI 2023-TN10705, HDI 2024-TN10706). Approximately 34.5 ac (14.0 ha) of the proposed land disturbance footprint would fall within mapped CDAs. However, all of this land disturbance would take place in existing developed areas or previously disturbed lands, and all Michigan EGLE permits required for work in the CDAs would be obtained. These permits would likely require restoration of indigenous dune vegetation to any areas of disturbed dunes. Associated preparation activities (Table 3-1 of this EA) within mapped CDAs include intake pipe and crib, cable trays to cooling towers, buried pipeline repair area, security fence upgrade, access drive, and the radiological waste location within the secure area.

The NRC staff concludes that preparations for the resumption of power operations would be NOT SIGNIFICANT on terrestrial resources because: (1) the area likely to be disturbed, approximately 11 ac (4.5 ha), lies completely within already developed or previously disturbed parts of the Palisades site; (2) these activities are unlikely to alter patterns of wildlife use and migration across the site; and (3) required permit conditions and BMPs from Federal, State, and local agencies will minimize impacts to terrestrial resources. As noted in its biological evaluation in Appendix J, Section J.7, Table J-5, the NRC staff has determined that impacts to federally listed terrestrial species (Table 3-5 of this EA) would be “no effect” or “may affect, not likely to adversely affect.”

3.6.3 Environmental Impacts from the Resumption of Power Operations

In its 2006 SEIS (NRC 2006-TN7346), the NRC staff evaluated Palisades operational impacts to terrestrial resources using the 1996 LR GEIS (NRC 1996-TN288). Since the 2006 LR SEIS was published, terrestrial issues have been reorganized and updated in the 2013 LR GEIS (NRC 2013-TN2654) and the 2024 LR GEIS (NRC 2024-TN10161: p. 2-8). For the analysis in this section, the NRC staff incorporated by reference its 2006 analysis (NRC 2006-TN7346) and Holtec’s updated N&S Report analysis of terrestrial resources (Holtec 2023-TN10538), which used the 2013 LR GEIS (NRC 2013-TN2654). In its own independent assessment of operational impacts, the NRC staff evaluated whether past operational terrestrial issues analyzed in the 2006 SEIS would be significantly different under resumption of operations and whether any new information should be considered.

As a result of this independent review, the NRC staff uses the 2024 LR GEIS terrestrial resource issues (eight operational issues summarized in NRC 2024-TN10161: p. 2-8) to

summarize its decisions to not provide a detailed analysis of five issues. The NRC staff determined that three terrestrial resource operational effects would be minimal and not different from past operations and current conditions under resumption of operations: bird collisions with plant structures and transmission lines, in-scope transmission line right-of-way management impacts on terrestrial resources, and electromagnetic effects on terrestrial plant and animals for in-scope transmission lines. Two terrestrial resource issues do not apply to Palisades and will not be discussed further: water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) and cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds).

The NRC staff analyzed in detail below three terrestrial resource issues that were not analyzed previously or could be different from current conditions: (1) exposure of terrestrial organisms to radionuclides (not analyzed in 2006 SEIS), (2) non-cooling system impacts on terrestrial resources (not analyzed in 2006 SEIS, potentially different from non-operating conditions), and (3) cooling tower impacts on terrestrial plants (potentially different from current non-operating conditions).

In addition to these three terrestrial issues, the NRC staff updated its operational impacts analysis on federally protected species and other important terrestrial species and habitats (Table 3-5). As noted in its biological evaluation in Appendix J, Section J.7, Table J-5, the NRC staff has determined that impacts to federally listed terrestrial species (Table 3-5 of this EA) would be “no effect” or “may affect, not likely to adversely affect.”

Exposure of Terrestrial Organisms to Radionuclides

The 2006 SEIS for Palisades (NRC 2006-TN7346) did not address exposure of terrestrial organisms to radionuclides because the 1996 LR GEIS (NRC 1996-TN288) did not include this issue from routine operations as an issue to analyze. Radionuclides may be released from nuclear power plants into the environment through several pathways (NRC 2024-TN10161: pp. 4-49 to 4-52). During normal operations, nuclear power plants can release gaseous emissions that deposit small amounts of radioactive particulates in the surrounding environment. Nuclear power plants can also release radionuclides as liquid effluents into water, and terrestrial plant roots can absorb radionuclides from shallow groundwater or surface waters. Animals may experience exposure to ionizing radiation through (1) inhalation; (2) direct contact with air, water, or other media; or (3) ingestion of contaminated food, water, or soil.

Palisades REMP has been ongoing since 1971 and is described in the 2006 SEIS (NRC 2006-TN7346). The NRC staff reviewed Holtec’s analysis of this issue (Holtec 2023-TN10538) and reviewed Palisades Annual Radiological Environmental Operating Reports from 2019 to 2023 (Entergy 2020-TN10687, Entergy 2021-TN10686, Entergy 2022-TN10685; HDI 2023-TN10684, HDI 2024-TN10771). No measurable levels of radiation above baseline levels attributable to operations of Palisades were found through routine monitoring conducted in the Palisades vicinity from 2019 to 2022. Additionally, no measurable levels of radiation above baseline levels were detected during 2023 monitoring when the reactor was in decommissioning status. The NRC staff has concluded that exposure to radionuclides on terrestrial organisms would be NOT SIGNIFICANT.

Non-Cooling System Impacts on Terrestrial Resources

The 2006 SEIS for Palisades (NRC 2006-TN7346) did not address non-cooling system impacts on terrestrial resources because the 1996 LR GEIS (NRC 1996-TN288) only included this issue

to analyze for refurbishment. According to the 2024 LR GEIS (NRC 2024-TN10161: Section 4.6.1.1), non-cooling system impacts on terrestrial resources can include impacts that result from Palisades site and landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that would occur during operations on and near a plant site. The NRC staff reviewed Holtec's analysis of terrestrial resource issues in the N&S Report (Holtec 2023-TN10538: Section 4.3.2), Palisades NPDES permit (MDEQ 2014-TN10665, MEGLE 2023-TN10739), nonradiological environmental reports from 2019 to 2023 (Entergy 2020-TN10708, Entergy 2021-TN10707, Entergy 2022-TN10709; HDI 2023-TN10705, HDI 2024-TN10706), and Palisades compliance documents available through Michigan EGLE's portal (MEGLE 2024-TN10868, MEGLE 2024-TN10869). Because the Palisades site is within Michigan's CZMA (Section 3.6.1 of this EA) and has designated CDAs onsite (Figure 3-4 of this EA), Michigan EGLE regulates many plant operations and activities.

Site-specific programs (e.g., SPCC-PIPP, SWPP, NPDES) and BMPs are and will continue to be utilized at the Palisades site to decrease environmental effects and reduce the occurrence of inadvertent releases of nonradiological contaminants (NRC 2024-TN10842). Michigan EGLE will continue to regulate and evaluate land disturbing activities in CDAs and the site itself. The NRC staff has concluded that non-system cooling impacts on terrestrial resources would be NOT SIGNIFICANT.

Cooling Tower Impacts on Terrestrial Plants

As summarized in meteorology and air quality (Section 3.3.1 of this EA) and detailed in Rochow 1978-TN10666, Palisades' initial cooling tower operations resulted in loss of forest vegetation, severe icing, and signs of chemically induced vegetation injury associated with sulfate deposition from the towers. Most vegetation damage occurred within 160 ft (50 m) of the towers, with trees and shrubs affected. As detailed in the 1996 LR GEIS (NRC 1996-TN288: Section 4.3.5.1), woody species damage resulted from the unique Palisades topography, unusual operating and weather conditions, and use of sulfuric acid as a biocide (which was discontinued before the 2006 SEIS). Rochow 1978-TN10666 reported the tower drift design rate at the time of damage to be between 0.005 and 0.2 percent. The 2006 SEIS (NRC 2006-TN7346: pp. 4-10 through 4-11) rated the impacts of Palisades cooling tower operations on vegetation (crops, ornamental vegetation, and native plants) as SMALL. Both rows of cooling towers were replaced, in 2012 and 2017, respectively, within the same footprint (Holtec 2023-TN10538; Google Earth 2024-TN10690). The replacement towers have drift eliminators that have a guaranteed drift rate of not to exceed 0.001 percent of the circulating water flow rate (HDI 2024-TN10670: RAI-TE-1).

Field surveys of potentially suitable dune habitat conducted by Holtec in 2024 identified the only Pitcher's thistle location onsite as occurring in a forest clearing situated approximately 1,000 ft (300 m) east (inland) of the cooling towers (HDI 2024-TN10670: RAI-SE-1). No information is available to NRC staff on the sensitivity of Pitcher's thistle to cooling tower drift. Considering the physical stresses inherent in surviving in dune habitat, it is possible that cooling tower drift could contribute cumulatively to adverse effects on a Pitcher's thistle population. However, because the mechanical draft cooling towers are equipped with drift eliminators and are separated from the Pitcher's thistle population by approximately 1,000 ft (300 m) of deciduous forest vegetation, it is reasonable to expect that noticeable drift is unlikely to reach the population. If substantially potent drift were to reach the Pitcher's thistle populations onsite, the effects would likely be first visible on deciduous tree foliage at the edge of the cooling towers, giving nuclear power plant managers time to take corrective action. The NRC staff conclude that cooling tower impacts to Pitcher's thistle to be "may affect, not likely to adversely affect."

The NRC staff conclude that resumption of cooling tower operations would be less than those determined to be SMALL in 2006. This is based on: the changes in cooling tower operations from the initial conditions that led to vegetation damage; the replacement of both towers within the last 12 years; replacement tower drift rate of 0.001 percent; and a determination of "may affect, not likely to adversely affect" for Pitcher's thistle for cooling tower operations. Therefore, the NRC staff concludes that the impact from resumption of cooling tower operations would be NOT SIGNIFICANT.

3.6.4 Cumulative Effects

Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental effects of the proposed Federal actions.

The projects in the vicinity of Palisades that may affect terrestrial ecology include future onsite construction (a new spent fuel pad and new SMRs); potential SLR of Palisades; continued operation of energy generation facilities; construction, upgrade, and rebuilding of power transmission infrastructure; continued operation of existing mines; residential, commercial, and industrial development; continued operation of water supply and wastewater treatment facilities; cleanup of contaminated sites; continued operation and upgrade of transportation infrastructure; and continued recreational activities. The general characteristics of the terrestrial habitats and ecological resources in the landscape on and surrounding the Palisades site would not be noticeably altered by the projects. The resumption of power operations would result in only small areas of terrestrial habitat disturbance situated in previously developed areas of the site. It is also anticipated that SMR development would mostly take place within previously developed areas of the site and affect only narrow or small areas of naturally vegetated terrestrial habitat adjoining areas of previous development, without noticeably intruding into areas of intact terrestrial habitat in relatively undeveloped areas of the site. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to terrestrial ecology when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.7 Aquatic Ecology

This section describes the aquatic resources of the affected environment (i.e., Lake Michigan). The NRC staff evaluated previous environmental documents and analyses with regard to aquatic ecology along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for aquatic ecology (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.1.3, Cooling and Auxiliary Water Systems; 2.2.3, Water Quality; 4.1, Cooling System
- N&S Report (Holtec 2023-TN10538): Section 3.2.2.2, Surface Water Quality
- 2024 LR GEIS (NRC 2024-TN10161): Sections: 3.5.1.2, Surface Water Quality; 4.6.1.2, Aquatic Resources
- 1972 FES (AEC 1972-TN10603): Section V.C.1.a., Sources of Potential Biological Damage; Table V-1, Examples of Number and Length of Fish Counted Daily at the Intake Screens from January 23, 1972 - February 22, 1972; Appendix V-2, Outline Map of North America Showing the Southern Limit of Distribution of Lake Whitefish

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.7.1 Affected Environment

In defining the affected environment for aquatic ecology, the NRC staff assessed previous environmental documents, incorporating by reference where relevant, along with current data.

3.7.1.1 Site and Vicinity

Palisades is located along the southeastern shore of Lake Michigan's main basin, which provides the source and receiving body for the plant's cooling-water system. Lake Michigan's main basin, which is separated into a northern and southern basin, contains cold, clear, nutrient-poor (oligotrophic) water with water depths ranging from 50 ft (15 m) at 1 mi (1.6 km) offshore, to a maximum depth of 923 ft (281 m), and average depths of 279 ft (85 m) (Michigan Sea Grant 2024-TN10710). Water moves slowly along the southeastern side of the lake in a generally northern direction toward the Strait of Mackinac to Lake Huron (Michigan Sea Grant 2024-TN10710; NOAA Undated-TN10711). Surface water temperatures in Lake Michigan vary from a low of 36.9°F (2.7°C) in February to a high of 70.5°F (21.4°C) in August (NOAA 2024-TN10714). A 2021 study by NOAA revealed a warming trend in surface water temperatures based on a single location, which was hypothesized to be due to climate change (Anderson et al. 2021-TN10715). Using a 30-year dataset, NOAA found that the winter cooling season in the deep waters of the lake is shortening (less than 100 days) and the summer warming season is lengthening (greater than 200 days) which could lead to permanent changes in the lake's seasonal mixing patterns and disrupt the food web (Anderson et al. 2021-TN10715). The aquatic biological communities of Lake Michigan, including plankton, macrophytes, benthic invertebrates, and fish, are described in detail in Appendix J, Section J.4 to this EA.

3.7.1.2 Important Species and Habitats

The Michigan Department of Natural Resources (MDNR) is responsible for fisheries management in Lake Michigan and co-manages some commercial and recreational fisheries from approximately Grand Haven, Michigan northward with Indian Tribes. The co-managed fishing areas end approximately 50 mi (80 km) north of Palisades and are not discussed further (MDNR 2024-TN10762). The aquatic region of the action area (as defined above in Section 3.6.1.2) encompasses the area of Lake Michigan influenced by the intake and discharge systems. These systems are described in the 2006 SEIS (NRC 2006-TN7346). There are no federally protected aquatic species, essential fish habitat, or national marine sanctuaries located within action area (FWS 2024-TN10697; NMFS 2024-TN10304; NOAA Undated-TN10727). Additional information can be found in Appendix J, Sections J.4 and J.5 of this EA.

<u>Commercially Important Fisheries</u>

The only commercially fished species in Lake Michigan since 2022 is the lake whitefish (*Coregonus clupeaformis*) although over the last five years small amounts of burbot (*Lota lota*), chub (*Squalius cephalus*), round whitefish (*Prosopium cylindraceum*), smelt (Osmeridae), and sucker (Catostomidae) were also commercially harvested (MDNR 2024-TN10728; Michigan Sea Grant 2024-TN10729). Lake whitefish is a benthic cool water fish that primarily feeds on zooplankton and *Diporeia* (Michigan Sea Grant 2024-TN10730). Whitefish spawn in early winter in shallow rocky or sandy bottom lake waters less than 25 ft (7.6 m) deep, the young hatch in the spring and leave for deeper and cooler waters by early summer where they live in schools at

depths of up to 200 ft (61 m) (MDNR 2024-TN10731). The lake whitefish population has declined rapidly in Lake Michigan over the past 15–20 years, with slow growth and poor body condition that correlates with the loss of their primary food source, *Diporeia,* to invasive *Dreissena* mussels (MEGLE 2022-TN10732). Since the early 2000s, whitefish populations have also experienced poor recruitment, the process of young fish making it to the adult stage, which is thought to be a result of changes in water temperature, water levels, currents, and ice cover due to changing climate conditions (MEGLE 2022-TN10732).

Recreationally Important Fisheries

Recreational fisheries in the Michigan portion of Lake Michigan are also regulated by MDNR. Popular sport fish include yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), sunfish (Centrarchidae), crappie (*Pomoxis* spp.), rock bass (*Ambloplites rupestris*), lake trout (*Salvelinus namaycush*), and salmon (chinook, coho, steelhead; *Oncorhynchus* spp.). Lake trout is an important species that contributes to a multimillion-dollar Lake Michigan sport fishery. The Michigan United Conservation Clubs reported in 2019 that recreational fishing in Michigan, not just in Lake Michigan, generates $2.3 billion in economic activity (MUCC 2019-TN10733).

State-Protected and Other Special Status Aquatic Species

MDNR has regulatory authority for fish and wildlife in Michigan including endangered species. The Endangered Species Protection Act of the State of Michigan (Michigan Compiled Law Part 365-TN10704) specifies the State's responsibility for conserving, protecting, restoring, and propagating endangered and threatened species. Under these laws, "endangered" indicates the species is in danger of extinction throughout all or a significant portion of its range, "threatened" indicates the species is likely to become endangered within the foreseeable future, and the designation of "special concern" indicates declining or relict species in the State. While not protected by State law, species of special concern need protection to prevent them from becoming threatened or endangered. Michigan last updated its State-listed species list on March 20, 2023, and species that could occur in Van Buren or Berrien counties in the vicinity of Palisades are listed in Appendix J, Section J.6, Table J-4 of this EA (MNFI 2024-TN10734).

3.7.1.3 Invasive and Nuisance Species of Lake Michigan

Non-native species are those species that are present only because of introduction and that would not naturally occur either currently or historically in an ecosystem. Invasive species cause harm when they out-compete native species by reproducing and spreading rapidly in areas where they have no natural predators, thus changing the balance of the ecosystems (MDNR 2024-TN10735). For purposes of this discussion, nuisance species are non-native species that alter the environment but that do not rise to the level of invasive.

At least 180 aquatic species have been introduced into the Great Lakes over the years but most of them were either unable to establish or only have a small impact on the ecosystem. A small number of these have had negative impacts to the ecosystem and fisheries including sea lamprey (*Petromyzon marinus*), alewife (*Alosa Pseudoharengus*), zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*), round goby (*Apollonia melanostomus*), and the spiny waterflea (*Bythotrephes longimanus*) (GLFC 2024-TN10736). Invasive species of concern in Michigan include Asian clam (*Corbicula fluminea*), grass carp (*Ctenopharyngodon idella*), Eurasian ruffe (*Gymnocephalus cernuus*), hydrilla (*Hydrilla verticillata*), Japanese/Oriental weatherfish (*Misgurnus anguillicaudatus*), New Zealand

mudsnail (*Potamopyrgus antipodarum*), rudd (*Scardinius erythrophthalmus*), tench carp (*Tinca tinca*), and the tubenose goby (*Proterorhinus semilunaris*) (MDNR 2024-TN10737).

The primary invasive species of concern related to Palisades operations is biofouling of the cooling-water intake system by invasive bivalves, such as zebra mussels and quagga mussels. The spring 2024 intake crib inspection and cleaning reported 100 percent coverage of the bars along the sides of the intake crib by zebra mussels roughly 1.5 in. (3.8 cm) thick (HDI 2024-TN10843: RCI-AE-4a). Divers also found and cleaned out debris, including zebra mussels, just west of the traveling screens. These invasive mussels are controlled using biocides and cleaned out of the intake by divers annually; biocide use is regulated by Michigan EGLE as part of the discharge authorizations in permit no. MI0001457 under Section A, Part I (MDEQ 2014-TN10665).

3.7.2 Environmental Impacts from the Preparations for Resumption of Power Operations

3.7.2.1 Site and Vicinity

The only potential impacts to the onsite streams during the proposed activities would result from stormwater runoff and sedimentation. Planned stormwater drainage management would continue to follow BMPs with monitoring of outfalls to prevent pollutants from entering stormwater (see Section 3.4.2 of this EA). The NRC staff concludes that, based on the current SWPPP, the existing stormwater system, and the small area of potential surface disturbance or new impervious surfaces, the impacts to onsite streams from the proposed activities would be minimal.

Holtec would have to withdraw approximately 4.5 million gallons (17 million liters) of water from Lake Michigan to initially fill the cooling tower basins. Holtec plans no changes to the water intake system from Lake Michigan, relative to the previously operating plant. A description of the cooling-water intake system can be found in the 2006 SEIS (NRC 2006-TN7346). Diver inspections of the intake system were conducted in the spring of 2024. The inspection showed that sand, zebra mussels, and other debris had infiltrated the intake system (intake crib, mixing bay, etc.) but there was no visible damage to the mixing bay, trash racks, or traveling screens (HDI 2024-TN10843: RCI-AE-4a). The intake areas would need to be cleaned of sand and debris and some repairs would need to be made to the intake crib prior to the filling of the cooling tower basins during the preparation for resumption of power operations. The potential impacts related to withdrawals of water from Lake Michigan would be minimal, as described below for resumption of power operations. The NRC staff concludes that the effects on aquatic organisms during the proposed preparations for the resumption of power operations of Palisades would be NOT SIGNIFICANT.

3.7.2.2 Important Aquatic Species and Habitats

Four State-listed fish species have occurred in the vicinity of Palisades, although the lake herring and shortjaw cisco have not been observed in 30 years (Table J-4 of this EA). The starheaded topminnow and spotted gar are expected to still be in the vicinity. The spotted gar is tolerant of warm waters and low dissolved oxygen. Both species can be found in shallow waters or near the surface and both spawn in shallow water, although the gar prefers heavily vegetated areas and the topminnow prefers gravel. Because of the applicant’s efforts to control sedimentation and the offshore location of the intake, the potential for impacts to these fish species from activities at the site would be NOT SIGNIFICANT. There are also four State-listed

mussels, the slippershell, creek heelsplitter, flutedshell, and round pigtoe, that may occur within the vicinity of Palisades (Table J-4 of this EA). Holtec has not identified any State-listed species in the intake or discharge systems during annual monitoring (HDI 2024-TN10843: RCI-AE-4a). Therefore, the potential for impact to State-listed mussel species is expected to be NOT SIGNIFICANT.

3.7.3 Environmental Impacts from the Resumption of Power Operations

The impacts from resumption of operation of Palisades would be similar to those described in the 2006 SEIS (NRC 2006-TN7346), which is incorporated by reference. In Section 3.3.1 of the N&S Report, the applicant states that no additional aquatic studies have been conducted and that the descriptions and discussions of aquatic resources in the 2006 SEIS remain valid (Holtec 2023-TN10538). The NRC staff has not identified any new and significant information during its independent review of the N&S Report (Holtec 2023-TN10538), the 2024 site visit, the scoping process for this EA, and the NRC staff's evaluation of other available information.

3.7.3.1 Site and Vicinity

For aquatic resources, the primary concerns relate to water withdrawal and consumption, especially flow rate and whether there is ample water to operate the facility without a detrimental impact to the aquatic organisms living in Lake Michigan (GLC 2024-TN10738). Lake Michigan water is drawn into the cooling-water intake system through a submerged crib structure 3,300 ft (1,005 m) offshore, with bars and mesh screens filtering out debris and larger organisms (NRC 2006-TN7346). While most of the water used for cooling would be returned to the lake, the cooling system would lose approximately 12,000 gpm or 0.0006 percent of the total volume of water in Lake Michigan to evaporation from the cooling towers each year. Currently, even in the present state of decommissioning, one intake pump is running and pulling 6,000 gpm (8.64 mgd) from Lake Michigan to cool the spent fuel that is onsite, and all the pumped water is returned to the lake (HDI 2024-TN10669: RCI-SW-5, 6, and 7). This pump would continue to operate after resumption of power operations. During return normal operations approximately 98,000 gpm (141 mgd) would be pumped from the lake at a flow rate of 0.1 feet per second (fps) and 86,000 gpm (124 mgd) returned (Holtec 2023-TN10538). These impacts would also be possible while initially filling the cooling tower basins during the preparations for resumption of power operations.

<u>Impingement and Entrainment of Aquatic Organisms:</u>

If approved and power operations resume, the resumed water intake would impinge and entrain aquatic organisms from Lake Michigan. Section 2.1 of this EA and the 2006 SEIS (NRC 2006-TN7346) describe the Palisades cooling and auxiliary water systems in detail. Smaller organisms, such as fish eggs and larvae, can be entrained and pass through the system, where they are subjected to mechanical, thermal, and toxic stresses before the water is discharged back into the lake. Impinged organisms are collected at the trash racks or traveling screens and disposed as solid waste.

A description of the susceptibility of organisms to impingement and entrainment can be found in the 2024 LR GEIS (NRC 2024-TN10161). The magnitude of the impact that impingement and entrainment create on the aquatic environment depends on the plant-specific characteristics of the cooling system as well as the local aquatic community. Relevant nuclear power plant-based characteristics include location of the cooling-water intake structure, intake velocities, withdrawal volumes, screening device technologies, and the presence or absence of a fish

return system. Relevant characteristics of the aquatic community include species present in the environment, life history characteristics, population abundances and distributions, special species statuses and designations, and regional management objectives.

Cooling-water intake from Lake Michigan to Palisades are authorized under NPDES permit no. MI0001457. The current permit was issued in 2014 and is being operated under an administrative extension (MDEQ 2014-TN10665). The new draft permit was published in 2023 and a final permit is expected prior to the resumption of power operations (MEGLE 2023-TN10739). As part of the draft permit, Michigan EGLE reviewed the cooling-water intake structures (CWIS) and determined that they comply with the best technology available (BTA) standards for impingement mortality and entrainment to minimize adverse environmental impact in accordance with 40 CFR Subpart J under Section 316(b) of the CWA. The chosen method of compliance for impingement is 40 CFR Part 125.94(c)(1) (TN254)—closed-cycle recirculating system. In addition, the Palisades CWIS is BTA as specified by operating an existing offshore velocity crib under 40 CFR Part 125.94(c)(4).

The impacts on impingement from the resumption of power operations of Palisades would be similar to those described in the 1972 FES, which analyzed impingement potential for principal fish species during interim operations of Palisades in 1972 (AEC 1972-TN10603), and which is incorporated by reference. This issue was not further analyzed in the 2006 SEIS because it was considered a Category 1 issue. For the most part, fish and free-swimming organisms would avoid impingement because the intake crib is located in the water column, about 6 ft (2 m) above the bottom, 3,300 ft (1,005 m) from the shoreline, and the intake velocity is only approximately 0.1 fps. The intake is well sited to avoid most fishes' preferred habitat and distribution in the water column, apart from rainbow smelt, alewife, and bloater. During interim operations during start-up in 1972, the primary impingement mortality was of sculpins in January and February (AEC 1972-TN10603). Enercon Services, Inc. conducted an impingement estimate in 2000, estimating the impingement of 863 fish, which included yellow perches, alewives, and spottail shiners, from July to November (Enercon/Normandeau 2018-TN10740). The location of the intake and the low intake water velocity would help prevent any large fish from being sucked into the intake crib and then the intake pipe. Small fish and other aquatic organisms that are unable to swim against the 0.1 fps current at the intake would be drawn inside and impinged on the traveling screens and trash racks, or if small enough entrained. EPA data shows that 96 percent of studied fish can avoid an intake structure when the intake velocity is 0.5 fps or less so, hence the resulting impingement is expected to be a relatively small amount in relation to nearby populations within the lake (EPA 2014-TN10834).

Updating the gross estimate of damage to aquatic biota analyzed in the 1972 FES (AEC 1972-TN10603) for current fish density, which is estimated to be 7.8 pounds (lb)/ac (8.7 kilograms per hectare [kg/ha]) and the reduced flow into the cooling system of 98,000 gpm, total fish loss to impingement is estimated at just under 6,000 lb (2,721 kilograms [kg]) per year. This amount is 10 times less than was calculated in the 1972 FES and just 0.06 percent of the total fish harvested from Lake Michigan in 2023 (GLFC 2024-TN10835). Cooling-water intake from Lake Michigan to Palisades are authorized under NPDES permit no. MI0001457; the current permit was issued in 2014 and is being operated under an administrative extension (MDEQ 2014-TN10665). The draft permit was published in 2023 and a final permit is expected to be issued prior to the resumption of power operations (MEGLE 2023-TN10739). As part of the draft permit, the CWIS was reviewed and determined to comply with the BTA standards for impingement mortality and entrainment to minimize adverse environmental impact in accordance with 40 CFR Subpart J under Section 316(b) of the CWA (TN662).

The impacts on entrainment from the resumption of power operations of Palisades would be similar to those described in the 1972 FES, which analyzed entrainment potential for principal fish species in the vicinity of Palisades (AEC 1972-TN10603), and which is incorporated by reference. In addition, Enercon Services, Inc. conducted an entrainment estimate in 2000, estimating total entrainment of 26,770 fish larvae, including yellow perches, alewives, and cyprinid species (minnows and carps) (Enercon/Normandeau 2018-TN10740). Most fish species, including yellow perch, alewives, minnows, and carp, tend to produce large numbers of offspring to account for high mortality rates in natural aquatic settings. In addition, fish and free-swimming organisms would avoid entrainment because the intake crib is located in the water column, about 6 ft (2 m) above the bottom, 3,300 ft (1,005 m) from the shoreline, and the intake velocity is approximately 0.1 fps. As discussed above for entrainment, EPA recognizes that intake velocities not exceeding 0.5 fps are generally protective of aquatic biota from impingement as well (EPA 2014-TN10834). Since plankton recover and reproduce rapidly, the small amount entrained and killed in the cooling-water system would have a minimal effect on the productivity of the lake.

Based on the information presented above, the NRC staff concludes that the impacts of impingement and entrainment on aquatic organisms resulting from the proposed Palisades preparation for the resumption of power operations would be NOT SIGNIFICANT.

Thermal Impacts of Discharges

In the 2006 SEIS (NRC 2006-TN7346), the NRC staff discussed field surveys to assess the thermal plume after the MDCTs were installed, which is incorporated in the EA by reference. At its largest in the winter, the 3°F (1.67°C) isotherm encompassed approximately 286 ac (116 ha) of water surface and seldom extended below a depth of 5 ft (1.5 m) with discharge temperatures of 25 to 34°F (-3.9 to 1.1°C), except in peak winter when they reached 44°F (6.7°C) above the ambient lake temperature (NRC 2006-TN7346). In its current decommissioning state, Palisades is averaging a discharge temperature of approximately 2°F (1.1°C) above ambient water temperatures (MEGLE 2024-TN10741). The NDPES permit no. MI0001457 limits the thermal discharge from Palisades to 2,100 MBtu/hr, with a daily monitoring requirement of the temperature at the intake and discharge (MDEQ 2014-TN10665; MEGLE 2023-TN10739). Based on the discharge limits of the NPDES permit, the NRC staff concludes that thermal impacts on aquatic organisms would be NOT SIGNIFICANT for the proposed preparation for the resumption of power operations.

Chemical Impacts from Discharges:

The first chemical issue concerns the potential effects of nonradiological contaminants on aquatic organisms that could occur from nuclear power plant operations. This issue initially became a concern because some nuclear power plants used heavy metals in condenser tubing that could leach from the tubing and expose aquatic organisms to these contaminants (NRC 2024-TN10161). Because aquatic organisms can bioaccumulate heavy metals, even when exposed at low levels, this can be toxic to fish and other animals that consume contaminated organisms. However, Palisades has stainless steel condenser tubes that do not leach metals to the cooling-water discharge (Holtec 2023-TN10538). The NRC staff verified that the issue associated with heavy metals leaching from condenser tubing, does not apply to Palisades.

For certain plant equipment and systems Holtec will use, Michigan EGLE approved chemical additives to control pH, scale, corrosion, and biofouling. The 2006 SEIS (NRC 2006-TN7346) and the Environmental New and Significant Review (Holtec 2023-TN10538) describe the

chemicals used and the discharge limits under the NPDES permit no. MI0001457 and are incorporated by reference. Section 3.4 of this EA addresses the discharge of metals in cooling system effluent. As explained in that section, Palisades NPDES permit establishes allowable levels of metals including copper, silver, zinc, nickel, and lead (MDEQ 2014-TN10665; MEGLE 2023-TN10739). While the proposed preparation for the resumption of power operations would mean restarting chemical discharges from the CWIS into Lake Michigan, the chemical concentrations at the outfall are regulated by the NPDES permit. Also, no impacts to the aquatic environment from these chemicals were observed when Palisades was operating under its provisional license (1971–1991), full-term operating license (1991–2007), or its license renewal (2007–2022, expires 2031).

The other chemical issue concerns the potential impacts on aquatic organisms from exposure to radionuclides from routine radiological effluent releases. The NRC requires nuclear power plants to maintain a REMP as per requirements specified in 10 CFR Part 50, Appendix I, 10 CFR Part 20-TN283, and 10 CFR Part 72-TN4884, and through plant-specific technical specifications. These collectively require that licensees establish and implement a REMP to obtain data on measurable levels of radiation and radioactive material. The 2021 and 2022 REMP report did not show any measurable levels of radiation, above baseline environmental levels, detected in the vicinity of Palisades. If power operations resume, Palisades would be required to remain in compliance with NRC radiological effluent limits and reimplement the REMP to ensure aquatic organisms' exposure to any radionuclides are within acceptable limits.

The NRC staff concludes that the effects of nonradiological and radiological contaminants on aquatic organisms during the proposed resumption of power operations of Palisades would be NOT SIGNIFICANT.

3.7.3.2 Important Aquatic Species and Habitats

As noted in Section 3.7.2.2, four State-listed fish species have occurred in the vicinity of Palisades, although the lake herring and shortjaw cisco have not been observed in 30 years (Table J-4 of this EA). The starheaded topminnow and spotted gar are expected to still be in the vicinity. The spotted gar is tolerant of warm waters and low dissolved oxygen. Both species can be found in shallow waters or near the surface and both spawn in shallow water, although the gar prefers heavily vegetated areas and the topminnow prefers gravel. As a result, the potential for impact to the spotted gar or the starheaded topminnow from entrainment, impingement, thermal or chemical discharges, and other operational activities is expected to be NOT SIGNIFICANT due to the location of the intake offshore and mid-water column.

As also noted in Section 3.7.2.2, there are also four State-listed mussels, the slippershell, creek heelsplitter, flutedshell, and round pigtoe, that may occur within the vicinity of Palisades (Table J-4 of this EA). Potential impacts could include entrainment of the larval forms, entrainment or impingement of the fish host, and thermal or chemical impacts to individuals that settle near the discharge. Holtec has not identified any State-listed species in the intake or discharge systems during annual monitoring (HDI 2024-TN10843: RCI-AE-4a). As a result, the potential for impact to State-listed mussel species from entrainment, impingement, thermal or chemical discharges, or other operational activities is expected to be NOT SIGNIFICANT.

3.7.4 Cumulative Effects

Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental impacts of the proposed Federal actions. Key past and present actions affecting aquatic resources in the affected area include planned

construction of multiple SMRs, expansion of the independent spent fuel storage installation (ISFSI), and the potential subsequent license renewal of Palisades in 2026. There are also three other energy generating facilities (Donald C. Cook Nuclear Power Plant, Covert Generating Plant, and Holland Energy Park) on or near Lake Michigan, within a 40 mi (64 km) radius of Palisades. These plants have been operating concurrently with Palisades prior to shut down in 2022. The expansion of the ISFSI and planned construction of multiple SMRs would take place, if completed, on the landward side of the dunes onsite at Palisades. The ISFSI expansion would occur in an area that is already concrete and not affect the surface water input. The ISFSI expansion is also replacing an existing ISFSI location, so cooling water needs are not expected to increase above what is currently being used. If the planned installation of multiple SMRs are approved, it will be subject to regulation by the NRC and the intake and discharge of any additional water from Lake Michigan will be subject to regulation under the CWA. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to aquatic ecology when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.8 Historic and Cultural Resources

The NRC staff evaluated previous environmental documents and analyses regarding historic and cultural resources and the relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents relevant to the subject area are incorporated by reference to support the NRC staff's significance effects determination for historic and cultural resources (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.2.9.1, Cultural Background; 2.2.9.2, Historical and Archaeological Resources at the Palisades Site
- SEARCH Archaeological Report (SEARCH 2024-TN10846): in its entirety
- SEARCH Architectural Report (Theriot and Travisano 2024-TN10847): in its entirety

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.8.1 Affected Environment

In the 2006 SEIS (NRC 2006-TN7346), the NRC staff evaluated and described the historic and archaeological background, cultural resources surveys, and identified historic properties at Palisades. The APE for the license renewal action evaluated as part of the 2006 SEIS included the entire 432 ac (175 ha) Palisades site. The NRC staff identified, confirmed, and validated only minor changes in the known affected environment as part of this EA. The following sections reflect new information since publication of the 2006 SEIS (NRC 2006-TN7346).

3.8.1.1 Area of Potential Effects

The APE for this project includes the entire 432 ac (175 ha) Palisades site (Figure 3-5 of this EA; e.g., NRC 2024-TN10840) that may be directly or indirectly affected by activities related to both the preparations for and the resumption of power operations. Aside from the transmission line and corridor, the facilities at Palisades are only publicly visible from Lake Michigan and the beach areas to the north and south of the plant boundary. Therefore, the APE analysis also includes a 1 mi (1.6 km) buffer, which allows the NRC staff to evaluate the potential impacts to historic properties located nearby but outside of the Palisades site boundary.

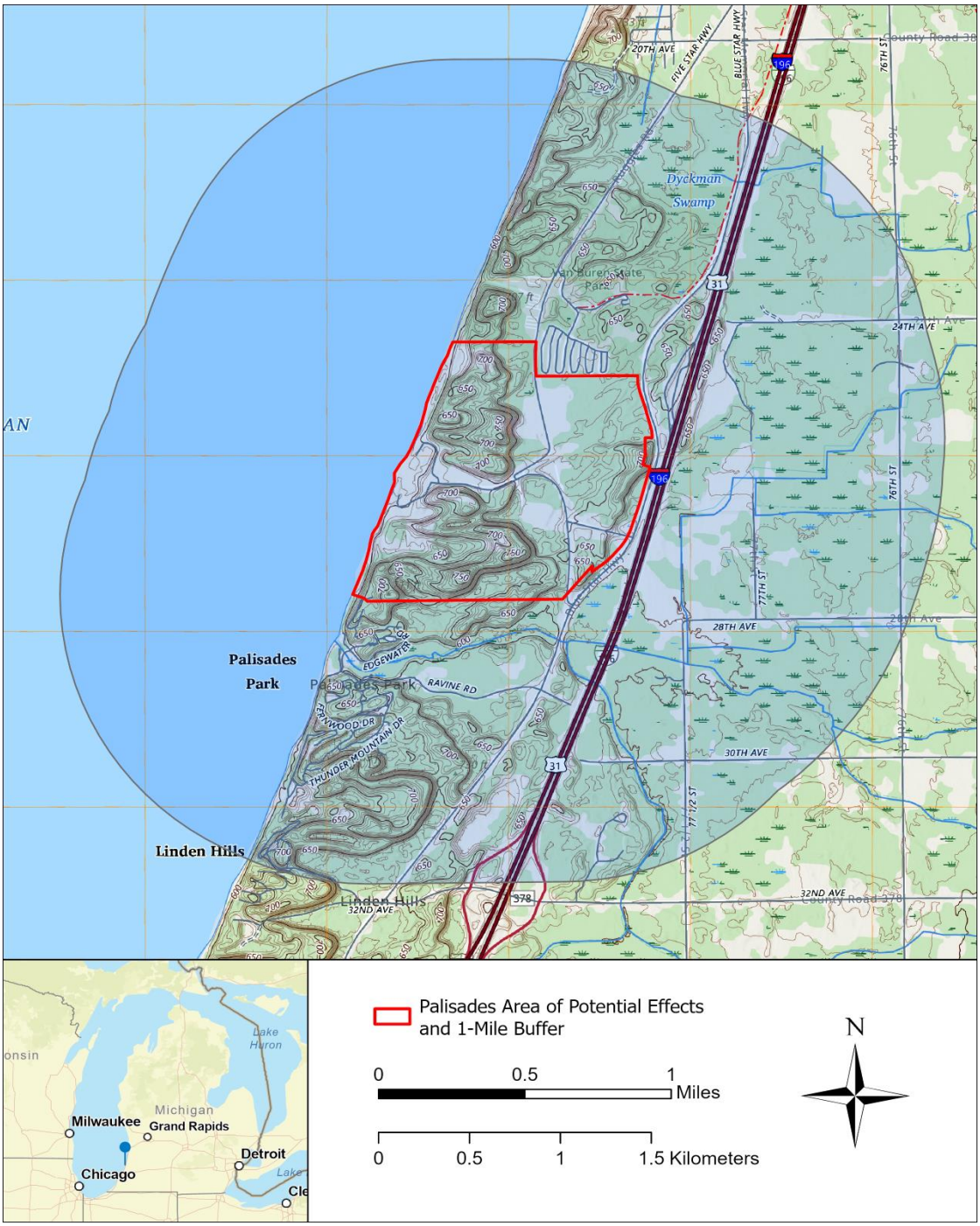

Figure 3-5 Area of Potential Effects and 1 mi (1.6 km) Buffer Area at the Palisades Nuclear Plant Site

3.8.1.2 Cultural Background

The 2006 SEIS (NRC 2006-TN7346) describes the long-term cultural history and chronology for this portion of the Great Lakes and southwest Michigan, specifically because Indigenous peoples lived in this region for at least the past 10,000 years. Recent archaeological summaries of the cultural context within this region of southwest Michigan support this interpretation

(SEARCH 2024-TN10846). The NRC staff characterized the cultural chronology which included a “Paleoindian” or “First Peoples” period between 10,000–8,000 Before Common Era (BCE), an “Archaic” period between 8,000–1,000 BCE, a “Woodland” period between 1,000 BCE–1050 Common Era (CE), a “Mississippian” period between 1050–1600 CE, and a “Contact/Post-Contact” period from 1600 CE–present (NRC 2006-TN7346). While these cultural chronological periods are broadly accurate and reflective of the changes in cultural periods in this region of the Great Lakes, recent research also indicates that sand dunes along the southeastern shore of Lake Michigan—including in Van Buren State Park to the immediate north of Palisades—have intact, buried paleo-soil surfaces (Lovis et al. 2012-TN10742). Excavation, sampling, and radiocarbon dating of deeply buried sand dune deposits indicate that between approximately 6,000 to 5,000 years ago the area around Van Buren State Park consisted of a noncontiguous marshy environment. This marsh environment extended between Holland, Michigan south to Indiana and existed for about 1,000 years prior to the beginning of sand dune formation. Sand dunes in this region formed episodically for around 2,500 years but slowed, allowing the formation of a new paleo-soil surface around 2,000 years ago. Episodic sand dune formation then continued for the last 1,000 years (Lovis et al. 2012-TN10742). These records indicate that sand dunes at Palisades and this region of southeastern Lake Michigan have buried paleo-soil surfaces with the potential for evidence of past human activity (i.e., areas with stable ground surfaces where evidence of human activity might accumulate).

The 2006 SEIS (NRC 2006-TN7346) identified the shipwreck site of the *City of Greenbay* as the closest shipwreck to Palisades, located approximately 0.5 mi (0.8 km) north. Since publication of the 2006 SEIS, one new shipwreck site has been identified in southeastern Lake Michigan. The *A.P. Dutton*, which sank in 1868, is located approximately 4.6 mi (7.2 km) west of Palisades (SEARCH 2024-TN10846).

3.8.1.3 Identified Historic Properties

The 2006 SEIS (NRC 2006-TN7346) describes that no archaeological or architectural cultural resources surveys occurred at Palisades prior to construction in 1967 to 2006, although a cultural resource assessment was prepared in 1979. As noted in the 2006 SEIS (NRC 2006-TN7346), this assessment identified the need for an archaeological survey in undisturbed portions of Palisades. Archaeologists re-visited Palisades in 1982 to assess the potential impacts from building projects. A report was produced for the Palisades operator at the time, Consumers Power Company, but was not submitted for review to the Michigan State Historic Preservation Office (SHPO) (NRC 2006-TN7346). However, as part of a recent proposal to construct and operate multiple SMRs at Palisades (SMR 2024-TN10713), Holtec subcontracted to SEARCH, Inc., to complete archaeological and architectural surveys from 2023 through 2024 (SEARCH 2024-TN10846; Theriot and Travisano 2024-TN10847). These surveys occurred in three parts: (1) a pedestrian, surface-level archaeological survey through the Palisades sand dune environments (i.e., western portion of the Palisades site); (2) a subsurface campaign of archaeological shovel testing occurred through non-sand dune environments at Palisades (i.e., eastern portion of the Palisades site); and (3) a built-environment survey of the Palisades facilities conducted by an architectural historian.

Historic properties are defined as cultural resources which are eligible or listed on the National Register of Historic Places (NRHP) (NPS 2024-TN10772). Results from the archaeological survey indicated that there are three archaeological sites located at Palisades (20VA92, 20VA93 and 20VA94), but none of these sites are eligible or potentially eligible for the NRHP (SEARCH 2024-TN10846; HDI 2024-TN10669). The Michigan SHPO concurred with these determinations by letter dated September 18, 2024 (MI SHPO 2024-TN10850). All other

regional site information within an approximate 1 mi (1.6 km) radius of Palisades remains the same as in the 2006 SEIS (NRC 2006-TN7346). Results from the architectural survey recommended that only the containment building was potentially eligible for NRHP listing (HDI 2024-TN10669; Theriot and Travisano 2024-TN10847; MI SHPO 2024-TN10844; MI SHPO 2024-TN10873), but after further evaluation and consultation, the Michigan SHPO determined that the containment building cannot be considered separately from the remaining parts of the Palisades facility and does not rise to the level of significance required for listing in the NRHP under Criteria C for Architecture/Engineering by letter dated November 6, 2024 (MI SHPO 2024-TN10844). The NRC staff transmitted the archaeological report to the federally recognized Indian Tribes (NRC 2024-TN11054); no comments were received.

3.8.1.4 Consultation

The NRC has initiated consultation with the Advisory Council on Historic Preservation (ACHP), Michigan SHPO and 35 federally recognized Indian Tribes, as further described in Appendix D, Appendix E, and Appendix I.

3.8.2 Environmental Impacts from the Preparations for Resumption of Power Operations

Section 3.1 of this EA describes the activities Holtec is completing as part of the preparations for the resumption of power operations. Several of these activities have expected ground disturbance in and around the Palisades site. These ground-disturbing activities include the construction of a new access road, removal and construction of a new security fence, a re-cabling project between the reactor facility and the cooling towers, demolition of two current radioactive storage facilities, and construction of a new radioactive waste storage facility and a new digital storage facility (see Table 3-1 of this EA). These activities, as shown in Figure 3-1 of this EA, are all occurring within the western portion of the Palisades site, with the only exception being the construction of the digital storage facility.

The western portion of Palisades was considerably modified through ground disturbance, sand dune remediation, and shoreline modification during the original construction of Palisades in the late-1960s and early 1970s (Appendix I to this EA) (SEARCH 2024-TN10846). Although no archaeological survey (e.g., shovel testing) occurred in the critical dune environment within the western portion of Palisades, if future ground-disturbing activities occur within this area, then a Michigan State critical dune permit would be required. Holtec will have cultural resource protection procedures for any ground-disturbing activities at the site (HDI 2024-TN10843: RCI-HCR-7a). These procedures were submitted to the Michigan SHPO and federally recognized Indian Tribes for review and comment, and Michigan SHPO provided comments by letter dated October 23, 2024 (HDI 2024-TN10843: RCI-HCR-7a; MI SHPO 2024-TN10983). The Michigan SHPO also recommended that noninvasive archaeological survey techniques be employed if future undertakings overlap with the CDAs, since these are dynamic environments and may include deeply buried deposits (MI SHPO 2024-TN10850).

As no historic properties have been identified at Palisades and activities related to the preparations for resumption of power operations will have a nominal subsurface impact that does not extend below previously disturbed grades and will occur in previously disturbed areas (e.g., the cooling tower re-cabling project extends to a depth of 27 in. [69 cm] [HDI 2024-TN10670: RAI-GEN-1]), no significant impacts to archaeologic resources are indicated.

Activities that will occur at Palisades as part of the preparations for the resumption of power operations that are within buildings and structures will not result in significant impacts to architectural resources. There are no eligible built-environment properties within the APE. In accordance with 36 CFR 800.4 (TN513), this undertaking will have no historic properties affected as no historic properties have been identified and activities associated with the resumption of power operations are limited to previously disturbed areas. Holtec will have procedures to address inadvertent discoveries and notification protocols. Additionally, no historic and cultural resources have been identified within the APE. Therefore, the NRC staff determined that impacts to historic and cultural resources related to the activities from the preparations for resumption of power operations would be NOT SIGNIFICANT.

3.8.3 Environmental Impacts from the Resumption of Power Operations

In 2006, the previous Palisades operator (Entergy) had existing historic and cultural resources procedures (NMC 2006-TN10743), which provided a screening tool and mechanism to protect archaeological sites and other resources that may be inadvertently encountered during day-to-day operations (NRC 2006-TN7346). The Michigan SHPO concurred with NRC's determination of "no historic properties are affected" as part of the 2006 SEIS (NRC 2006-TN7346), because while Palisades lacked archaeological and architectural surveys, Entergy had procedures in place to protect unidentified cultural resources.

By returning to power operations, Palisades would operate in a manner similar to past operations, except with the addition of new archaeological and architectural surveys and updated site-wide cultural resource procedures (HDI 2024-TN10670, HDI 2024-TN10843: RCI-HCR-7a; MI SHPO 2024-TN10850). In accordance with 36 CFR 800.4 (TN513), this undertaking will have no historic properties affected as no historic properties have been identified, and Holtec will have procedures to address inadvertent discoveries and notification protocols. Additionally, no historic and cultural resources have been identified within the APE. Therefore, the NRC staff determined that impacts to historic and cultural resources related to the activities associated with resumption of power operations would be NOT SIGNIFICANT.

3.8.4 Cumulative Effects

Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental effects of the proposed Federal actions. For the cumulative analysis for this resource, the region of interest is the APE. Key past, present, and reasonably foreseeable actions in the vicinity of Palisades that may affect historic and cultural resources include the potential construction of multiple SMRs (SMR 2024-TN10713) and potential subsequent license renewal. Ground disturbance as part of construction activities associated with the potential SMR project have the greatest possibility to affect historic and cultural resources. The potential subsequent license renewal and SMR projects are new and separate undertakings under NHPA and would be independently evaluated by the NRC under Section 106 of the NHPA (TN4157). Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to historical and cultural resources when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.9 Socioeconomics

The NRC staff evaluated previous environmental documents and analyses with regard to socioeconomics along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents are

incorporated by reference to support the NRC staff's significance effects determination for socioeconomics (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Section 4.4, Socioeconomics
- N&S Report (Holtec 2023-TN10538): Section 3.4, Socioeconomics
- Holtec RAI Response (HDI 2024-TN10670): RAI-SE-1 (Temporary workforce); RAI-SE-2 (Description and breakdown of projected plant employment)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.9.1 Affected Environment

This section describes current baseline socioeconomic conditions near Palisades, including population demographics, regional economy, and infrastructure and public services. Socioeconomic information documented in the 2006 SEIS (NRC 2006-TN7346) has been updated to reflect more recent socioeconomic data where applicable. Based on information provided by Holtec (HDI 2024-TN10670: RAI-SE-2), nearly 70 percent of the current 442 Palisades workforce resides in Berrien and Van Buren Counties.

The following tables present demographic, income, and housing information about the two-county region of influence (ROI) from the Census Bureau. Based on the information presented in Table 3-6, racial and ethnic diversity in the ROI is similar to the State of Michigan as a whole. Van Buren County has a smaller percentage African American population and a higher percentage Hispanic, Latino, or Spanish population. Information in Table 3-7 of this EA shows that the unemployment in the ROI is similar to the Michigan average, with lower incomes and higher numbers of people and families living in poverty than in Michigan as a whole. As shown in Table 3-8 of this EA, vacant housing rates exceed the State level and median home values and rents are below the average State levels.

Table 3-6 Demographic Profile of the Population in the Region of Influence of Palisades Nuclear Plant in 2020

Demographic	Berrien County	Van Buren County	ROI	Michigan
Total population	**154,316**	**75,587**	**229,903**	**10,077,331**
Percent White race alone	72.3	78.6	74.4	72.4
Percent Black or African American race alone	13.7	3.1	10.2	13.5
Percent American Indian and Alaska Native race alone	0.5	0.7	0.6	0.5
Percent Asian race alone	2.0	0.5	1.5	3.3
Percent Native Hawaiian and Other Pacific Islander race alone	0.1	0.0	0.1	0.0
Percent some other race alone	0.4	0.4	0.4	0.4
Percent two or more races	4.9	4.8	4.9	4.4
Hispanic, Latino, or Spanish Ethnicity of Any Race (Total Population)	9,210	8,966	18,176	564,422
Percent Hispanic, Latino, or Spanish Ethnicity of Any Race of total population	6.0	11.9	7.9	5.6

ROI = region(s) of influence.
Source: USCB 2022-TN11058.

Table 3-7 Estimated Income Information for the Socioeconomic Region of Influence of Palisades Nuclear Plant, 2018–2022, 5-Year Estimates

Metric	Berrien County	Van Buren County	ROI	Michigan
Median household income (dollars)	60,379	65,531	62,017	68,505
Per capita income (dollars)	36,764	32,361	35,314	37,929
Families living below the poverty level (percent)	12.1	9.5	11.2	8.8
People living below the poverty level (percent)	15.7	14.2	15.2	13.1
Unemployment rate	6.6	4.7	6.0	6.0

ROI = region(s) of influence.
Source: USCB 2022-TN10748.

Table 3-8 Housing in the Region of Influence of Palisades Nuclear Plant, 2018–2022, 5-Year Estimate

Metric	Berrien County	Van Buren County	ROI	Michigan
Total housing units	**76,948**	**37,076**	**114,024**	**4,580,447**
Occupied housing units	63,512	29,609	93,121	4,009,253
Total vacant housing units	13,436	7,467	20,903	571,194
Percent total vacant	17.5	20.1	18.3	12.5
Owner occupied units	46,359	23,731	70,090	2,906,470
Median value (dollars)	193,600	172,100	186,609	201,100
Owner vacancy rate (percent)	1.1	0.3	0.8	1.0
Renter occupied units	16,328	5,323	21,651	1,045,070
Median rent (dollars/month)	885	843	875	1,037
Rental vacancy rate (percent)	4.3	6.8	4.9	4.8

ROI = region(s) of influence.
Source: USCB 2022-TN10749.

3.9.2 Environmental Impacts from the Preparations for Resumption of Power Operations

Socioeconomic impacts of preparation for resumption of power operations activities would be similar to those experienced during a typical nuclear power plant refueling outage (HDI 2024-TN10670: RAI-SE-1). Holtec expects site employment levels during preparation for resumption of power operations to peak at 1,600 workers before ramping down to the previously established reactor operations workforce (HDI 2024-TN10670: RAI-SE-1). Preparation for the resumption of power operations activities are temporary and impacts would be similar to the socioeconomic impacts described for Palisades refueling outages in the 2006 SEIS (NRC 2006-TN7346). Based on this information, socioeconomic impacts from the proposed Federal actions would be similar to those experienced during previous Palisades refueling outages, of short duration, and would be NOT SIGNIFICANT.

3.9.3 Environmental Impacts from the Resumption of Power Operations

Socioeconomic impacts of nuclear power plant operations would be similar to those described in the 2006 SEIS (NRC 2006-TN7346). Holtec expects site employment levels during operations to be 600 workers (HDI 2024-TN10670: RAI-SE-1). The operations workforce would be

expected to reside in similar patterns to when the plant was operating prior to decommissioning, as described in the 2006 SEIS (NRC 2006-TN7346).

In addition, the resumption of operations at Palisades would increase the amount of tax money paid to Van Buren County and the City of Benton Harbor. Annual property tax payments for Palisades paid to Van Buren County (with a small portion to the City of Benton Harbor) averaged $10 million per year prior to reactor shutdown and the commencement of decommissioning. Annual property tax payments during Palisades decommissioning decreased over a 6-year period to approximately $1.6 million. Annual property tax payments could increase up to $15.6 million in 2025 due to power plant modifications and improvements that could increase the nuclear plant's valuation. However, Holtec expects property tax payments to return to pre-decommissioning levels (approximately $10 million per year) starting in 2027 (Holtec 2023-TN10538).

Other socioeconomic impacts from nuclear power plant operations include effects on community services, transportation (e.g., traffic volumes), and the economic impacts of expenditures for goods and services including labor. These impacts are described in the 2006 SEIS (NRC 2006-TN7346), and NRC staff do not expect socioeconomic impacts to noticeably differ after the resumption of power operations. Based on this information, including information from Holtec (Holtec 2023-TN10538), the socioeconomic impacts from the proposed Federal actions and the resumption of reactor power operations would be similar to those described in the 2006 SEIS and would be NOT SIGNIFICANT.

3.9.4 Cumulative Effects

Appendix G, Table G-1 identifies other past, present, and reasonably foreseeable actions that could result in cumulative effects. The proposed SMR project would require additional workers during construction and operation. However, NRC staff recognizes the site has experienced fluctuations in site worker numbers in the past and that the expected fluctuations associated with the SMR would be generally consistent with previous fluctuations. Minor beneficial economic impacts including the resumption of pre-decommissioning tax revenues would result from proposed SMR project.

As discussed in Sections 3.9.2 and 3.9.3, the socioeconomic effect of the proposed Federal actions would be similar to those experienced during previous refueling outages and reactor operations at Palisades. Therefore, the NRC staff has determined that the incremental socioeconomic effects of the proposed Federal actions when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.10 Environmental Justice

Consistent with the Commission's 2004 "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions," (69 FR 52040-TN1009), the NRC analyzed whether there are disproportionately high and adverse impacts on low-income and minority populations as part of its NEPA review. In assessing the impacts of the proposed agency action, the following CEQ *Environmental Justice: Guidance Under the National Environmental Policy Act* definitions of minority individuals, minority populations, and low-income populations were used (CEQ 1997-TN452):

Minority Individuals: Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races, meaning individuals who identified themselves on a census form as being a member of two or more races, for example, White and Asian.

Minority Populations: Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Meaningfully greater was used in this analysis to identify minority populations within a 50 mi (80 km) radius.

Low-income Population: Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P60, on Income and Poverty. Meaningfully greater was used in this analysis to identify low-income populations within a 50 mi (80 km) radius.

The NRC addresses EJ matters by (1) identifying the location of minority and low-income populations that may be affected by the proposed Federal actions, (2) determining whether there would be any potential human health or environmental effects to these populations and special pathway receptors (groups or individuals with unique consumption practices and interactions with the environment), and (3) determining whether any of the effects may be disproportionately high and adverse. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionate environmental effects refer to the effects or risks of effects on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental effect on the larger community. Such effects may include biological, cultural, economic, or social impacts.

The NRC staff evaluated previous environmental documents and analyses with regard to EJ along with their relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following environmental documents are incorporated by reference to support the NRC staff's significance effects determination for EJ (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 4.4.6, Environmental Justice; 4.0, Environmental Impacts of Operation; 4.3, Radiological Impacts of Normal Operation
- N&S Report (Holtec 2023-TN10538): Section 3.5, Environmental Justice
- Community Benefits Plan (DOE 2024-TN10833): in its entirety
- Holtec RAI Response (HDI 2024-TN10670): RAI-SE-1 (Temporary workforce)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.10.1 Affected Environment

For this review, the EJ affected environment is a 50 mi (80 km) radius of the Palisades site, the same area that was analyzed in the 2006 SEIS (NRC 2006-TN7346) and the N&S Report

(Holtec 2023-TN10538). The review examined 2020 American Community Survey Census data in census block groups located fully or partially in this radius for changes in potentially affected EJ populations (USCB 2023-TN11056, USCB 2022-TN11057). This radius encompasses nine counties in Michigan: Allegan, Barry, Berrien, Cass, Kalamazoo, Kent, Ottawa, St. Joseph and Van Buren, and three counties in northern Indiana: Elkhart, LaPorte, and St. Joseph. Information from community-based organizations, city planning, and social service organization meetings in Van Buren and Berrien counties were included in the review (Appendix D to this EA). Holtec's N&S Report provided further demographic and low-income data between 2006 and 2020, including an assessment of subsistence populations and migrant workers, and is incorporated here by reference (Holtec 2023-TN10538).

There are 1,145 census block groups within the 50 mi (80 km) radius. The meaningfully greater comparisons, defined by the aggregate minority and low-income percentages within a 50 mi (80 km) radius were 24.6 percent and 12.1 percent, respectively. With this criteria, 163 block groups (14.3 percent) are considered above the aggregate minority meaningfully greater threshold, 152 block groups (13.3 percent) are above the low-income threshold, and 275 block groups (24.1 percent) are above both thresholds. Figure 3-6 below displays the EJ designations for each census block group.

DOE's CBP (DOE 2024-TN10833), designed to meet DOE's Loan Guarantee requirements, is a comprehensive community strategy aimed at supporting the repowering of Palisades (DOE 2024-TN10833). The Community Snapshot in Enclosure 18, Attachment 1 provides a detailed characterization of existing environmental burdens in Covert Township, utilizing the EPA's EJScreen tool.[4] These factors are relevant for determining EJ impacts as they highlight pre-existing conditions that may be affected by the proposed Federal actions. Specifically, the analysis of Covert Township revealed high-energy costs, elevated asthma rates, transportation barriers, and significant concentrations of toxic wastewater. Additionally, a broader examination of the EJ affected environment mirrors these findings, indicating systemic issues that affect community health and resilience.

Sections A and B of the CBP (DOE 2024-TN10833), along with public comments during local meetings, provide an understanding of the current state of Holtec's EJ engagement. Combined, these references reflect a complex relationship between Palisades and local communities. Workforce development, service, and advocacy organizations all reported a lack of awareness about DOE's CBP and noted a decline in donations and volunteerism since the plant's shutdown in 2022. They also noted significant barriers to attracting a workforce, such as limited affordable housing and inadequate public transportation options, which contribute to the economic disadvantages in Benton Harbor and surrounding areas. Additionally, concerns about perceived health impacts from multiple local nuclear facilities, along with a historical context of racial disparities in community support and job opportunities, have led to mistrust among minority organizations. Although decommissioning did not drastically shift community needs, many residents look forward to potential economic benefits from the Palisades' planned resumption of power operations. Community concerns primarily focus on housing, transportation, job training, and food security, with local organizations striving to support needs based on demand rather than specific income levels. Overall, the anticipated resumption of power operations has raised hopes for economic improvement, but significant challenges remain regarding community engagement and equity (NRC 2024-TN10842).

[4] EJScreen is EJ screening and mapping tool by EPA that helps identify areas with environmental burdens and vulnerable populations.

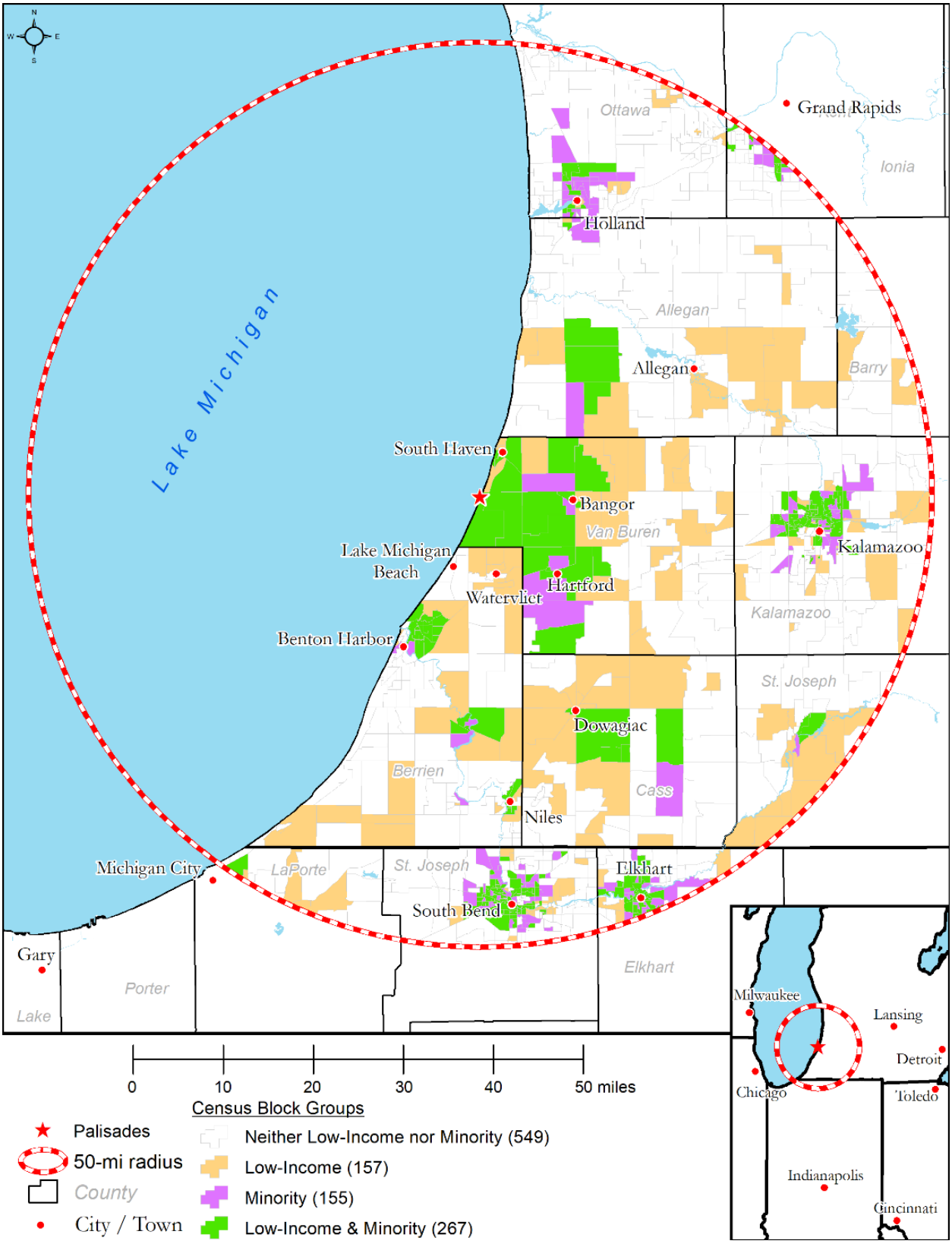

Figure 3-6 Environmental Justice 50 mi (80 km) Affected Environment. Sources: USCB 2023-TN11056, USCB 2022-TN11057.

3.10.2 Environmental Impacts from the Preparations for Resumption of Power Operations

Preparations for the resumption of power operations activities are not expected to have significant human health or environment land use, air, water, or waste generation and disposal effects on EJ populations living near Palisades. These activities would be similar to those that occurred during previous Palisades refueling outages (HDI 2024-TN10670: RAI-SE-1), including noise and the temporary increase in the number of workers and vehicular traffic volumes on local roads. Holtec expects site employment levels to peak at 1,600 workers before ramping down to the normal reactor power operations workforce (HDI 2024-TN10670: RAI-SE-1). Human health and environmental effects from preparations for resumption of power operations activities would be similar to those experienced during a typical nuclear power plant refueling outage (HDI 2024-TN10670: RAI-SE-1). Given the presence of 590 EJ census block groups in the affected environment, EJ populations could experience disproportionate effects due to increased vehicular traffic, the increased number of workers, and associated noise. However, since the human health and environmental effects would be similar to those experienced during previous Palisades refueling outages, as described in the 2006 SEIS (NRC 2006-TN7346), and would predominately occur within the developed areas of the industrial site, impacts to EJ populations would not be disproportionally high and adverse, and therefore, would be NOT SIGNIFICANT.

3.10.3 Environmental Impacts from the Resumption of Power Operations

Human health and environmental effects of nuclear power plant operations would be similar to those described in the 2006 SEIS (NRC 2006-TN7346), and the resumption of power operations at Palisades is not likely to result in any new, different, or increased human health and environmental effects beyond what has already been experienced. Potential environmental effects include changes in socioeconomic conditions (such as traffic volumes, demand for community services, job creation, income generation, and tax revenue changes), air and water quality, and waste generation and disposal. Given the presence of 590 EJ census block groups in the affected environment, EJ populations could experience disproportionate effects.

In addition, communities near nuclear facilities can face health risks from radiation exposure and contaminated water. EJ populations, in particular, are vulnerable due to limited means and resources to advocate for their health and safety, and pre-existing challenges such as elevated asthma rates and transportation barriers. Public comments during scoping (NRC 2024-TN10605) and concerns expressed at public meetings have raised human health concerns regarding the resumption of power operations of Palisades. Based on the human health and environmental effects conclusions for reactor operations at Palisades in the 2006 SEIS (NRC 2006-TN7346) and the review of human health in Section 3.11 of this draft EA, radiological or nonradiological health effects from the resumption of power operations would not be significant. Further, DOE concluded human health and environmental effects would be the same as was experienced during previous Palisades reactor operation (DOE 2024-TN10775). Since no special pathway receptors have been identified, EJ populations near Palisades are not expected to experience disproportionately high and adverse human health and environmental effects from the proposed Federal actions. Therefore, the impact to EJ populations from the resumption of power operations would be NOT SIGNIFICANT.

3.10.4 Cumulative Effects

Appendix G, Table G 1 in this EA identifies other past, present, and reasonably foreseeable actions that could cumulatively contribute to the environmental effects of the proposed Federal actions. The proposed reasonably foreseeable projects, such as SLR and the SMRs, are not expected to have any new or significant disproportionally high and adverse human health or environmental effects on EJ populations or communities near Palisades beyond what has already been experienced. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions to EJ populations when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.11 Radiological and Nonradiological Human Health

The NRC staff evaluated previous environmental documents and analyses with regard to radiological and nonradiological human health and the relevance to potential environmental effects of the proposed Federal actions at the Palisades site. Portions of the following documents relevant to the subject area are incorporated by reference in support of the NRC staff's radiological and nonradiological human health significance effects determination (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.2.7, Radiological Impacts; 2.2.8, Socioeconomic Factors; 4.1, Cooling System; 4.2, Transmission Lines; 4.3, Radiological Impacts of Normal Operation
- 2023 N&S Report (Holtec 2023-TN10538): Sections: 3.9, Human Health; 4.8.1, SEIS Findings; 4.9.2, N&S Review for Reauthorization of Power Operations
- 2024 LR GEIS (NRC 2024-TN10161): Sections: 3.3.3, Noise; 3.9, Human Health; 4.2, Land Use and Visual Resources

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.11.1 Radiological Human Health

3.11.1.1 Affected Environment

The affected environment is described generically for all nuclear power plants in the 2024 LR GEIS (NRC 2024-TN10161) and specifically in the 2006 SEIS (NRC 2006-TN7346). The REMP is also described in the 2006 SEIS (NRC 2006-TN7346).

Table 3.9.2 of the N&S Report (Holtec 2023-TN10538) presents the REMP sample results for 2021 and 2022, and the reported data in the table is consistent with the reporting data described in the 2006 SEIS (NRC 2006-TN7346). The NRC staff conducted a review of the Palisades Annual Radioactive Effluent Reports (NRC 2024-TN10750) and NRC Office of Enforcement Annual Reports going back to 2006 (NRC 2024-TN10751). The effluent reports indicated that emissions during operation and subsequent decommissioning were within compliance with 10 CFR Part 20 (TN283) and Appendix I of 10 CFR Part 50 (TN249).

In addition to reviewing data from actively monitored emissions, the NRC staff reviewed independent data collect by Michigan EGLE. The Michigan EGLE runs an independent REMP (MEGLE 2016-TN10744) for all nuclear power plants within the State, including areas surrounding Palisades. This data is published from 1958 up to 2016 and includes environmental

sampling of air particulate, air vapors, milk, surface water, and direct radiation monitoring (MEGLE 2014-TN10865). The data collected by Michigan EGLE for the majority of plant operations demonstrate that Palisades emissions are low and confirms submitted Annual Radioactive Effluent Reports for the same time frame are within regulatory limits.

The N&S Report (Holtec 2023-TN10538) provides the most recent (2018–2022) average occupational radiation dose per individual; the total effective dose equivalent (TEDE) was 0.225 roentgen equivalent(s) man (rem). The annual occupational TEDE limit is 5 rem, as outlined in 10 CFR 20.1201(a)(1). Also provided in the N&S Report (Holtec 2023-TN10538) are the doses to a member of the public for the last full year of operation (2021), which were: 0.112 millirem (mrem) for whole body, 0.117 mrem for thyroid, and 0.522 mrem for other organs. Furthermore, in the 2006 SEIS (NRC 2006-TN7346) the maximum annual TEDE (over the five-year period 2000–2005) was reported as 7.53×10^{-3} mrem, with the TEDE including estimates for liquid and gaseous effluents. The average occupational radiation exposure TEDE dose for the operational years 2006 to 2021 ranged from 0.09 rem to 0.39 rem (NRC 2024-TN9915). These dose results confirm that Palisades was operating in compliance with 10 CFR Part 50, Appendix I, 10 CFR Part 20, and 40 CFR Part 190.

The radiological effects on the environment related to the resumption of power generation at Palisades would be consistent with that observed prior to the shutdown of operations in 2022.

Local Cancer Concerns

During scoping, numerous individuals expressed concerns about the impact of radioactive emissions and cancers on human health at locations near Palisades, specifically related to thyroid cancer (NRC 2024-TN10605). To understand the potential impact of radioactive emissions on the environment, the NRC staff conducted a review of the Palisades Annual Radioactive Effluent Reports (NRC 2024-TN10750) and NRC Office of Enforcement Annual Reports going back to 2006 (NRC 2024-TN10751). The effluent reports indicated that emissions during operation and subsequent shutdown were within compliance with 10 CFR 50 Appendix I requirements (TN249).

The NRC staff investigated the reports of increased rates of cancer using data sources provided by the Michigan Department of Health and Human Services, such as the Centers for Disease Control and Prevention's National Environmental Public Health Tracking Network (CDC 2024-TN10845) and the University of Kentucky's Cancer Incidence and Mortality Inquiry System (University of Kentucky 2014-TN10851). The provided data included total cancer rates and thyroid cancer rates for Van Buren County, the counties surrounding Van Buren County, and the state of Michigan as a whole. This data was used in conjunction with annual effluent reports provided by the operators of Palisades and data collected through the Michigan REMP program. Based on its review of this data, the NRC staff did not identify any higher incident rates of cancer, specifically for thyroid cancer in the counties around Palisades. This information is discussed in further detail in Appendix H, "Discussion of Cancer Risks at and around Palisades Nuclear Plant." While Palisades did have enforcement actions applied during the time period reviewed (NRC 2024-TN10751), no enforcement actions were related to the radioactive emissions control systems described in Section 3.11.1.1 of this EA.

Additionally, the State of Michigan Department of Health and Human Services, Department of Environmental Health provided the NRC staff with a letter sent to the township of Covert, Michigan on November 15, 2024 (MDHHS 2024-TN10866). The letter summarizes a review of the instances of thyroid cancer in Covert Township from 1985 to 2021. The number of recorded

cases of thyroid cancer in permanent residents was 6, a number too low to conduct viable statistical analysis with other comparable locations. No temporal patterns were identified with regards to thyroid cancer for the location during the review.

3.11.1.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

Radiological impacts of normal operations are addressed in the 2006 SEIS (NRC 2006-TN7346) and in Section 4.9 of the 2024 LR GEIS (NRC 2024-TN10161) for continued operation. Any refurbishment activities are expected to be similar to those of a refueling outage. As no radiological releases are expected during the activities for the preparations for the resumption of power operations described in Section 3.1.3 of this EA, there would be no significant radiological impacts to members of the public. Occupational exposures would occur when working within radiation areas in Palisades and would be controlled under 10 CFR Part 20. Thus, radiological human health impacts related to the activities from the preparations for resumption of power operations would be NOT SIGNIFICANT.

3.11.1.3 Environmental Impacts from the Resumption of Power Operation

Radiological impacts of normal operations are addressed in the 2006 SEIS (NRC 2006-TN7346), where the NRC staff noted that there would be no impacts of radiation exposures to the public during the renewal term beyond those discussed in the 2006 SEIS. Given that Palisades would be operated as before with no significantly different radiological environmental impacts, the NRC staff has determined that the environmental impacts of radiological effluent releases from the resumption of power operation at Palisades would be consistent with what was provided in the 2021 and 2022 REMP reports prior to the shutdown of operations in 2022 (Holtec 2023-TN10538), and therefore, would be NOT SIGNIFICANT. The operational impacts are minimized by compliance with radiation protection regulations in 10 CFR Part 20 (TN283), 10 CFR Part 50 Appendix I (TN249), and Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1910-TN654) created by the Occupational Safety and Health Act of 1970 (TN4453).

3.11.1.4 Cumulative Effects

This section of the EA considers the incremental cumulative radiological human health impacts of the proposed Federal actions when added to the contributory effects of other past, present, and reasonably foreseeable actions. Appendix G, Table G-1 of the EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental impacts of the proposed Federal actions.

The proposed Federal actions would not have an incremental cumulative effect on the design configuration, operational changes, or radiological monitoring at Palisades. The facility would return to the same operational state prior to decommissioning and would have the same level of impacts. The addition of SMRs, if pursued, must also meet the NRC regulatory requirements for effluent releases. Additionally, the combination of all nuclear power plants on the site and within 50 mi (80 km) of Palisades would be required to meet the regulations of 40 CFR Part 190 (e.g., maximum annual dose equivalent no greater than 25 mrem for whole body) (TN739).

Therefore, the NRC staff determined that the incremental radiological human health effects of the proposed Federal actions when added to the effects of other past, present, and reasonably foreseeable actions would not have significant cumulative effects.

3.11.2 Nonradiological Human Health

3.11.2.1 Affected Environment

In defining the affected environment for nonradiological human health, the NRC staff assessed previous environmental documents, incorporating by reference where relevant, along with current data.

Chemical Hazards: State and Federal environmental agencies regulate the use, storage, and discharge, and management of chemical spills at the Palisades site as outlined in the 2006 SEIS (NRC 2006-TN7346). Water treatment discharge and management are regulated by an NPDES permit, which is under renewal and discussed further in Section 3.4.2 of this EA. Occupational health impacts are managed through established industrial hygiene practices that comply with OSHA requirements (Holtec 2023-TN10538). Between 2018 and 2023, one reportable chemical spill occurred in September 2020, when a leak from a condensate storage tank exceeded the threshold for hydrazine (reportable quantity of 1 lb [0.45 kg]) and was reported to the state of Michigan (Entergy 2021-TN10707). The quantity of hydrazine released (2.7 lb [1.2 kg]) was not significant enough to cause any human health effects.

Microbiological Hazards: As described in the 2024 LR GEIS (NRC 2024-TN10161), microbiological hazards occur when workers or members of the public come into contact with disease-causing microorganisms, also known as etiological agents. As described in the N&S Report, the Palisades' cooling system does not discharge to a small river; therefore, microbiological public health hazards are not applicable to Palisades (Holtec 2023-TN10538). Microbiological hazards to plant workers are applicable to Palisades. As described in 2024 LR GEIS, nuclear power plant workers can be exposed to *Legionella* spp. when performing cooling system maintenance through inhalation of cooling tower vapors because these vapors are often within the optimum temperature range for *Legionella* spp. growth. In the N&S Report, occupational health impacts are managed through established industrial hygiene practices that comply with OSHA requirements (Holtec 2023-TN10538). In the 2006 SEIS (NRC 2006-TN7346), NRC concluded that there would be no impacts of microbiological organisms during the license renewal term due to potential impacts being controlled by continued application of industrial hygiene practices.

Physical Hazards: As described in the 2024 LR GEIS (NRC 2024-TN10161), a physical hazard is an action or condition that can cause harm upon contact. Nuclear power plants have many of the typical occupational hazards found at any other electric power generation sites as workers perform electrical and repair work and maintenance activities and may be exposed to potentially hazardous physical conditions (e.g., falls, excessive heat, cold, noise, electric shock, and pressure). In 2022, the U.S. Bureau of Labor Statistics reported that national incidence rates for nonfatal occupational injuries and illnesses for the utility industry was 1.7 per 100 full-time workers (BLS 2023-TN10752).

Electric shock hazards and chronic exposure to electromagnetic fields that are produced by the power transmission systems are discussed in the 2024 LR GEIS (NRC 2024-TN10161) and the 2006 SEIS (NRC 2006-TN7346). Occupational workers and members of the public could be exposed to acute electric shock from transmission lines or electrical equipment needed to support the facility. Per the N&S Report, in-scope transmission lines at Palisades (i.e., the transmission lines within the protected area from the reactor to the switchyard) were constructed in accordance with the National Electrical Safety Code criteria and standards and no changes have been made since the 2006 SEIS analysis (Holtec 2023-TN10538). Holtec follows an

industrial safety program that includes electrical safety. There are no Federal standards limiting exposure to electromagnetic fields from power lines in the United States.

As described in detail in the 2024 LR GEIS (NRC 2024-TN10161), noise is an unwanted or unwelcome sound generated by various sources. According to Holtec's N&S Report, the nearest residence is approximately 0.5 mi (0.8 km) to the southwest of the Palisades site (Holtec 2023-TN10538). Noise measurements for the Palisades site are unavailable; however, the cooling towers that were replaced in 2012 and 2017 produce a maximum sound of 90 A-weighted decibel at 3 ft (0.9 m) when operational. As the Palisades site is surrounded by sand dunes and vegetation and most equipment is inside the buildings, noise generation at Palisades is mitigated (NRC 2006-TN7346).

3.11.2.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

Based on information in the review of Holtec's N&S Report, (Holtec 2023-TN10538), Holtec's response to NRC's RAIs/RCIs, and public scoping (Appendix B to this EA), the NRC staff have determined the proposed Federal actions would not alter resources related to nonradiological human health at Palisades. Section 3.2.2 of this EA describes the activities that Holtec is completing in the preparation of resumption of power operations. Palisades continues to have a comprehensive industrial safety program that addresses all applicable OSHA standards (Holtec 2023-TN10538).Therefore, the NRC staff has concluded that the proposed Federal actions related to the preparations for resumption of power operations would not result in a significant impact on nonradiological human health. Based on this, the NRC staff concluded that the impacts from the proposed Federal actions would be NOT SIGNIFICANT.

3.11.2.3 Environmental Impacts from the Resumption of Power Operation

The environmental effects of reactor operations on nonradiological human health resources as a result of license renewal are described in the 2024 LR GEIS (NRC 2024-TN10161). As explained in the 2024 LR GEIS, continued reactor operations and refurbishment activities at nuclear power plants have had little or no environmental effect. The NRC staff expects that Palisades would continue to have a comprehensive industrial safety program that addresses all applicable OSHA standards, as described in Holtec 2023-TN10538, including personal protective equipment (29 CFR 1910.132 [TN654]), eye and face protection (29 CFR 1910.133), respiratory protection (29 CFR 1910.134), and hearing protection (29 CFR 1910.95). Based on the review of N&S Report (Holtec 2023-TN10538) and Holtec's responses to NRC's RAIs/RCIs (HDI 2024-TN10670, HDI 2024-TN10669), the affected environment related to nonradiological human health resources at Palisades has not changed to any significant degree since the 2006 SEIS (NRC 2006-TN7346). Therefore, the NRC staff has concluded that the proposed Federal actions related to the resumption of power operations would not result in a significant impact on nonradiological human health. Based on this, the NRC staff concluded that the impacts from the proposed Federal actions would be NOT SIGNIFICANT.

3.11.2.4 Cumulative Effects

This section of the EA considers the incremental nonradiological human health impacts of the proposed Federal actions when added to the contributory effects of other past, present, and reasonably foreseeable actions. Appendix G, Table G-1 of this EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental impacts of the proposed Federal actions.

Planned onsite construction of multiple SMRs (SMR 2024-TN10713), expansion of the ISFSI (Holtec 2023-TN10538), and potential subsequent license renewal in 2031 at Palisades all have the potential to impact nonradiological human health. Most of the nonradiological impacts of preparation and operation would be localized to the vicinity nearby the Palisades site and the effects are expected to be minimal. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to nonradiological human health when added to the effects of other past, present, and reasonably foreseeable projects would not have significant cumulative effects.

3.12 Waste Management

The NRC staff evaluated waste management information in other environmental documents to determine the potential environmental effects from the proposed Federal actions at the Palisades site. Portions of the following documents relevant to the subject area are incorporated by reference in support of the NRC staff's waste management significance effects determination (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Sections: 2.1.4, Radioactive Waste Management Systems and Effluent Control Systems; 2.1.5, Nonradioactive Waste Systems
- 2023 N&S Report (Holtec 2023-TN10538): Sections: 2.1.1, General Plant Information; 3.10, Waste Management
- 2024 LR GEIS (NRC 2024-TN10161): Section 4.11, Waste Management and Pollution Prevention
- Holtec RAI Response (HDI 2024-TN10670): RAI-GEN-1 (Detailed list of activities related to the Federal actions); RAI-WM-1 (Description of waste management strategy and expected waste generation)

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.12.1 Affected Environment

Complete descriptions of the radioactive waste management and effluent control systems are found in the 2006 SEIS (NRC 2006-TN7346). The systems include gaseous and liquid effluent control systems that prevent release of waste emissions to the environment and must meet the regulatory requirements of 10 CFR Part 20 Appendix B (TN283). Additionally, the solid radioactive waste processing system encompasses the systems and processes used to capture and prepare solid waste for transport. As described in the N&S Report (Holtec 2023-TN10538), these systems have not been changed since the issuance of the SEIS and the description from the N&S Report is incorporated by reference.

Mixed waste, regulated under Resource Conservation and Recovery Act of 1976, as amended (Resource Conservation and Recovery Act of 1976-TN1281) and Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.-TN663), include both radioactive and hazardous waste (EPA 2019-TN6956). According to Holtec's N&S Report (Holtec 2023-TN10538), Palisades has generated minimal mixed waste from 2018 to 2023.

Section 2.1.5 of the 2006 SEIS (NRC 2006-TN7346) provides a description of the nonradioactive waste generation and waste management at Palisades prior to start of plant decommissioning. Generated nonradioactive waste includes chemical, biocide, sanitary,

universal, site stormwater runoff, and lubrication oil waste. Palisades has a nonradioactive waste management program and procedures to handle and dispose of this nonradioactive waste in accordance with Federal, State, and local regulations. Solid wastes are collected and stored onsite, then shipped offsite for disposal.

Sections 2.1.1 and 3.10.2 of Holtec's N&S Report (Holtec 2023-TN10538) provides a current review of waste management activities. Nonradioactive waste generated at Palisades are similar to those identified in the 2006 SEIS. However, there has been a reduction in generation of fluorescent light luminaires like fluorescent bulbs and ballasts being replaced with light-emitting diode lighting fixtures. Palisades has typically been classified as a small or very small quantity hazardous waste generator. However, in 2015, 2017, and 2019, Palisades has also been classified as large quantity hazardous waste generator due to occasional episodic events (MEGLE 2021-TN10753). The NRC staff expects that Holtec would continue to implement plans and procedures for management of its waste types including an asbestos abatement or human-made mineral fiber removal plan (HDI 2024-TN10670: RAI-WM-1).

Procedures, such SPCC-PIPP and the SWPPP are in place for nonradioactive waste management and for the minimization and management of liquid chemical spills. With respect to unplanned, nonradiological releases, the NRC staff's review of the annual nonradiological environmental operating reports over the period of 2018 through 2023 found one documented instance of a reportable chemical spill in September 2020, which is described in Section 3.11.2.1 of this EA. In the unlikely event of generation of a medical incident and generation of medical waste, the State of Michigan Medical Waste Regulatory Program provides procedures for managing medical waste, which would typically be handled by the supporting medical facility.

3.12.2 Environmental Impacts from the Preparations for the Resumption of Power Operations

Section 3.1.3 of this EA lists the planned activities in preparation of resumption of operations. Both radioactive and nonradioactive waste may be generated as a result of these activities.

As discussed in Section 3.4.1 of this EA, if sediments are removed from the mixing basin as a result of the sediment level evaluation, removal would be performed under the appropriate permits, and sediments would be tested for radioactivity and other contaminants prior to disposal offsite. Mixed waste production may result from the cleaning and removal of any residual contaminants that accumulate in the primary coolant system. Holtec maintains plans and procedures for management of radioactive and nonradioactive waste and plans to use existing processes for preparation of reauthorization activities resulting in waste generation (HDI 2024-TN10670: RAI-GEN-1, RAI-WM-1). Holtec estimated the total amount of radioactive wastes generated during refueling activities as part of the preparations for the resumption of power operations as 44,520 ft^3 (1,260 m^3) of Class A waste, 240 ft^3 (7 m^3) of Class B waste, and 1,770 ft^3 (50 m^3) of Class C waste (HDI 2024-TN10670: RAI-WM-1).

Based on information in the review of Holtec's N&S Report, (Holtec 2023-TN10538), Holtec's response to NRC's RAIs (HDI 2024-TN10670: RAI-WM-1), and public scoping (Appendix B to this EA), the NRC staff has determined the proposed Federal actions would not alter radiological or nonradiological waste management processes currently in place at Palisades. Therefore, the NRC staff determined that radioactive and nonradioactive waste management impacts related to the activities from the preparations for resumption of power operations would be NOT SIGNIFICANT.

3.12.3 Environmental Impacts from the Resumption of Power Operations

Hazardous waste generation is not expected to increase during resumption of power operations. As described in the N&S Report, Palisades is expected to continue as a small or very small hazardous waste generator upon renewed operations, but certain events such as cleaning of storage tanks may result in generation of large quantities of hazardous waste (Holtec 2023-TN10538).

The radiological and nonradiological waste management impacts of operation would be consistent with those described in the 2006 SEIS (NRC 2006-TN7346). Holtec has confirmed that waste generation rates would also be consistent with those analyzed in the 2006 SEIS (HDI 2024-TN10670: RAI-WM-1).

In addition, the NRC staff have determined that radioactive and nonradiological waste management impacts analyses in the 2024 LR GEIS are relevant to the proposed Federal actions, including the resumption of power operations at Palisades. The 2024 LR GEIS (NRC 2024-TN10161) describes the environmental effects of reactor operations on radiological and nonradiological waste management as a result of license renewal. As explained in the 2024 LR GEIS, continued reactor operations and refurbishment activities at nuclear power plants have had little or no environmental effect on waste management.

Based on the review of the N&S Report (Holtec 2023-TN10538) and Holtec's responses to NRC's RAIs/RCIs, the waste management affected environment at Palisades has not changed to any significant degree since the 2006 SEIS (NRC 2006-TN7346). Based on NRC staff's review of the N&S Report and conclusions of the 2006 SEIS and the 2024 LR GEIS, NRC staff concludes that radioactive and nonradioactive waste management impacts from the resumption of reactor power operations would be NOT SIGNIFICANT.

3.12.4 Cumulative Effects

Appendix G, Table G-1 of the EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental impacts of the proposed Federal actions. No significant design configuration or operational changes are expected to impact waste management as a result of the proposed Federal actions. The facility would return to the same operational state prior to decommissioning and would have the same level of impacts as concluded in the 2006 SEIS. The addition of SMRs, if pursued, would be required to meet the NRC regulatory requirements for safe handling and processing of generated waste. Additionally, the combination of all nuclear power plants on the site and within 50 mi (80 km) of Palisades would be required to meet the applicable 10 CFR Part 20 and Part 72 regulations for waste management. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to waste management when added to the effects of other past, present, and reasonably foreseeable actions would not have significant cumulative effects.

3.13 Uranium Fuel Cycle and Transportation

The NRC staff evaluated previous environmental documents and analyses with regard to uranium fuel cycle and the transportation of fuel and waste with the relevance to potential environmental effects of the proposed Federal actions at the Palisades site. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the 2024 LR GEIS (NRC 2024-TN10161: Section 4.14.1) based, in part, on the generic impacts

provided in 10 CFR 51.51(b), Table S-3, “Table of Uranium Fuel Cycle Environmental Data,” and in 10 CFR 51.52(c), Table S-4, “Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor.”

Portions of the following documents relevant to the subject area are incorporated by reference in support of the NRC staff’s uranium fuel cycle and transportation significance effects determination (see Table 1-2 of this EA):

- 2006 SEIS (NRC 2006-TN7346): Section 6, Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management
- 2023 N&S Report (Holtec 2023-TN10538): Section 4.11, Fuel Cycle
- 2024 LR GEIS (NRC 2024-TN10161): Section 4.14.1.1, Background on Uranium Fuel Cycle Facilities
- Holtec RAI Response (HDI 2024-TN10670): RAI-FC-1 (Description of fuel re-loading plans); RAI-TR-2 (Transportation data related to spent fuel shipments)
- Continued Storage GEIS (NRC 2014-TN4117): in its entirety
- Evaluation of Accident Tolerant Fuels (NRC 2024-TN10333) Sections: 2, Uranium Fuel Cycle; 3, Transportation

A brief summary of the material incorporated by reference along with the relevance to the current environmental review is provided in the discussion that follows.

3.13.1 Affected Environment

With respect to the uranium fuel cycle and transportation impacts, the affected environment is considered to be common to all nuclear power plants. Table S-3 of 10 CFR Part 51.51(b) and Table S-4 of 10 CFR Part 51.51(c) (TN10253) provide bounding estimates of the impacts of the uranium fuel cycle and transportation of fuel and waste to and from a reactor. NUREG-2266 (NRC 2024-TN10333) evaluated the impacts to the uranium fuel cycle for up to 10 weight percent (wt%) U-235 and transportation of fuel and waste for up to 8 wt% U-235 and burnup levels up to 80 gigawatt days (GW/d)/metric ton uranium (MTU). The analysis in NUREG-2266 demonstrates that 10 CFR Part 51 Tables S-3 and S-4 are still bounding. Although Holtec is not proposing to use accident tolerant fuels or increased enrichment or burnups as part of its requests related to resumption of operations, the staff relied on NUREG-2266 as it contains the latest analysis and also bounds Holtec's proposal. The information referenced in Holtec’s N&S Report (Holtec 2023-TN10538) and response to RAI-FC-1 (HDI 2024-TN10670) is consistent with the assumptions and descriptions found in Section 4.14.1.1 of the 2024 LR GEIS (NRC 2024-TN10161) and incorporated by reference in this EA.

3.13.2 Environmental Impacts from the Preparations for Resumption of Power Operations

Holtec indicates that the operations to load fuel into the reactor would be similar to a typical refueling outage. This is because Holtec plans to continue to use fuel currently onsite along with some new fuel assemblies. This would result in up to 72 new fuel assemblies being transported to Palisades (HDI 2024-TN10670: RAI-FC-1, RAI-TR-2). Impacts from the uranium fuel cycle were analyzed in the 2006 SEIS (NRC 2006-TN7346), the 2024 LR GEIS (NRC 2024-TN10161), and the Continued Storage GEIS (NRC 2014-TN4117). Based on information in the review of Holtec’s N&S Report (Holtec 2023-TN10538), Holtec’s responses to NRC’s RAIs/RCIs

(HDI 2024-TN10670: RAI-FC-1, RAI-TR-2), and public scoping (Appendix B to this EA), NRC staff have determined the proposed Federal actions would not alter impacts to the uranium fuel cycle and transportation at Palisades. Therefore, uranium fuel cycle and transportation impacts related to the activities from the preparations for resumption of power operations would be NOT SIGNIFICANT.

3.13.3 Environmental Impacts from the Resumption of Power Operations

The impacts to the uranium fuel cycle and subsequent transportation of fresh nuclear fuel and spent nuclear fuel (SNF) and radioactive waste during operation would be consistent with those described in the 2006 SEIS (NRC 2006-TN7346), the 2024 LR GEIS (NRC 2024-TN10161), and the Continued Storage GEIS (NRC 2014-TN4117), along with Evaluation of Accident Tolerant Fuels (NRC 2024-TN10333). These documents describe the impacts bounded by Table S-3 and Table S-4 of 10 CFR Part 51 and impacts of SNF at-reactor and away-from-reactor storage. The documents listed above demonstrate that continued reactor operations at nuclear power plants have had little or no environmental effects due to the uranium fuel cycle, SNF management, and transportation of fuel and waste. No additional nuclear plant-specific analysis is required unless any new and significant information is identified.

Based on the review of the N&S Report (Holtec 2023-TN10538) and Holtec's responses to NRC's RAIs/RCIs (HDI 2024-TN10670, HDI 2024-TN10669), the radioactive waste management affected environment at Palisades has not changed to any significant degree nor was new or significant information identified since the 2006 SEIS (NRC 2006-TN7346). Therefore, uranium fuel cycle and the transportation of fuel and waste impacts from the resumption of reactor power operations would also be NOT SIGNIFICANT.

3.13.4 Cumulative Effects

Appendix G, Table G-1 of EA identifies past, present, and reasonably foreseeable projects that could cumulatively contribute to the environmental impacts of the proposed Federal actions. No significant design configuration or operational changes are expected to impact these resource areas as a result of the proposed Federal actions. The facility would return to the same operational state prior to decommissioning and would have the same level of impacts. Fuel-cycle impacts would occur not only at Palisades but also at other locations in the United States. In addition to fuel-cycle impacts from the proposed SMRs, this cumulative analysis also considers fuel-cycle impacts from Palisades. The fuel-cycle impact of the proposed SMRs would be similar to that of Palisades. There is one other nuclear power plant within 50 mi of Palisades. The addition of SMRs, if pursued, would result in an increased impact, but would remain bounded by the impacts described in 10 CFR Part 51 Tables S-3 and S-4 (TN10253). For example, a number of fuel-management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and separative work (enrichment) requirements. The cumulative effects of reauthorization and subsequent operation are expected to be consistent with conditions described and analyzed in the 2006 SEIS for all nuclear power plants on the site and within 50 mi (80 km) of Palisades. Therefore, the NRC staff determined that the incremental effects of the proposed Federal actions related to uranium fuel cycle and transportation of nuclear fuel and radioactive waste when added to the effects of other past, present, and reasonably foreseeable actions would not have significant cumulative effects.

3.14 Postulated Accidents

The environmental impacts of design basis accidents and severe accidents are considered for all nuclear power plants, including Palisades. The effects of postulated accidents and consideration of severe accident mitigation alternatives (SAMAs) are discussed in Section 4.9.1.2 of the 2024 LR GEIS Volume 1 and in further detail in Appendix E in Volume 3 of the 2024 LR GEIS (NRC 2024-TN10161). A plant-specific analysis of the environmental impacts of postulated accidents, including consideration of SAMAs, was performed for Palisades in Appendix G of the 2006 SEIS (NRC 2006-TN7346). The descriptions in these sections of the 2024 LR GEIS and the 2006 SEIS are discussed below and incorporated by reference.

The impacts described in the 2024 LR GEIS summarize the estimated impacts of nuclear power plants within the United States and indicate the environmental impacts of design basis accidents (DBAs) and the environmental impacts from the probability-weighted consequences of severe accidents are generic issues with a SMALL environmental impact. Palisades previously considered SAMAs on a site-specific basis in the 2006 SEIS. The NRC staff reviewed Palisades current site-specific information and found no new information that would change either the generic SMALL impact determinations for DBAs and severe accidents in the 2024 LR GEIS or the determination of SMALL impacts for DBAs and severe accidents in the 2006 SEIS for Palisades (HDI 2024-TN10669: RCI-A-1). Holtec confirmed there would be no changes to the design basis which would require a reevaluation of the SAMA analysis (HDI 2024-TN10669: RCI-A-1). Additionally, the NRC has stated in Table B-1 of 10 CFR Part 51 (TN10253) Appendix B, that, so long as a previous SAMA analysis has been performed, SAMAs do not warrant further plant-specific analysis because the demonstrated reductions in population dose risk and continued severe accident regulatory improvements substantially reduce the likelihood of finding cost-effective significant plant improvements.

Palisades is included in the NRC staff's generic evaluation presented in the 2024 LR GEIS, where the impacts of postulated accidents were determined to be SMALL. Estimated population dose values for Palisades are provided in Table E.3-1 of the 2024 LR GEIS. The reported values from the 2006 Palisades SEIS SAMA analysis illustrate the large reduction of the estimated population dose values from those used in the 1996 LR GEIS (NRC 1996-TN288) that resulted in the SMALL impact determination for severe accidents made generically for all plants. Holtec confirmed to NRC staff during the environmental audit that the assumptions used by the NRC staff during the generation of values in Table E.3-1 of the 2024 LR GEIS Volume 3 remain valid. There was no new and significant information regarding the NRC staff's NEPA findings for design basis or severe accidents since the staff's previous environmental analysis of these accidents for Palisades in the 2024 LR GEIS (HDI 2024-TN10669: RCI-A-1).

Holtec confirmed that the 2024 LR GEIS generic findings for Severe Accidents and SAMAs will remain applicable to Palisades during resumption of power operations for the duration of the RFOL(HDI 2024-TN10669: RCI-A-1). The current updated model of record for internal event and internal flood risk for Palisades is 3.22×10^{-5}/yr, which is within the 2024 LR GEIS, Revision 2 Table E.3-2 SAMA CDF range of 3.9×10^{-6}/yr to 5.6×10^{-5}/yr for pressurized water reactors and is a reduction over values used at the time of Palisades license renewal (4.05×10^{-5}/yr). Both internal and external events were evaluated in the 2006 Palisades SEIS.

When identifying potential NEPA cost-beneficial mitigation alternatives, the most limiting PRA sequences are considered for reducing the risk. As provided in Table 5-3 **"**Palisades Core Damage Frequency for Internal Events" of the 2006 SEIS, the most significant initiating event was Loss of offsite power (including station blackout) with a CDF of 1.24×10^{-5} Per Year (31%

Contribution to Total internal events CDF). Also, risk estimates for both internal and external events are presented and discussed in Section G.2 of Appendix G of the 2006 SEIS. Potential SAMAs to further reduce external event risk were explored as part of the SAMA evaluation (see Sections G.2.2 and G.3.2 of the 2006 SEIS). As described in Section G.6.2, the risk associated with external events was specifically accounted for in the risk calculations that were used to support the decision regarding potentially cost-beneficial SAMAs at Palisades. Although the treatment of external events in the 2006 SEIS was limited by the unavailability an external event PRA, the NRC staff accounted for external event risk by increasing the estimated risk from internal events by a factor of 2 to account for risk from both internal and external events. Several candidate SAMAs related to seismic and fire events were considered using this conservative method which reduced the likelihood of omitting cost-beneficial enhancements or mitigation.

Furthermore, from the 2006 SEIS, the NRC evaluated the risk reduction of the eight remaining potentially cost-beneficial SAMAs that were applicable to Palisades. The SAMA evaluations were performed in a conservative fashion, where the proposed SAMA, if implemented, was assumed to completely eliminate the risk associated with the sequence. Such evaluations overestimate the benefit and therefore are conservative.

On September 9, 2019, the Mitigation of Beyond-Design-Basis Events (MBDBE) rule (10 CFR 50.155; TN249) became effective. This rule primarily addresses mitigation strategies for a wide range of potential extreme events, including seismic events, fire, flooding, and other natural phenomena, requiring nuclear power plants to have plans in place to maintain core cooling, containment integrity, and spent fuel pool cooling even when facing events beyond their design basis, including large-scale natural disasters. If the NRC's proposed actions are approved and the 10 CFR 50.82(a)(1) certifications are withdrawn, Palisades will again be required to comply with 10 CFR 50.155 (TN249).

As a result of the NRC's ongoing safety oversight and updates to NRC regulatory requirementsthe overall risk of a severe accident has been reduced. Because the NRC's regulations and safety oversight have provided additional severe accident mitigation and have further reduced the risk profile of operating reactors since the Palisades SAMA analysis in the 2006 SEIS, further SAMA analyses would be unlikely to find any cost-effective significant plant improvements, as discussed in the 2024 LR GEIS (NRC 2024-TN10161).

Based on information in the review of Holtec's N&S Report (Holtec 2023-TN10538), Holtec's response to the NRC's RCI (HDI 2024-TN10669: RCI-A-1), public scoping (Appendix B to this EA), and that the published impacts from postulated accidents are considered bounding, the NRC staff have determined the proposed Federal actions would not alter the previously determined impacts from design basis accidents and severe accidents, or the previous SAMA conclusions for Palisades in the 2024 LR GEIS (NRC 2024-TN10161); and therefore the environmental impacts of postulated accidents of the proposed Federal actions would be NOT SIGNIFICANT.

3.15 Decommissioning Impact Evaluation

This section describes the environmental impacts associated with the permanent cessation of power operations and the return to decommissioning of Palisades at a future date. All operating nuclear power plants will permanently cease power operations and be decommissioned at the end of their operating life when a decision is made to cease power operations.

As discussed in Section 1 of this EA, Palisades ceased operations and removed fuel from the reactor in 2022. Prior to cessation of power generation activities and removal of all fuel, Holtec submitted a PSDAR to NRC (Holtec 2020-TN10539), in accordance with 10 CFR 50.82(a)(4) (TN249), to outline the proposed decommissioning activities and describe potential associated environmental impacts. In the PSDAR submission, Holtec concluded that the environmental impacts associated with the planned Palisades site-specific decommissioning activities would be bounded by appropriate, previously issued environmental impact statements, including:

- Decommissioning GEIS (NRC 2002-TN7254)
- 2006 SEIS (NRC 2006-TN7346)
- 2013 LR GEIS (NRC 2013-TN2654)

The impacts of decommissioning nuclear power plants are evaluated in the Decommissioning GEIS. In the 2006 SEIS, the NRC staff concluded that there were no new and significant impacts beyond those discussed in the 1996 LR GEIS—in the 1996 LR GEIS, the NRC concluded that impacts of license renewal on terminating reactor operations and decommissioning were small for all nuclear plants. Since the 2006 SEIS, the impacts of license renewal on terminating reactor operations and decommissioning were considered to be small for all nuclear plants in the 2013 LR GEIS. Additionally, in the 2024 LR GEIS the NRC, after review, considered decommissioning impacts to be small (NRC 2024-TN10161) for all nuclear plants.

Sections 7.0 through 7.2 of the 2006 SEIS (NRC 2006-TN7346), incorporated by reference, evaluated the impacts of decommissioning with the license renewal term ending in 2031, for the Palisades RFOL (NRC 2007-TN11052). Under the current Federal actions the licensed term of operation would also end in 2031. Based on information in the review of Holtec's N&S Report (Holtec 2023-TN10538), the 2013 LR GEIS (NRC 2013-TN2654) and the 2024 LR GEIS (NRC 2024-TN10161), the NRC staff has determined the proposed Federal actions would not alter the previously determined impacts from decommissioning in the 2006 SEIS (NRC 2006-TN7346); and therefore the environmental impacts of decommissioning of the proposed Federal actions would be NOT SIGNIFICANT.

4 CONCLUSIONS

This EA describes the environmental review conducted by NRC and DOE LPO staff for evaluating the environmental effects of granting the licensing and regulatory requests necessary to reauthorize power operations at Palisades through March 24, 2031, which is the end of the current operating license term under the Palisades RFOL. DOE LPO acted as a cooperating agency on this review. Procedurally, this document follows 10 CFR 51.30, "Environmental Assessment" and 10 CFR 51.31, "Determinations Based on Environmental Assessment," which are the NRC's regulations for preparing EAs to implement NEPA requirements (National Environmental Policy Act of 1969-TN661). Within this section of the EA, the NRC staff presents conclusions and recommendations based on its environmental review. The section is organized as follows:

- Section 4.1 summarizes the environmental impacts of the proposed actions necessary to reauthorize power operations at Palisades.
- Section 4.2 compares the environmental impacts of the proposed Federal actions against reasonable alternatives identified by the NRC staff.

4.1 Environmental Impacts of the Proposed Federal Actions

The proposed set of Federal actions for the reauthorization of power operations at Palisades includes an exemption request, a license transfer request and several LARs (see Section 1.1.1, Table 1-1 of this EA). The purpose and need for these proposed Federal actions are to provide an option for clean energy baseload power generation through the current licensing term of March 24, 2031 (see Section 1.2 of this EA). Section 3 of this EA evaluates the environmental impacts from activities associated with the preparations for resumption of power operations, activities associated with the resumption of reactor power operations, and cumulative effects. The NRC staff evaluated environmental impacts associated with a return to decommissioning in Section 3.15 and for climate change and GHGs in Appendix F to the EA.

As indicated in Section 3, the NRC staff concludes that the potential impacts from both the preparations for and the resumption of power operations, and from the return to decommissioning at a future time at Palisades would be NOT SIGNIFICANT for each potentially affected environmental resource area. Additionally, there were no significant cumulative effects identified. The NRC staff based its conclusions on an independent review of information provided in Holtec's licensing submittals, as well as other relevant information and sources. Section 1.3.5 and Table 1-2 of this EA provide a summary of the most important sources for the review. Table 4-1 of this EA summarizes the environmental impacts and the NRC staff's conclusions for each resource considered.

Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant

Resource Area	EA Section	Summary of Impact	Significance Level
Land Use and Visual	3.2	The Palisades site remains 432 ac of industrial zoned property. No land use or visual resources would be significantly impacted as a result of the activities associated with the preparation for the resumption of reactor operations or reactor operations as there are no activities occurring which have the potential to significantly impact these resources.	NOT SIGNIFICANT
Meteorology and Air Quality	3.3	Air emissions of criteria pollutants would be below 100 TPY, and hazardous air pollutants would be below 10 TPY individually and 25 TPY combined. Emissions would comply with non-Title V permitting requirements. Standard control measures would mitigate fugitive dust releases. Minimal criteria pollutant emissions would occur during the preparations for the resumption of power operations.	NOT SIGNIFICANT
Surface Water	3.4	Palisades uses water from Lake Michigan and from the South Haven Municipal Water Authority. BMPs would be employed for soil erosion and sediment control. There is little expected water need for dust suppression. Stormwater, wastewater and treated water are regulated through NPDES permit no. MI0001457 and Storm Water Management Industrial Site Certification I-18257. Total water withdrawal from Lake Michigan is insignificant to the total volume of the lake itself, and since Palisades' water is treated and returned to Lake Michigan, there is no significant consumptive water use or impact on water quality. Potable and sanitary water use will be similar during the resumption of operations as with past operations at Palisades.	NOT SIGNIFICANT

Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant (Continued)

Resource Area	EA Section	Summary of Impact	Significance Level
Geologic Environment and Groundwater Resources	3.5	Preparations for resumption of power operations activities would occur only in previously disturbed areas on the Palisades site, reducing the impact to soil resources, as there are no known geologic resources in the vicinity of Palisades. Construction activities associated with the preparations for the resumption of operations will occur under State and Federal regulations and will be implemented using the "as low as reasonably achievable" program for individual radiation protection. Palisades monitors 29 groundwater wells that are sampled quarterly for gamma activity and tritium. Monitoring well data indicate that tritium releases have impacted onsite groundwater within the upper 10–15 ft of the aquifer. None of the surface water and drinking water samples collected as part of Palisades' radiological environmental monitoring program contained measurable radiological materials associated with the Palisades site. Site-specific programs (e.g., SPCC-PIPP, SWPP, NPDES) and BMPs are and will continue to be utilized at the site to manage and reduce the occurrence of inadvertent releases of nonradiological contaminants.	NOT SIGNIFICANT
Terrestrial and Aquatic Ecology	3.6 and 3.7	Preparations for resumption of power operations activities would occur only in previously disturbed areas on the Palisades site. These areas support only sparse or ruderal vegetation. The activities are unlikely to alter wildlife use on the site. Palisades is certified under the Coastal Zone Management Act and permits are required under Michigan's Critical Dune Act for any ground disturbance within designated critical dune areas. The NPDES permit no. MI0001457 regulates thermal discharge and chemical releases into Lake Michigan. The draft NPDES permit has determined the cooling-water intake structure meets best technology available for impingement and entrainment. Palisades uses BMPs during work activities (e.g., stormwater management, erosion, sediment control, and pesticide usage). Brief increases in noise during the preparations for resumption of power operations may affect wildlife, but area wildlife is already exposed to industrial noise. For federally listed terrestrial and aquatic species, activities associated with the preparations for the resumption of operations and the	NOT SIGNIFICANT

Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant (Continued)

Resource Area	EA Section	Summary of Impact	Significance Level
		resumption of operations will either have “no effect” on the species or “may affect, not likely to adversely affect” the species.	
Historic and Cultural Resources	3.8	Historic properties under the NHPA do not occur within the APE, and thus there will be no historic properties affected as part of the preparations for resumption of power operations, and the resumption of operations. Additionally, no historic and cultural resources have been identified within the APE. Ground disturbance will occur in areas of previous ground disturbance, and Palisades-specific procedures provide a control to monitor and protect cultural resources, if encountered on Palisades site during the resumption of power operations (and for activities occurring as part of the preparations for resumption of power operations).	NOT SIGNIFICANT
Socioeconomics	3.9	The number of workers at Palisades will peak at 1,600 during preparations for the resumption of operations (similar to the number of workers needed during refueling outages). Once operations resume, the number of workers will return to 600, similar to the number of workers at Palisades during previous operational periods. Holtec expects property tax payments to return to pre-decommissioning levels (approximately $10 million per year) starting in 2027. Any other socioeconomic impacts would be minimal.	NOT SIGNIFICANT
Environmental Justice	3.10	There would be no significant human health or environmental effects from the proposed Federal actions that would be disproportionately high and adversely affect environmental justice populations.	NOT SIGNIFICANT The proposed Federal actions would not have disproportionately high and adverse human health or environmental effects on environmental justice populations.
Radiological and Nonradiological Human Health	3.11	The NRC staff expect radiological releases, doses to the public, and occupational doses would be less than the limits established for protection of human health and the environment in 10 CFR Part 20 and Occupational Safety and Health Administration (OSHA) regulations. There will not be any significant increased exposure to the population or occupational	NOT SIGNIFICANT

Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant (Continued)

Resource Area	EA Section	Summary of Impact	Significance Level
		workers as part of the preparations for the resumption of operations and the resumption of operations. For nonradiological human health, Palisades maintains a safety program that addresses applicable OSHA standards that will be in place for preparations for resumption of power operations and resumption of power operations.	
Waste Management	3.12	Waste management is completed in accordance with facility plans and procedures and in accordance with Federal, State, and local regulations. Management of solid waste, including construction and demolition wastes, would involve waste reduction efforts, recycling, and BMPs. Liquid wastes would be discharged for municipal treatment at a wastewater treatment plant or trucked offsite for proper disposal. Gaseous emissions would comply with Michigan State regulations. Radioactive effluents would comply with 10 CFR Part 20 Appendix B.	NOT SIGNIFICANT
Uranium Fuel Cycle and Transportation	3.13	A low quantity of uranium would be used during the 7-year operational period (resumption of operations). Fuel processes are bounded by Table S-3 and S-4 of 10 CFR 51.51. Environmental impacts from storage of spent fuel would be less than the environmental impact described by the Continued Storage GEIS. The estimated volume of LLRW is less than or comparable to that of other reactors, and the NRC staff determined that there is adequate capacity for LLRW disposal. The on-site storage of spent fuel would have to meet the same regulatory requirements as currently licensed reactors and the currently stored spent fuel at Palisades. Transportation of fresh fuel to Palisades, and transportation of LLRW from Palisades, would be performed in compliance with DOT and NRC regulations and constitutes only a small percentage of the total materials of these types shipped each year.	NOT SIGNIFICANT
Postulated Accidents	3.14	NRC staff completed an independent review of the consequences of accidents which are documented in the 2024 LR GEIS. Review of Palisades-specific information in the 2024 LR GEIS, which is relevant for these proposed Federal actions, indicates that there is no new and significant information that would alter the staff's previous impact determinations	NOT SIGNIFICANT

Table 4-1 Summary of Environmental Impacts from the Preparations for Resumption of Power Operations and Resumption of Power Operations at Palisades Nuclear Plant (Continued)

Resource Area	EA Section	Summary of Impact	Significance Level
		for the probability-weighted consequences of severe accidents and design basis accidents, or the previous consideration of severe accident mitigation alternatives. Palisades is undergoing a separate NRC NRR safety review.	

APE = area of potential effect; BMP = best management practice(s); CFR = *Code of Federal Regulations*, DOT = U.S. Department of Transportation; EA = environmental assessment; GEIS = generic environmental impact statement; LLRW = low-level radioactive waste; LR = license renewal; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; NRR = Office of Nuclear Reactor Regulation; OSHA = Occupational Safety and Health Administration; TPY = ton(s) per year

4.2 Comparison of Alternatives

In Section 2.2 of this EA, the NRC staff considered possible alternatives to the proposed Federal actions to reauthorize power operations at Palisades. Only one alternative was carried forward for further analysis, the no-action alternative. The NRC staff independently reviewed information concerning other possible alternatives and determined that none were reasonable alternatives warranting further evaluation. As noted in Section 2.2.1.1 of this EA, taking no action would not meet the clean energy demand driving the purpose and need for the proposed Federal actions and could lead to a need to build new nuclear or non-nuclear power generation facilities. If Holtec were to select the no-action alternative and not build new generation facilities, any avoidance of environmental impacts resulting from not implementing the proposed action would be minimal, as indicated by the analysis of environmental impacts presented in Section 3. However, building new facilities would result in additional environmental impacts related to land disturbance and use of construction equipment. These impacts would be greater than those needed to put the already built Palisades facilities back into operation. Depending on the location or locations ultimately selected for the new facilities, the environmental impacts could potentially be SIGNIFICANT. In contrast, the potential environmental impacts from proposed Federal actions to resume operation of the existing Palisades reactor are known to be NOT SIGNIFICANT. The NRC staff has therefore determined that there are no environmentally preferrable alternatives to the proposed Federal actions.

5 DRAFT FINDING OF NO SIGNIFICANT IMPACT

The proposed Federal actions before the NRC are whether to grant requests for an exemption, a license transfer, and license amendments to support reauthorizing Palisades for power operations through the remainder of its licensing term (to March 24, 2031). The NRC staff has conducted an environmental review of these actions and prepared a draft EA. This draft FONSI incorporates by reference the draft EA in Sections 1 through 4 of this document. Based on preliminary determinations in the draft EA that the environmental impacts of the proposed actions would be NOT SIGNIFICANT for each potentially affected resource area, the NRC staff is issuing a draft determination that the proposed Federal actions would not significantly affect the quality of the human environment. Therefore, the NRC staff has made a draft determination that preparation of an EIS is not required for the proposed Federal actions and that a draft FONSI appears warranted.

This draft finding and the related environmental documents referenced throughout the EA are available for public review as discussed in the draft EA. The NRC's staff's determination is tentative. Before making a final determination, the NRC staff will consider comments received on the draft EA and draft FONSI over a 30-day public comment period from Federal, State, Tribal, and local officials, and members of the public. Once the NRC staff makes a final determination, the NRC will publish the final EA and final FONSI or proceed to prepare an environmental impact statement. At the conclusion of the NRC environmental review, DOE LPO would publish a separate Record of Decision or FONSI, as appropriate.

6 REFERENCES

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.” TN283.

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.” TN249.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” TN10253.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” TN250.

10 CFR Part 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste.” TN4884.

15 CFR Part 930. *Code of Federal Regulations*, Title 15, *Commerce and Foreign Trade*, Part 930, “Federal Consistency with Approved Coastal Management Programs.” TN4475.

29 CFR Part 1910. *Code of Federal Regulations*, Title 29, *Labor*, Part 1910, “Occupational Safety and Health Standards.” TN654.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.” TN513.

40 CFR Part 52. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 52, “Approval and Promulgation of Implementation Plans.” TN4498.

40 CFR Part 70. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 70, “State Operating Permit Programs.” TN5488.

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Air Programs*, Subchapter C, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.” TN7226.

40 CFR Part 125. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 125, “Criteria and Standards for the National Pollutant Discharge Elimination System.” TN254.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations.” TN739.

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87 FR 26152. May 3, 2022. “Endangered and Threatened Wildlife and Plants; Review of Species that are Candidates for Listing as Endangered or Threatened; Annual Notification of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions.” *Federal Register*, Fish and Wildlife Service. TN8591.

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APPENDIX A

LIST OF PREPARERS

Table A-1 List of Preparers

Name	Education and Experience	Function or Expertise
William Burris, NRC	MS, Environmental Management BA, Geology 32 years of relevant experience	Environmental Project Manager
Jennifer Davis, NRC	BA, Historic Preservation and Classical Civilization (Archaeology) 5 years of archaeological fieldwork; 22 years of experience in NEPA compliance, project management, cultural resources impact analysis, and National Historic Preservation Act Section 106 consultations	Historic and Cultural Resources
Peyton Doub, NRC	MS Plant Physiology BS Plant Sciences (Botany) Professional Wetland Scientist (PWS) Certified Environmental Professional (CEP) Duke NEPA Certificate 38 years of relevant experience	Alternatives, Terrestrial Resources, Aquatic Resources
Jerry Dozier, NRC	MS Reliability Engineering MBA Business Administration BS Mechanical Engineering 31 years of experience including operations, reliability engineering, technical reviews, and NRC branch management	Postulated Accidents
Brian Glowacki, NRC	BS Environmental Engineering 3 years of relevant experience	Meteorology and Air Quality, Climate Change, Surface Water Resources
Robert Hoffman, NRC	BS, Environmental Resource Management 35 years of experience in NEPA compliance, environmental impact assessment, alternatives identification and development, and energy facility siting	Alternatives
Caroline Hsu, NRC	BS Molecular Biology BA English Literature 13 years of government experience	Aquatic Resources
Donald Palmrose, NRC	PhD Nuclear Engineering MS Nuclear Engineering BS Nuclear Engineering 36 years of experience, including operations on U.S. Navy nuclear powered surface ships, technical and NEPA analyses, nuclear authorization basis support for U.S. Department of Energy (DOE), and NRC project management	Radiological Human Health, Radiological Waste, Postulated Accidents, Decommissioning
Mary Richmond, NRC	BA Biological Sciences MS Environmental Engineering 35 years of relevant experience	Environmental Project Manager

Table A-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Jeffrey Rikhoff, NRC	MRP Regional Environmental Planning MS Development Economics BA English 44 years of combined industry and government experience in NEPA compliance for DOE Defense Programs/NNSA and Nuclear Energy, DoD, and DOI; project management; socioeconomics and environmental justice impact analysis, historic and cultural resource impact assessments, consultation with American Indian Tribes, and comprehensive land use and development planning studies	Land Use and Visual Resources, Socioeconomics, Environmental Justice
Gerry Stirewalt, NRC	PhD Structural Geology Registered Professional Geologist (PG) Certified Engineering Geologist (CEG) 50+ years of experience including geologic site characterization for nuclear energy facilities and high-level nuclear waste disposal facilities, 3-D geospatial modeling of subsurface geology, tectonic faults, and contaminated groundwater plumes, environmental geology, and assessment of groundwater	Groundwater Resources and Geologic Environment
Rao Tammera, NRC	MS Chemical/Nuclear Engineering MS Environmental Engineering 50 years of relevant experience Working for consulting firm and for NRC	Nonradiological Human Health, Nonradiological Waste, Transportation
Laura Willingham, NRC	BS Environmental Sciences 18 years of relevant experience	Environmental Project Manager
Dave Anderson, PNNL	MS Forest Economics BS Forest Resources 32 years of experience in NEPA planning, national and regional economic impact modeling, socioeconomics, and environmental justice impact analysis	Socioeconomics, Environmental Justice
Teresa Carlon, PNNL	BS Information Technology 30 years of experience as SharePoint administrator, project coordinator, and databases	Reference Coordinator
Cyler Conrad, PNNL	PhD Anthropology (Archaeology) MA Anthropology (Archaeology) BA Anthropology 13 years of relevant experience Over 10 years of experience in archaeology, cultural resource management, National Historic Preservation Act Section 106, NEPA, and project management	Project Management, Land Use and Visual Resources, Historic and Cultural Resources

Table A-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Tracy Fuentes, PNNL	PhD Urban Design and Planning MS Plant Biology BS Botany Over 15 years of experience, including NEPA planning; environmental impact analysis, environmental resource monitoring, data analysis, and research	Terrestrial Resources
Saikat Ghosh, PNNL	PhD Chemical Engineering MS Environmental Engineering BE Environmental Engineering 15 years of relevant experience in air quality assessments, meteorological data analyses and dispersion modeling	Meteorology and Air Quality
Leah Hare, PNNL	MS Geographic Information Science BS Environmental Studies 12 years of experience in environmental monitoring, regulatory compliance, project management, and environmental assessment	Deputy Project Management, Nonradiological Human Health, Nonradiological Waste
Rebecka Iveson, PNNL	MS Hydrogeology and Water Resource Management BS Earth and Environmental Science 5+ years in groundwater resource assessment and environmental impact evaluation, contaminated land risk assessment and remediation, and natural resource management and monitoring	Groundwater Resources and Geologic Environment, Climate Change
Hayley McClendon, PNNL	BS Environmental Science 8 years of experience in environmental compliance and technical document preparation and review	Reference Coordinator
Ann Miracle, PNNL	PhD Molecular Immunology MS Molecular Genetics BA Biology Over 15 years of experience in ecological impact analysis, Endangered Species Act Section 7 consultations, and Essential Fish Habitat consultations	Aquatic Resources, Terrestrial Resources
Jon Napier, PNNL	PhD Radiation Health Physics MS Health Physics BS Environmental Science Certified Health Physicist with 9 years of experience in health physics, nuclear materials inspections and licensing, and radiation safety	Radiological Human Health, Radiological Waste, Transportation, Postulated Accidents, Decommissioning
Kendall Parker, PNNL	PhD Mechanical Engineering MS Mechanical Engineering BS Mechanical Engineering 3 years in human impact analysis of energy, electricity, and the environment	Environmental Justice

Table A-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Mike Parker, PNNL	BA English Literature 25 years of experience copyediting, document design, and formatting and 20 years of experience in technical editing	Production
Nati Phan, PNNL	BS Public Health MS Environmental Health 2 years of experience in environmental justice, GIS, and Justice40 projects	GIS Mapping
Rajiv Prasad, PNNL	PhD Civil and Environmental Engineering MTech Civil Engineering; BE Civil Engineering 28 years of experience in applying hydrologic principles to water-resources engineering, hydrologic design, flooding assessments, environmental engineering, and impacts assessment including 18 years of experience in NEPA environmental assessments of surface water resources	Surface Water Resources
Kacoli Sen, PNNL	PhD Cancer Biology MS Zoology (Specialization Ecology) BS Zoology Diploma in Environmental Law Over 6 years of document editing and production experience	Production Editor
Kazi Tamaddun, PNNL	PhD Civil and Environmental Engineering MSc Civil and Environmental Engineering BSc Civil Engineering 10 years of experience in hydro-climatology, hydraulics, Earth systems modeling, environmental systems engineering, and water-energy nexus; 3 years of experience in NEPA environmental assessments of surface water resources	Surface Water Resources, Climate Change
Seema Verma, PNNL	PhD Biological Sciences MS Biosciences BS Zoology Graduate Certificate in Regulatory Sciences 2.5 years of experience in navigating Federal agency regulations including Title 10 *Code of Federal Regulations*. Assessment of human health impacts from nonradiological contaminants and etiological agents for nuclear and renewable energy	Nonradiological Human Health, Nonradiological Waste
Caitlin Wessel, PNNL	PhD Marine Science MS Coastal, Marine, and Wetland Science 12 years of relevant experience in ecology, habitat modeling, chemical analysis, physical processes, and environmental assessments	Aquatic Resources, Federally Protected Species

Table A-1 List of Preparers (Continued)

Name	Education and Experience	Function or Expertise
Lin Zeng, PNNL	PhD Environmental Science and Engineering BE Civil Engineering Over 15 years relevant experience in socioeconomic/environmental modeling and analysis, including 10 years of experience in environmental compliance and NEPA environmental impact assessment	Socioeconomics

AM or MA = Master of Arts; BA = Bachelor of Arts; BS = Bachelor of Science; DoD = U.S. Department of Defense; DOE = U.S. Department of Energy; DOI = U.S. Department of Interior; CEG = Certified Engineering Geologist; EA = environmental assessment; GIS = Geographic Information System; MBA = Master of Business Administration; MRP = Master of Regional Planning; MS = Master of Science; NEPA = National Environmental Policy Act of 1969; NNSA = National Nuclear Security Administration; NRC = U.S. Nuclear Regulatory Commission; PG = Professional Geologist; PhD = Doctor of Philosophy; PNNL = Pacific Northwest National Laboratory.

APPENDIX B

COMMENTS RECEIVED THROUGH PUBLIC SCOPING

The U.S. Nuclear Regulatory Commission (NRC or Commission) staff began the scoping process for the environmental review of the Palisades Nuclear Plant (Palisades) in June 2024. On June 27, 2024, the NRC published a Notice of Intent in the *Federal Register* to conduct an environmental scoping process to gather information to prepare an environmental assessment to evaluate environmental impacts related to reauthorizing power operations at Palisades (89 FR 53659-TN10604). In its Notice of Intent, the NRC staff requested that members of the public and stakeholders submit comments on the scope of the Palisades environmental review to the Federal Rulemaking website at Regulations.gov, by email, or postal mail.

The Palisades scoping process also included a hybrid (virtual and in-person) public meeting that was held on July 11, 2024. To advertise this public meeting, the NRC issued press releases, posted on NRC social media and on the NRC public website, and purchased newspaper advertisements in the Herald-Palladium, Michigan Live-Kalamazoo, Michigan Live-Grand Rapids, Holland Sentinel, Detroit News, *Chicago Tribune*, and *Chicago Sun-Times*. In addition to the NRC staff, U.S. Department of Energy staff, local officials, and members of the public participated in the public meeting. After the NRC staff presented prepared statements on the reauthorization actions and National Environmental Policy Act process at the public meeting, the staff opened the meeting for public comments. Attendees made oral statements that were recorded and transcribed by a certified court reporter. A summary and a transcript of the public scoping meeting are available in the NRC's Agencywide Documents Access and Management System (ADAMS) under ADAMS Accession No. ML24221A033 (NRC 2024-TN10605). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html.

At the conclusion of the scoping period, the NRC staff issued the Palisades Scoping Summary Report (NRC 2024-TN10773). The report contains a summary of the comments received during the scoping period grouped by subject area and significant issues of concern that are in scope and considered as part of the environmental review.

B.1 References

89 FR 53659. June 27, 2024. "Holtec Decommissioning International, LLC, and Holtec Palisades, LLC; Palisades Nuclear Plant; Notice of Intent To Conduct Scoping Process and Prepare an Environmental Assessment." *Federal Register*, Nuclear Regulatory Commission. TN10604.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from L. Willingham, Project Manager, Environmental Project Management Branch 3, Division of Rulemaking, Environmental, and Financial Support, Office of Nuclear Material Safety and Safeguards, to D. Barnhurst, Branch Chief, Environmental Project Management Branch 3, Division of Rulemaking, Environmental, and Financial Support, Office of Nuclear Material Safety and Safeguards, dated August 12, 2024, regarding "Summary of Public Scoping Meeting Related to the Potential Reauthorization of Power Operations for the Palisades Nuclear Plant (EPID Number: L-2024-LNE-0003) (Docket Number: 50-0255)." Washington, D.C. ADAMS Accession Package No. ML24221A033. TN10605.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Scoping Process Summary Report Palisades Nuclear Plant*. Washington, D.C. ADAMS Accession No. ML24353A149. TN10773.

APPENDIX C

APPLICABLE LAWS, REGULATIONS AND OTHER REQUIREMENTS

Several Federal laws and regulations affect environmental protection, health, safety, compliance, and consultation at every U.S. Nuclear Regulatory Commission (NRC or Commission) licensed nuclear power plant. Some of them require permits by or consultation with other Federal agencies or State, Tribal, or local governments. Certain Federal environmental requirements have been delegated to State authorities for enforcement and implementation. Furthermore, States have also enacted laws to protect public health and safety and the environment. It is the NRC's policy to make sure that nuclear power plants are operated in a manner that provides adequate protection of public health and safety and protection of the environment through compliance with applicable Federal and State laws, regulations, and other requirements, as appropriate.

The Atomic Energy Act of 1954, as amended (42 *United States Code* [U.S.C.] 2011 et seq.-TN663), and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.-TN4466), give the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR). The Atomic Energy Act of 1954, as amended, also authorizes the NRC to enter into an agreement with any State that allows the State to assume regulatory authority for certain activities (see 42 U.S.C. 2021-TN10029). Michigan State has not yet entered into an agreement with the NRC to assume regulatory responsibility over certain byproduct, source, and quantities of special nuclear materials not sufficient to form a critical mass (NRC 2022-TN10754). Although Michigan is not an agreement State, the Michigan Department of Environment, Great Lakes, and Energy (Michigan EGLE) does maintain a network of environmental monitoring stations around each nuclear power plant site in the State. In addition, the Michigan EGLE maintains a Radiological Emergency Preparedness program to provide response capabilities to radiological accidents or emergencies at any of Michigan's commercial nuclear power plants (MEGLE 2024-TN10755).

In addition to carrying out some Federal programs, State legislatures develop their own laws. State statutes can supplement, as well as implement, Federal laws for the protection of their air, surface water, and groundwater resources. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The U.S. Environmental Protection Agency (EPA) has the primary responsibility to administer the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq., herein referred to as the Clean Water Act [CWA]-TN662). The National Pollutant Discharge Elimination System Program addresses water pollution by regulating the discharge of potential pollutants to waters of the United States. The EPA allows for primary enforcement and administration through State agencies if the State program is at least as stringent as the Federal program.

One important difference between Federal regulations and certain State regulations is the definition of waters regulated by the State. Certain State regulations may include underground waters, whereas the CWA only regulates surface waters. The Michigan EGLE Water Resources Division provides regulatory oversight for all public water supplies, issues permits to regulate the

discharge of industrial and municipal wastewaters—including discharges to groundwater, and monitors State water resources for water quality (MEGLE 2024-TN10756).

C.1 Federal and State Requirements

The Palisades Nuclear Plant (Palisades) is subject to various Federal and State requirements. As a convenient source of references of environmental requirements, Table C-1 below lists principal Federal and State approvals necessary for the resumption of power operations at Palisades.

Table C-1 Federal and State Requirements

Activity	Law/Regulation	Requirements
Current operating license	Atomic Energy Act, (42 U.S.C. 2011 et seq.)	The AEA, and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.), gives the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10, “Energy,” of the CFR.
Current operating license	Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001 et seq.) (also known as “SARA Title III”)	The EPCRA, which is an amendment to the CERCLA (42 U.S.C. 9601 et seq.), establishes the requirements for Federal, State, and local governments; Tribes; and industry regarding emergency planning and “Community Right-to-Know” reporting on hazardous and toxic chemicals. The “Community Right-to-Know” provisions increase the public’s knowledge of and access to information about chemicals at individual facilities, their uses, and releases into the environment. States and communities working with facilities can use the information to improve chemical safety and protect public health and the environment. The EPCRA requires emergency planning and notice to communities and government agencies concerning the presence and release of specific chemicals. The EPA implements the EPCRA under regulations found in 40 CFR Part 355, Part 370, and Part 372.
Current operating license	National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.)	NEPA requires Federal agencies to integrate environmental values into their process by considering the environmental impacts of proposed Federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. NEPA Section 102(2) contains action-forcing provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information.

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Current operating license	10 CFR Part 20	Regulations in 10 CFR Part 20, "Standards for Protection Against Radiation," establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. These regulations are issued under the AEA and the Energy Reorganization Act of 1974, as amended. The purpose of these regulations is to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this part.
Current operating license	10 CFR Part 50	Regulations in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," are NRC regulations issued under the AEA and Title II of the Energy Reorganization Act of 1974, as amended, to provide for the licensing of production and utilization facilities, including nuclear power reactors.
Current operating license	10 CFR Part 51	Regulations in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," contain the NRC's regulations that implement NEPA.
Air quality protection	Clean Air Act (42 U.S.C. 7401 et seq.)	The CAA is intended to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population. The CAA establishes requirements to ensure maintenance of air quality standards and authorizes individual States to manage permits. Section 118 of the CAA requires each Federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants to comply with all Federal, State, interstate, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the EPA to set National Ambient Air Quality Standards for criteria pollutants. The EPA has identified and set National Ambient Air Quality Standards for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires the establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated before permit approval to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each State and approved by the EPA. The CAA requires sources to meet standards and obtain permits to satisfy those standards. Nuclear power plants may be required to comply with the CAA

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
		Title V, Sections 501–507, for sources subject to new source performance standards or sources subject to national emission standards for hazardous air pollutants. The EPA regulates the emissions of air pollutants using 40 CFR Parts 50 to 99.
Air quality protection	Natural Resources and Environmental Protection, Act 451 of 1994, Section 5506(1)	After the established compliance date, any source required to obtain a Title V operating permit under Section 502(a) of the Clean Air Act may not operate unless it holds a valid permit issued by the department.
Air quality protection	Mich. Admin. Code R. 336.1211	Establishes that stationary sources meeting specific thresholds for hazardous air pollutants or regulated air contaminants, as defined by the Clean Air Act, must obtain and operate under a renewable operating permit (ROP).
Air quality protection	Natural Resources and Environmental Protection Act, Act 451 of 1994, Section 5508	Under Michigan law, sources or equipment regulated by Federal air toxics standards under Section 112 of the Clean Air Act are exempt from state requirements for best available control technology for toxics or hazardous air pollutants.
Air quality protection	Mich. Admin. Code R. 336.1818	Emission limitations for stationary internal combustion engines.
Nonradiological human health	Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.)	The Occupational Safety and Health Act establishes standards to enhance safe and healthy working conditions in places of employment throughout the United States. The Act is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. Employers who fail to comply with OSHA standards can be penalized by the Federal government. The Act allows States to develop and enforce OSHA standards if such programs have been approved by the U.S. Secretary of Labor.
Nonradiological human health	Noise Control Act of 1972 (42 U.S.C. 4901 et seq.)	The Noise Control Act delegates the responsibility of noise control to State and local governments. Commercial facilities are required to comply with Federal, State, inter-State, and local requirements regarding noise control. Section 4 of the Noise Control Act directs Federal agencies to carry out programs in their jurisdictions “to the fullest extent consistent with their authority” and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.
Water-resources protection	Clean Water Act, [33 U.S.C. 1251 et seq., and the NPDES (40 CFR Part 122)]	The CWA was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation’s water. The CWA requires all branches of the Federal government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, State, inter-State, and local requirements. As authorized by the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program requires all facilities that

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
		discharge pollutants from any point source into waters of the United States to obtain an NPDES permit. A nuclear power plant may also participate in the NPDES General Permit for Industrial Stormwater due to stormwater runoff from industrial or commercial facilities to waters of the United States. The EPA is authorized under the CWA to directly implement the NPDES program; however, the EPA has authorized many States to implement all or parts of the national program. Section 401 of the CWA requires that an applicant for a Federal license or permit to conduct any activity that may result in any discharge into navigable waters must provide the Federal licensing or permitting agency with a certification (or waiver) from the State or appropriate water pollution control agency in which the discharge originates or will originate. This water quality certification implies that discharges from the activity or project to be licensed or permitted will comply with all limitations necessary to meet established State water quality requirements (40 CFR Part 121). The U.S. Army Corps of Engineers is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320). Under Section 401 of the CWA, the EPA or a delegated State agency has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge to waters of the State, including wetlands.
Water-resources protection	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.)	Congress enacted the CZMA in 1972 to address the increasing pressures of over- development upon the Nation's coastal resources. The National Oceanic and Atmospheric Administration administers the CZMA. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary. To encourage States to participate, the CZMA makes Federal financial assistance available to any coastal State or territory, including those on the Great Lakes, as long as the State or territory is willing to develop and implement a comprehensive coastal management program.
Water-resources protection	Michigan Act 451, Public Acts of 1994 (as amended), Parts 31 and 41; Michigan Executive Orders 1991-31, 1995-4, and 1995-18	These Michigan laws and executive orders are related to implementation of the Clean Water Act requirements within the State.

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Water-resources protection	Michigan Administrative Code, R 323.1050 of the Part 4 Rules promulgated pursuant to Part 31 of Michigan Act 451, Public Acts of 1994 (as amended)	This rule specifies physical characteristics for surface waters of the state to protect designated use of the waters. Storm Water Management Industrial Site Certification is issued for proper management of the stormwater runoff and inspection program at industrial sites.
Water-resources protection	Safe Drinking Water Act of 1974 (42 U.S.C. 300(f) et seq.)	The SDWA was enacted to protect the quality of public water supplies and sources of drinking water and establishes minimum national standards for public water supply systems in the form of maximum contaminant levels for pollutants, including radionuclides. Other programs established by the SDWA include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control Program. In addition, the SDWA protects underground sources of drinking water from releases and spills of contaminants.
Water-resources protection	Rivers and Harbors Act of 1899, Section 10 (33 U.S.C. 401 et seq.)	The Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq.) requires USACE authorization in order to protect navigable waters during the development of harbors and other construction and excavation. Section 10 of the Act prohibits the unauthorized obstruction or alteration of any navigable water of the United States. That section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the USACE Chief of Engineers and authorized by the Secretary of the Army through the USACE. Activities requiring Section 10 permits include structures (e.g., piers, wharves, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States.
Water-resources protection	Wild and Scenic Rivers Act, (16 U.S.C. 1271 et seq.)	The Wild and Scenic Rivers Act created the National Wild and Scenic Rivers System that was established to protect the environmental values of free-flowing streams from degradation by impacting activities, including water-resources projects.
Waste management and pollution prevention	Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)	The Resource Conservation and Recovery Act requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006, “Authorized State Hazardous Waste Programs” (42 U.S.C. 6926), allows States to establish and administer these permit programs with EPA approval. EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated,

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
		stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.
Waste management and pollution prevention	Pollution Prevention Act (42 U.S.C. 13101 et seq.)	The Pollution Prevention Act establishes a national policy for waste management and pollution control that focuses first on source reduction, then on environmental issues, safe recycling, treatment, and disposal.
Waste management and pollution prevention	Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.)	The Nuclear Waste Policy Act provides for the research and development of repositories for the disposal of high-level radioactive waste, spent nuclear fuel, and low-level radioactive waste. Title I includes the provisions for the disposal and storage of high-level radioactive waste and spent nuclear fuel. Subtitle A of Title I delineates the requirements for site characterization and construction of the repository and the participation of States and other local governments in the selection process. Subtitles B, C, and D of Title I deal with the specific issues for interim storage, monitored retrievable storage, and low-level radioactive waste.
Waste management and pollution prevention	Low-Level Radioactive Waste Policy Act of 1980, as amended (42 U.S.C. 2021b et seq.)	The Low-Level Radioactive Waste Policy Act amended the AEA to improve the procedures for implementation of compacts that provide for the establishment and operation of regional low-level radioactive waste disposal facilities. It also allows Congress to grant consent for certain interstate compacts. The amended Act sets forth the responsibilities for disposal of low-level waste by States or inter-State compacts. The Act states the amount of waste that certain low-level waste recipients can receive over a set time period. The amount of low-level radioactive waste generated by both pressurized and boiling water reactor types is allocated over a transition period until a local waste facility becomes operational.
Waste management and pollution prevention	Hazardous Materials Transportation Act, as amended (49 U.S.C. 5101 et seq.)	The Hazardous Materials Transportation Act regulates the transportation of hazardous material (including radioactive material) in and between States. According to the Act, States may regulate the transport of hazardous material as long as their regulation is consistent with provisions of the Act or U.S. Department of Transportation regulations provided in 49 CFR Parts 171 through 177. Other regulations regarding packaging for transportation of radionuclides are contained in 49 CFR Part 173, Subpart I.
Waste management and pollution prevention	Toxic Substances Control Act (15 U.S.C. 2601 et seq)	The TSCA regulates the manufacture, processing, distribution, and use of certain chemicals not regulated by RCRA or other statutes, including asbestos-containing material and polychlorinated biphenyls. Any TSCA-regulated waste removed from structures (e.g., polychlorinated biphenyls-contaminated capacitors or asbestos) or discovered during the implementation phase (e.g., contaminated media) would be managed in compliance with TSCA requirements in 40 CFR Part 761.
Uranium Fuel Cycle	Environmental Standards for	These regulations establish maximum doses to the body or organs of members of the public because of normal

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
	Uranium Fuel Cycle (40 CFR Part 190, Subpart B)	operational releases from uranium fuel cycle activities, including uranium enrichment. These regulations were promulgated by the EPA under the authority of the AEA, as amended, and have been incorporated by reference in the NRC regulations in 10 CFR 20.1301(e).
Protected species	Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d et seq.)	The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts (including feathers), nests, or eggs. The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Regulations further define “disturb” as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.
Protected species	Endangered Species Act (16 U.S.C. 1531 et seq.)	The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7, “Interagency Cooperation,” of the Act requires Federal agencies to consult with the FWS or the NMFS on Federal actions that may affect listed species or designated critical habitats.
Protected species	Fish and Wildlife Coordination Act of 1934, as amended (16 U.S.C. 661–666e)	The Fish and Wildlife Coordination Act requires Federal agencies that construct, license, or permit water resource development projects to consult with the FWS (or NMFS, when applicable) and State wildlife resource agencies for any project that involves an impoundment of more than 10 ac, diversion, channel deepening, or other water body modification regarding the impacts of that action on fish and wildlife and any mitigative measures to reduce adverse impacts.
Protected species	Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136 et seq.)	The Federal Insecticide, Fungicide, and Rodenticide Act, as amended, by the Federal Environmental Pesticide Control Act and subsequent amendments, requires the registration of all new pesticides with the EPA before they are used in the United States.
Protected species	Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 et seq.)	The Fish and Wildlife Conservation Act provides Federal technical and financial assistance to States for the development of conservation plans and programs for nongame fish and wildlife. The Fish and Wildlife Conservation Act conservation plans identify significant problems that may adversely affect nongame fish and wildlife species and their habitats and appropriate conservation actions to protect the identified species. The Act also encourages Federal agencies to conserve and promote the conservation of nongame fish and wildlife and their habitats.
Protected species	Magnuson–Stevens Fishery Conservation and	The Magnuson–Stevens Fishery Conservation and Management Act governs marine fisheries management in Federal waters of the United States. The Act created eight

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
	Management Act, as amended by the Sustainable Fisheries 28 Act of 1996 (16 U.S.C. 1801 et seq.)	regional Fishery Management Councils and includes measures to rebuild overfished fisheries, protect essential fish habitat, and reduce bycatch. Under Section 305 of the Act, Federal agencies are required to consult with the NMFS for any Federal actions that may adversely affect essential fish habitat.
Protected species	Migratory Bird Treaty Act, (16 U.S.C. 703-712 et seq.)	The MBTA implements four international conservation treaties that the U.S. entered with Canada (1916), Mexico (1936), Japan (1972), and Russia (1976). The MBTA has been amended with the signing of each treaty, as well as when any of the treaties were subsequently amended. To ensure that populations of all protected migratory birds are sustained, the MBTA prohibits the take of protected migratory bird species without prior authorization from FWS. Under the MBTA, "take" includes killing, capturing, selling, trading, and transport of protected migratory bird species.
Protected species	National Marine Sanctuaries Act of 1966, as amended (16 U.S.C. 1431 et seq.)	The NMSA establishes provisions for the designation and protection of marine areas that have special national significance. The NMSA authorizes the Secretary of Commerce to designate national marine sanctuaries and establish the National Marine Sanctuary System. Pursuant to Section 304(d) of the NMSA, Federal agencies must consult with the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries when their proposed actions are likely to destroy, cause the loss of, or injure a sanctuary resource.
Protected species	Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq.)	The Marine Mammal Protection Act was enacted to protect and manage marine mammals and to prevent marine mammal populations from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The primary authority for implementing the Act belongs to the FWS and the NMFS. The FWS manages walruses, polar bears, sea otters, dugongs, marine otters, and the West Indian, Amazonian, and West African manatees. The NMFS manages whales, porpoises, seals, and sea lions. The two agencies may issue permits under Section 104 (16 U.S.C. 1374) to persons, including Federal agencies, that authorize the taking or importing of specific species of marine mammals. After the Secretary of the Interior or the Secretary of Commerce approves a State's program, the State can take responsibility for managing one or more marine mammals. The Act also established a Marine Mammal Commission whose duties include reviewing laws and international conventions related to marine mammals, studying the condition of these mammals, and recommending steps to Federal officials (e.g., listing a species as endangered) that should be taken to protect marine mammals. Federal agencies are directed by Section 205 (16 U.S.C. 1405) to cooperate with the Commission by permitting it to use their facilities or services.

Table C-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Protected Habitat	Sand Dunes Protection and Management (Part 353 of the Natural Resources and Environmental Protection Act)	To protect sand dunes along the shores of Lake Michigan and Lake Superior, Michigan designated approximately 74,000 ac of dunes as CDAs. Certain activities within CDAs require a permit from Michigan EGLE, including those that change dune contours, or propose new industrial or commercial uses. For shoreline activities within CDAs, applicants should submit a Michigan EGLE/USACE joint permit application.
Historic preservation and cultural resources	National Historic Preservation Act, 54 U.S.C. 300101 et seq.	The National Historic Preservation Act was enacted to create a national historic preservation program, including the National Register of Historic Places and the Advisory Council on Historic Preservation. Section 106 of the Act requires Federal agencies to consider the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800, "Protection of Historic Properties." The regulations call for public involvement in the Section 106 consultation process, including involvement from Indian Tribes and other interested members of the public, as applicable.

AEA = Atomic Energy Act; CAA = Clean Air Act; CDA = critical dune areas; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = *Code of Federal Regulations*; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; EPA = U.S. Environmental Protection Agency; ERA = Energy Reorganization Act; EPCRA = Emergency Planning and Community Right-to-Know Act; FWS = U.S. Fish and Wildlife Service; Michigan EGLE = Michigan Department of Environment, Great Lakes, and Energy; NAAQS = National Ambient Air Quality Standards; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NMSA = National Marine Sanctuaries Act; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; OSHA = Occupational Safety and Health Act; RCRA = Resource Conservation and Recovery Act; SDWA = Safe Drinking Water Act of 1974; TSCA = Toxic Substances Control Act; USACE = United States Army Corp of Engineers; U.S.C. = *United States Code*.

C.2 Operating Permits and Other Requirements

Table C-2 below lists the permits and licenses issued by Federal, State, and local authorities for activities at Palisades, as identified in the response to requests for additional information (HDI 2024-TN10670: RAI-GEN-3, RAI-AE-4).

Table C-2 Operating Permits and Other Requirements for Resumption of Activities at Palisades Nuclear Plant

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Renewed Facility Operating License	NRC	DPR-20	03/24/2031	Operation of Palisades[(a)]
NPDES permit	Michigan EGLE	MI0001457	10/01/2018 Under administrative extension	Discharge into water of the United States

Table C-2 Operating Permits and Other Requirements for Resumption of Activities at Palisades Nuclear Plant (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Certification of water quality standards	State of Michigan	n/a	n/a	Discharge into waters of the United States under the Michigan NPDES permit
Coastal Zone Management Act	State of Michigan	n/a	03/24/2031	Operations are consistent with Michigan coastal zone policies
Registration	U.S. DOT	051122600031EG	06/30/2025	Hazardous material shipment
License to ship radioactive material	TDEC	T-MI-003-L23	12/31/2024 Renewed annually	Shipment of radioactive material to a licensed disposal/ processing facility in Tennessee
Hazardous waste generator license	Michigan EGLE	MID098644685	n/a	Authorizes facility to operate as a hazardous waste generator
Storm Water Management Industrial Site Certification	Michigan EGLE	I-18257	07/01/2026	Management of the industrial sites storm water runoff and storm water inspection program
Renewable operating permit (air quality)	Michigan EGLE	MI-ROP-B2934-2019a	02/04/2024 Under timely renewal	Operation of air emission sources
Waste treatment plant operator certification	Michigan EGLE	W 7992 W 8468 W 8469 W 8470 W 8471	07/01/2025 07/01/2028 07/01/2028 07/01/2028 07/01/2028	Operate industrial or commercial waste treatment facility
Dredging permit	Michigan EGLE	WRP020704 v1.0	04/16/2025	Maintain dredging of sand along security infrastructure and stormwater outfall structures
Critical Dune Area Permit	Michigan EGLE	In review	In review	To conduct ground-disturbing activities in critical dune areas
Agreement	Texas LLRW Disposal Compact Commission	TLLRWDCC #2-0397-00/ #2-0398-00	08/31/2025 Renewed annually	Agreement for the importation of nonparty LLRW
Above ground storage tank registration	Bureau of Fire Service	Facility ID: 91084220	Registration and yearly fee. ASTs listed as registered with Michigan EGLE	Registration of three diesel ASTs
Scientific	Michigan DNR-	FSCP0107202213	12/31/2024	Authorization to survey,

Table C-2 Operating Permits and Other Requirements for Resumption of Activities at Palisades Nuclear Plant (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
collector's permit	Fisheries Division	0824	Renewed annually	handle, take, catch, kill and/or possess fish species not listed in Michigan as special concern, threatened, or endangered

AST = above ground storage tank; CCR = California Code of Regulations; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980; CFR = *Code of Federal Regulations*; CWA = Clean Water Act; DNR = Department of Fish and Wildlife; DOT = U.S. Department of Transportation; EPA = U.S. Environmental Protection Agency; LLRW = low-level radioactive waste; MBTA = Migratory Bird Treaty Act; Michigan EGLE = Michigan Department of Environmental, Great Lakes, and Energy; MPCA = Minnesota Pollution Control Agency; n/a = not applicable; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; Palisades = Palisades Nuclear Plant; SDWA = Safe Drinking Water Act; TDEC = Tennessee Department of Environment and Conservation; TSCA = Toxic Substances Control Act; U.S. = United States.

(a) Currently, the Renewed Facility Operating License at Palisades exists but only allows authorization for decommissioning and associated activities, not for power operations or fueling of the reactor.

C.3 References

42 U.S.C. § 2021. U.S. Code Title 42, Public Health and Welfare, Section 2021, "Cooperation with States." TN10029.

Atomic Energy Act of 1954. 42 U.S.C. § 2011 et seq. Public Law 112-239, as amended. TN663.

Energy Reorganization Act of 1974, as amended. 42 U.S.C. § 5801 et seq. TN4466.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 et seq. TN662.

HDI (Holtec Decommissioning International, LLC). 2024. Letter from J.A. Fleming, Vice President of Licensing and Regulatory Affairs, Holtec International, to NRC Document Control Desk, dated October 4, 2024, regarding "Response to Requests for Additional Information Regarding the Proposed Reauthorization of Power Operations of Palisades Nuclear Plant under Renewed Facility Operating License Number DPR-20." HDI PNP 2024-037, Covert, Michigan. ADAMS Accession No. ML24278A027. TN10670.

MEGLE (Michigan State Department of Environment, Great Lakes, and Energy). 2024. "Radiological Protection." Lansing, Michigan. Accessed September 19, 2024, at https://www.michigan.gov/egle/about/Organization/Materials-Management/radiological. TN10755.

MEGLE (Michigan State Department of Environment, Great Lakes, and Energy). 2024. "Water Resources Division." Lansing, Michigan. Accessed September 19, 2024, at https://www.michigan.gov/egle/about/organization/water-resources. TN10756.

NRC (U.S. Nuclear Regulatory Commission). 2022. "Michigan: Non-Agreement State Information." Washington, D.C. Accessed September 19, 2024, at https://www.nrc.gov/agreement-states/michigan.html. TN10754.

APPENDIX D

AGENCIES, ORGANIZATIONS, INDIAN TRIBES, AND INDIVIDUALS CONTACTED

The U.S. Nuclear Regulatory Commission (NRC or Commission) contacted Federal, State, Tribal, regional, and local agencies listed in Table D-1 below during the NRC staff's environmental review of the Palisades Nuclear Plant (Palisades) environmental assessment. This list excludes the U.S. Department of Energy, Loan Programs Office since they are a cooperating agency.

Table D-1 List of Agencies, Organizations, Indian Tribes, and Persons Contacted by NRC during the Environmental Review of the Draft Palisades Nuclear Plant Environmental Assessment

Name	Affiliation	Contact Information
Jaime Loichinger	Advisory Council on Historic Preservation	401 F Street NW, Suite 308, Washington, DC 20001
Chairman Robert Blanchard	Bad River Band of the Lake Superior Tribe of Chippewa Indians	P.O. Box 39, Odanah, Wisconsin 54861
President Whitney Gravelle	Bay Mills Indian Community	12140 West Lakeshore Drive, Brimley, Michigan 49715
Rev. Edward Pickney	Benton Harbor Community Water Council	275 Pipestone St, Benton Harbor, Michigan 49022
Lisa Cripps-Downey	Berrien Community Foundation	2900 S State St # 2E, St. Joseph, Michigan 49085
Chairwoman Catherine J. Chavers	Bois Forte Band (Nett Lake) of the Minnesota Chippewa Tribe	5344 Lakeshore Drive, Nett Lake, Minnesota 55772
Chairman Bruce Hamlin	Burt Lake Band	P.O. Box 206 3062 Indian Road, Brutus, Michigan 49716
Chairman Harlan Baker	Chippewa Cree Indians of the Rocky Boy's Reservation of Montana	96 Clinic Road, Box Elder, Montana 59521
Chairman John Barret	Citizen Potawatomi Nation	1601 South Gordon Cooper Drive, Shawnee, Oklahoma 74801
Alex Little	City of Benton Harbor	200 E Wall St, Benton Harbor, Michigan 49022
Mayor Annie Brown, Richie Garcia	City of South Haven	539 Phoenix Street, South Haven, Michigan 49090
Christina Frank	Cornerstone Alliance	80 W Main St, Benton Harbor, Michigan 49022
Daywi Cook	Covert Township	73943 Lake St, Covert, Michigan 49043
Chairman Kevin DuPuis Sr.	Fond du Lac Band of Lake Superior Chippewa Indians	1720 Big Lake Road, Cloquet, Minnesota 55720
Chairman James A. Crawford	Forest County Potawatomi	P.O. Box 340, Crandon, Wisconsin 54520

Table D-1 List of Agencies, Organizations, Indian Tribes, and Persons Contacted by NRC during the Environmental Review of the Draft Palisades Nuclear Plant Environmental Assessment (Continued)

Name	Affiliation	Contact Information
Nancy Ann Whaley	Geneva Township	63133 16th Avenue, Bangor Michigan 49013
Chairman Robert Deschampe	Grand Portage Band of Lake Superior Chippewa Indians	P.O. Box 428, Grand Portage, Minnesota 55605
Chairman Ron Yob	Grand River Bands of Ottawa Indians	P.O. Box 2937 1316 Front NW, Grand Rapids, Michigan 49504
Chairwoman Sandra Witherspoon	Grand Traverse Band of Ottawa and Chippewa Indians	2605 N. West Bay Shore Drive, Peshawbestown, Michigan 49682
Chairperson Kenneth Meshigaud	Hannahville Indian Community	N14911 Hannahville B1 Road, Wilson, Michigan 49896
President Doreen G. Blaker	Keweenaw Bay Indian Community, Lake Superior Band of Chippewa Indians	16429 Beartown Road, Baraga, Michigan 49908
Chairman Louis D. Taylor	Lac Courte Oreilles Band of Lake Superior Chippewa Indians	13394 W. Trepania Road Building #1, Hayward, Wisconsin 54843
President John D. Johnson	Lac du Flambeau Band of Lake Superior Chippewa Indians	P.O. Box 67, Lac du Flambeau, Wisconsin 54538
Chairman James Williams Jr.	Lac Vieux Desert Band of Lake Superior Chippewa Indians	N4698 U.S. HWY 45 P.O. Box 249, Watersmeet, Michigan 49969
Al Pscholka	Lake Michigan College	2755 E Napier Ave Benton Harbor, Michigan 49022
Chairperson Faron Jackson Sr.	Leech Lake Band of Ojibwe	190 Sailstar Drive NW, Cass Lake, Minnesota, 56633
Ogema Larry Romanelli	Little River Band of Ottawa Indians	2608 Government Center Drive, Manistee, Michigan 49660
Chairperson Regina Gasco	Little Traverse Bay Bands of Odawa Indians	7500 Odawa Circle, Harbor Springs, Michigan 49740
Chairperson Lisa Powers	Mackinac Bands of Chippewa and Ottawa Indians	P.O. Box 250, St. Ignace, Michigan 49781
Chairman Bob Peters	Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians (Gun Lake Tribe)	2872 Mission Drive Shelbyville, Michigan 49344
Chairwoman Gena Kakkak	Menominee Indian Tribe of Wisconsin	P.O. Box 910, Keshena, Wisconsin 54135
Chief Douglas G. Lankford	Miami Tribe of Oklahoma	P.O. Box 1326, Miami, Oklahoma 74355
Phillip Roos	Michigan Department of Environment, Great Lakes, and Energy	525 West Allegan Street P.O. Box 30473, Lansing, Michigan 48909
Jeremy Rubio	Michigan Department of Environment, Great Lakes, and Energy	7953 Adobe Road, Kalamazoo, Michigan 49009
Carin Speidel, Kristyn Vang	Michigan Department of Health and Human Services	333 S. Grand Ave P.O. Box 30195, Lansing, Michigan 48909

Table D-1 List of Agencies, Organizations, Indian Tribes, and Persons Contacted by NRC during the Environmental Review of the Draft Palisades Nuclear Plant Environmental Assessment (Continued)

Name	Affiliation	Contact Information
Sara Thompson, Randy Claramunt	Michigan Department of Natural Resources	P.O. Box 30446, Lansing, Michigan 48909
Quentin L. Messer Jr.	Michigan Economic Development Corporation	300 N. Washington Square, Lansing, Michigan 48913
Ryan Schumaker	Michigan State Historic Preservation Office	300 North Washington Square, Lansing, Michigan 48913
Nicholas Weil	Michigan State University, Remote Sensing & Geographic Information System Aerial Archive	1407 S. Harrison Road, East Lansing, Michigan 48823
Chairperson Melanie Benjamin	Mille Lacs Band of Ojibwe	43408 Oodena Drive, Onamia, Minnesota 56359
Andrew Robinson	Mosaic Christian Community Development Association	1804 M-139, Benton Harbor, Michigan 49022
Rebecca Held Knoche	National Oceanic and Atmospheric Administration	3725 Crane Road, Port Republic, Maryland 20676
Chairperson Dorrie Rios	Nottawaseppi Huron Band of Potawatomi Indians	1485 Mno-Bmadzewen Way, Fulton, Michigan 49052
Chief Kalisha Dixon	Ottawa Tribe of Oklahoma	P.O. Box 110, Miami, Oklahoma 74354
Chairperson Rebecca J. Richards	Pokagon Band of Potawatomi Indians	P.O. Box 180, Dowagiac, Michigan 49047
Chairman Joseph Rupnick	Prairie Band Potawatomi Nation	16281 Q Road, Mayetta, Kansas 66509
President Jordan D. Joaquin	Quechan Tribe of the Fort Yuma Indian Reservation	P.O. Box 1899, Yuma, Arizona 85366
Chairperson Nicole Boyd	Red Cliff Band of Lake Superior Chippewa Indians	88455 Pike Road, Bayfield, Wisconsin 54814
Chairperson Darrel Seki Sr.	Red Lake Band of Chippewa Indians	15484 Migizi Drive, Red Lake, Minnesota 56671
Chief Tim Davis	Saginaw Chippewa Indian Tribe of Michigan	7500 Soaring Eagle Boulevard, Mt. Pleasant, Michigan 48858
Chairperson Thomas Fowler	Saint Croix Chippewa Indians of Wisconsin	4663 Angeline Avenue, Webster, Wisconsin 54893
Chairperson Austin Lowes	Sault Sainte Marie Tribe of Chippewa Indians	523 Ashmun Street, Sault Ste. Marie, Michigan 49783
Chairperson Robert VanZile Jr.	Sokaogon Chippewa Community	3051 Sand Lake Road, Crandon, Wisconsin 54520
Angelica Gallegos	South Haven Rotary Club	06321 Blue Star Memorial Highway, South Haven, Michigan 49090
Kim L. Smith Oldham	Southwest Michigan Community Action Agency	185 E Main St, Benton Harbor, Michigan 49022
Arthur Havlicek	Southwest Michigan Regional Chamber	811 Ship St Ste 303 St. Joseph, Michigan 49085

Table D-1 List of Agencies, Organizations, Indian Tribes, and Persons Contacted by NRC during the Environmental Review of the Draft Palisades Nuclear Plant Environmental Assessment (Continued)

Name	Affiliation	Contact Information
Chairman Gerald Gould	Swan Creek Black River Confederated Ojibwa Tribes of Michigan	P.O. Box 2937 1220 Court Street, Saginaw, Michigan 48602
Chairperson Jamie Azure	Turtle Mountain Band of Chippewa Indians	4180 Highway 281, Belcourt, North Dakota 58316
Anna Murphy, Retta Curneal	United Way of Southwest Michigan	2015 Lakeview Ave., St. Joseph, Michigan 49085
Kathy Kowal, Alan Walts	U.S. Environmental Protection Agency, Region 5	77 West Jackson Blvd, Chicago, Illinois 60604
Scott Hicks	U.S. Department of the Interior, Fish and Wildlife Service	2651 Coolidge Road Suite 101, E. Lansing, Michigan 48823
George Friday	Van Buren/Cass District Health Department	260 South Street, Lawrence, Michigan 49054
Sandy Merchant	Van Buren County Historical Museum	58471 Red Arrow Highway, Hartford, Michigan 49057
Erika Morrison	We Care Community Resource Center	1301 M-43 Suite 2B South Haven, Michigan 49090
Chairperson Michael Fairbanks	White Earth Band of Minnesota Chippewa Tribe	35500 Eagle View Road, Ogema, Minnesota 56569

NRC = U.S. Nuclear Regulatory Commission.

APPENDIX E

CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC or Commission), Holtec Decommissioning International, LLC, and other correspondence related to the NRC staff's environmental review. All documents, with the exception of those containing proprietary information, have been placed in the NRC's Public Document Reading Room at One White Flint North, 11555 Rockville Pike (First Floor), Rockville, Maryland, and are electronically available from the NRC's Agencywide Document Access and Management System (ADAMS). The ADAMS accession numbers for each document are listed below. The docket number for Palisades is 05000255. Table E-1 below lists the environmental review correspondence, by date.

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades

Date	Originator	Correspondence	ADAMS Accession Number (ML)
02/01/2023	Holtec Decommissioning International, LLC	Letter described regulatory path to reauthorize power operations at the Palisades Nuclear Plant	ML23032A399
03/13/2023	Holtec Decommissioning International, LLC	Updated letter describing regulatory path to reauthorize power operations at the Palisades Nuclear Plant	ML23072A404
09/28/2023	Holtec Decommissioning International, LLC	Request for Exemption from Certain Termination of License Requirements of 10 CFR 50.82	ML23271A140
11/27/2023	U.S. Nuclear Regulatory Commission	Memorandum for the Palisades Restart Panel Charter	ML23297A053
12/06/2023	Holtec Decommissioning International, LLC	Application for Order Consenting to Transfer of Control of License and Conforming License Amendments	ML23340A161
12/14/2023	Holtec Decommissioning International, LLC	Request to Revise Operating License and Technical Specifications to Support Resumption of Power Operations	ML23348A148
12/15/2023	Representative Bill Huizenga et al.	Letter regarding the Federal loan funding application for Palisades	ML23349A164
02/05/2024	Chair Christopher T. Hanson, U.S. Nuclear Regulatory Commission	Letter responding to Representative Bill Huizenga et al.	ML24008A004
02/09/2024	Holtec Decommissioning International, LLC	Request to Revise the Administrative Technical Specifications to Support Resumption of Power Operations	ML24040A089

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
04/03/2024	Holtec International	Presentation on Palisades Construction Permit Application: Initial Environmental and Site Characterization for Small Modular Reactors	ML24086A582
04/18/2024	Holtec Decommissioning International, LLC	Notice of Intent to Pursue Subsequent License Renewal	ML24109A162
05/01/2024	Holtec Decommissioning International, LLC	Request to Reinstate the Palisades Emergency Plan to Support Resumption of Power Operations	ML24122C666
05/16/2024	U.S. Nuclear Regulatory Commission	Email to Federally Recognized Indian Tribes notifying of Activities Regarding the Palisades Restart	ML24141A086
06/21/2024	Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians	Response to U.S. Nuclear Regulatory Commission email Notifying of Activities Regarding the Palisades Restart	ML24214A066
05/20/2024	Michigan State Historic Preservation Office	Concurrence letter on U.S. Department of Energy's adoption of 2006 Supplemental Environmental Impact Statement for Palisades	ML24175A002
05/21/2024	U.S. Department of the Interior, Fish and Wildlife Service	List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project	ML24178A000
05/24/2024	Holtec Decommissioning International, LLC	Request to Update the Main Steam Line Break Analysis Methodology	ML24145A145
06/13/2024	U.S. Nuclear Regulatory Commission and U.S. Department of Energy	Memorandum of Understanding Between the U.S. Department of Energy, Loan Programs Office and the U.S. Nuclear Regulatory Commission on Nuclear Energy Projects Under Review by the U.S. Nuclear Regulatory Commission and Seeking Federal Financial Assistance from the Loan Programs Office	ML24172A001
06/24/2024	U.S. Nuclear Regulatory Commission	*Federal Register* Notice of Intent to conduct scoping	ML24149A002
06/26/2024	U.S. Department of Energy	Letter requesting cooperating agency status on Palisades	ML24219A429
06/27/2024	U.S. Nuclear Regulatory Commission	Letter with draft environmental regulatory audit plan and draft	ML24248A056

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
		request for information to Holtec Decommissioning International, LLC	
06/27/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to Holtec Decommissioning International, LLC	ML24155A026
06/28/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the U.S. Department of Interior, Fish and Wildlife Service	ML24163A147
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to Covert Township, Michigan	ML24151A640
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan Department of Environment, Great Lakes, and Energy	ML24152A013
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to Geneva Township, Michigan	ML24152A134
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan Department of Health and Human Services	ML24152A195
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the City of South Haven, Michigan	ML24152A197
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the City of South Haven Water Filtration Plant, Michigan	ML24152A199
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Van Buren/Cass District Health Department	ML24152A220
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an	ML24155A010

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
		environmental assessment to the Michigan Economic Development Corporation	
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the U.S. Environmental Protection Agency, Region 5 (Tribal and Multimedia Programs Office)	ML24155A033
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the U.S. Environmental Protection Agency, Region 5 (Environmental Justice, Community Health, and Environmental Review Division)	ML24156A022
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the National Oceanic and Atmospheric Administration	ML24163A055
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan Department of Environment, Great Lakes and Energy (Kalamazoo District Office)	ML24163A192
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan Department of Natural Resources (Wildlife Division)	ML24163A239
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan Department of Natural Resources (Fisheries Division)	ML24163A260
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Michigan State Historic Preservation Office	ML24163A083

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Advisory Council on Historic Preservation	ML24163A082
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Bad River Band of the Lake Superior Tribe of Chippewa Indians	ML24183A127
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Bay Mills Indian Community	ML24183A128
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Bois Forte Band (Nett Lake) of the Minnesota Chippewa Tribe	ML24183A129
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Chippewa Cree Indians of the Rocky Boy's Reservation of Montana	ML24183A130
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Citizen Potawatomi Nation	ML24183A131
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Fond du Lac Band of Lake Superior Chippewa	ML24183A132
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Forest County Potawatomi Community	ML24183A133
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Grand Portage Band of Lake Superior Chippewa	ML24183A134

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Grand Traverse Band of Ottawa and Chippewa Indians	ML24163A109
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Hannahville Indian Community	ML24183A135
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Keweenaw Bay Indian Community	ML24183A136
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Lac Courte Oreilles Band of Lake Superior Chippewa Indians	ML24183A137
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Lac du Flambeau Band of Lake Superior Chippewa Indians	ML24183A138
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Lac Vieux Desert Band of Lake Superior Chippewa Indians	ML24183A139
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Leech Lake Band of Ojibwe	ML24183A140
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Little River Band of Ottawa Indians	ML24183A141
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Little Traverse Bay Bands of Odawa Indians	ML24183A142
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Match-e-be-nash-she-wish Band of Pottawatomi Indians	ML24183A143
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an	ML24183A144

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
		environmental assessment to the Menominee Indian Tribe of Wisconsin	
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Miami Tribe of Oklahoma	ML24183A145
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Mille Lacs Band of Ojibwe	ML24183A146
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Nottawaseppi Huron Band of the Potawatomi	ML24183A147
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Ottawa Tribe of Oklahoma	ML24183A148
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Pokagon Band of Potawatomi Indians	ML24183A149
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Prairie Band Potawatomi Nation	ML24183A150
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Prairie Island Indian Community	ML24183A151
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Quechan Tribe of the Fort Yuma Indian Reservation	ML24183A153
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Red Cliff Band of Lake Superior Chippewa Indians	ML24183A154

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Red Lake Band of Chippewa Indians	ML24183A155
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Saginaw Chippewa Indian Tribe of Michigan	ML24183A156
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Saint Croix Chippewa Indians of Wisconsin	ML24183A157
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Sault Ste. Marie Tribe of Chippewa Indians	ML24183A158
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Sokaogon Chippewa Community	ML24183A159
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Turtle Mountain Band of Chippewa Indians	ML24183A160
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the White Earth Band of Minnesota Chippewa Tribe	ML24183A161
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Burt Lake Band	ML24183A124
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Swan Creek Black River Confederated Ojibwa Tribes of Michigan	ML24183A125

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Mackinac Bands of Chippewa and Ottawa Indians	ML24172A003
07/01/2024	U.S. Nuclear Regulatory Commission	Letter initiating the scoping process to prepare an environmental assessment to the Grand River Bands of Ottawa Indians	ML24183A126
09/04/2024	U.S. Nuclear Regulatory Commission	Email to Holtec Decommissioning International, LLC with the environmental audit draft request for confirmatory information	ML24248A261
09/12/2024	Holtec Decommissioning International, LLC	Email to the U.S. Nuclear Regulatory Commission responding to the request for confirmatory information	ML24260A354
09/18/2024	Michigan State Historic Preservation Office	Response letter on archaeological survey report for Palisades	ML24277A305
09/20/2024	U.S. Nuclear Regulatory Commission	Letter transmitting the request for additional information to Holtec Decommissioning International, LLC	ML24263A171
10/02/2024	U.S. Nuclear Regulatory Commission	Email providing a status update and opportunity to review cultural resource reports to Indian Tribes	ML24344A202
10/02/2024	Michigan State Historic Preservation Office	Response letter on architectural survey report for Palisades	ML24277A307
10/03/2024	Sokaogon Chippewa Community	Email providing consultation status to the U.S. Nuclear Regulatory Commission	ML24277A303
10/23/2024	Michigan State Historic Preservation Office	Response letter regarding Holtec Decommissioning International, LLC Environmental and Cultural Review Procedures	ML24305A143
10/31/2024	Quechan Tribe of the Fort Yuma Indian Reservation	Response letter on consultation for Palisades	ML24306A090
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to the Advisory Council on Historic Preservation	ML24292A007
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Michigan State Historic Preservation Officer	ML24292A026

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Bad River Band of the Lake Superior Tribe of Chippewa Indians	ML24309A049
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Bay Mills Indian Community	ML24309A182
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Bois Forte Band (Nett Lake) of the Minnesota Chippewa Tribe	ML24309A183
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Chippewa Cree Indians of the Rocky Boys Reservation of Montana	ML24309A184
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Citizen Potawatomi Nation	ML24309A185
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Forest County Potawatomi Community	ML24309A186
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Grand Portage Band of Lake Superior Chippewa	ML24309A187
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Grand Traverse Band of Ottawa and Chippewa Indians	ML24309A188
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Hannahville Indian Community	ML24309A189
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Lac Courte Oreilles Band of Lake Superior Chippewa	ML24309A190
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Lac du Flambeau Band of Lake Superior Chippewa Indians	ML24309A191
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Lac Vieux Desert Band of Lake Superior Chippewa Indians	ML24309A192
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Leech Lake Band of Ojibwe	ML24309A193

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Little River Band of Ottawa Indians	ML24309A195
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Little Traverse Bay Bands of Odawa Indians	ML24309A197
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Match-e-be-nash-she-wish Band of Pottawatomi Indians	ML24309A198
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Menominee Indian Tribe of Wisconsin	ML24309A199
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Miami Tribe of Oklahoma	ML24309A200
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Mille Lacs Band of Ojibwe	ML24309A201
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Nottawaseppi Huron Band of the Potawatomi	ML24309A202
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Ottawa Tribe of Oklahoma	ML24309A203
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Pokagon Band of Potawatomi Indians	ML24309A204
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Prairie Band Potawatomi Nation	ML24309A205
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Prairie Island Indian Community	ML24309A206
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Quechan Tribe of the Fort Yuma Indian Reservation	ML24309A207
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Red Cliff Band of Lake Superior Chippewa Indians	ML24309A208
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Red Lake Band of Chippewa Indians	ML24309A209
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Saginaw Chippewa Indian Tribe of Michigan	ML24309A210

Table E-1 Environmental Review Correspondence for the Resumption of Power Operations Activities at Palisades (Continued)

Date	Originator	Correspondence	ADAMS Accession Number (ML)
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Saint Croix Chippewa Indians of Wisconsin	ML24309A211
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Sault Ste. Marie Tribe of Chippewa Indians	ML24309A212
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Turtle Mountain Band of Chippewa Indians	ML24309A213
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to White Earth Band of Minnesota Chippewa Tribe	ML24309A214
11/04/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Fond du Lac Band of Lake Superior Chippewa	ML24313A146
11/05/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Burt Lake Band	ML24292A157
11/05/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Grand River Bands of Ottawa Indians	ML24310A013
11/05/2024	U.S. Nuclear Regulatory Commission	Letter for Palisades APE Notification to Mackinac Bands of Chippewa and Ottawa Indians	ML24310A014
11/06/2024	Michigan State Historic Preservation Office	Palisades Architectural Survey	ML24312A226
11/15/2024	Michigan State Department of Health and Human Services	Letter on Investigation of Cancer Incidences in Covert Township, Michigan	ML25006A210
12/10/2024	Michigan State Historic Preservation Office	Letter concurring with Palisades APE	ML24345A196

ADAMS = Agencywide Documents Access and Management System; APE = area of potential effect; CFR = *Code of Federal Regulations*; LLC = Limited Liability Company.

APPENDIX F

CLIMATE CHANGE AND GREENHOUSE GASES

F.1 Affected Environment

The U.S. Nuclear Regulatory Commission (NRC or Commission) has determined climate change may alter the affected environment described in Section 3 of this environmental assessment (EA) during the period of preparation for the resumption or power operations or resumption of power operations at the Palisades Nuclear Power Plant (Palisades) (the renewed operating license issued in 2007 expires in 2031). Climate change is a global phenomenon, and the activities associated with the continued operation of Palisades are not expected to appreciably alter these trends. However, climate change may create a new environment that could result in changed impacts from the ongoing operations or impose operational restrictions on the site's safety and performance. This section documents the NRC staff's assessment of the potential effects of climate change on its evaluation of the environmental impacts of the proposed continued operation of Palisades.

The interagency U.S. Global Change Research Program (USGCRP) was established under the Global Change Research Act of 1990 (P.L. 101-606)(15 U.S.C. § 2921 et seq. [Global Change Research Act of 1990-TN3330]) "to understand, assess, predict, and respond to human-induced and natural processes of global change." The USGCRP is the authoritative U.S. government source on likely climate change impacts in the United States. The NRC staff references the latest (i.e., fifth) National Climate Assessment report (NCA5) (USGCRP 2023-TN9762) and other supporting documents to provide the basis for assessing likely climate change impacts around the Palisades site.

Climate change projections in the latest USGCRP reports (i.e., NCA5) cover the period through 2100 and are generally expressed as a change expected for the mid-21st century (e.g., 2036–2065) or late 21st century (e.g., 2071−2099) relative to average conditions existing in the near-present (1991−2020). These projections are relevant to the evaluation of Palisades' continued operation, particularly as the plant proposes to operate until 2031.

The USGCRP's climate change impact reports include projections for various scenarios based on future emissions of heat-trapping gases. These scenarios include a "very high" emissions scenario (with continued increases in emissions throughout the 21st century), an "intermediate" scenario (with emissions increasing somewhat before decreasing midcentury), and a "low" scenario (with emissions rapidly decreasing and turning negative before the end of the century). Climate change projections described below are either for the very high scenario or the intermediate scenario, as applicable.

The NRC staff uses climate change projections for the mid-21st century (i.e., 2036–2065) as the bounding climate scenario for the time period covering the resumption of power operations at Palisades until the end of the current operating license (March 24, 2031). The assessment ensures the potential environmental impacts for all resource areas under a changing climatic regime are conservatively considered in the context of NRC's evaluation of Palisades' reauthorization to resume power operations.

F.2 Expected Climatological Changes

In southwest Michigan, where Palisades is located near Lake Michigan in Van Buren County, climate data indicate a warming trend. Observed changes in annual, winter, and summer average temperatures between 1901–1960 and 2002–2021 show increases of 1.5 to 2°F (0.8 to 1.1°C), more than 2°F (1.1°C), and 1 to 1.5°F (0.6 to 0.8°C), respectively. Over the more recent period from 1972 to 2021, annual average near-surface temperatures have risen by approximately 0.5 to 0.6°F (0.27 to 0.33°C) per decade. These temperature changes have implications for energy demand and infrastructure: under a very high emissions scenario, the annual electricity demand is projected to increase by 40–50 percent from 2020 to 2050, while rising air temperatures are expected to reduce summer transmission line capacity by 6 percent in the region.

As global temperatures continue to increase, each degree of warming brings greater temperature rise in many parts of the United States. As of the 2020s, global average temperatures have increased around 2°F (1.1°C) above pre-industrial (from 1851 to 1900) levels. Relative to the 1851-1900 baseline, under a very high emission scenario, a projected global temperature increase of 2.7°F (1.5°C), 3.6°F (2°C), 5.4°F (3°C), and 7.2°F (4°C) may increase the southwest Michigan local temperature by 3-4°F (1.7-2.2°C), 5-6°F (2.8-3.3°C), 7–8°F (3.9–4.4°C) and 9–11°F (5.0–6.1°C). With these rising temperatures, hot days (≥ 95°F) are expected to increase by 5-10 days annually, cold days (≤ 32°F) to decrease by 15–25 days, and warm nights (≥ 70°F) to increase by 5-15 days in southwest Michigan as global temperatures reach 2°C above pre-industrial levels.

Beyond atmospheric warming, Lake Michigan's summer surface water temperatures have also been rising. From 1980 to 2021, the July to September average surface temperature of Lake Michigan increased by about 0.1°F (0.05°C) per year (USGCRP 2023-TN9762), and further increases are anticipated. Other observed changes in the Great Lakes region include increased variability in lake levels, higher evaporation and water temperatures, more intense precipitation events (including lake-effect snow), and shorter durations of snow and ice cover.

Precipitation patterns in southwest Michigan are evolving as well, with annual precipitation projected to increase by up to 20 percent by midcentury compared to the past five decades under the highest warming scenarios. Extreme precipitation events are also expected to intensify, with the heaviest 1 percent of precipitation days, 5-year maximum daily precipitation, and annual maximum precipitation projected to rise by 10–30 percent, 10–20 percent, and 5–15 percent, respectively. This projected increase in precipitation, by 1 to 2 in. (2.5 to 5.1 cm) annually by midcentury (2036–2065) relative to 1991–2020, could lead to significant seasonal shifts in water availability. Winter runoff could increase by 15–20 percent, spring runoff by 5–10 percent, while summer runoff may decrease by around 5 percent, with fall runoff remaining steady or slightly increased. Annual actual evapotranspiration and runoff are also expected to rise, as outlined in Table F-1 below.

Table F-1 Projected Precipitation Change by Midcentury (2036–2065 relative to 1991–2020) Under an Intermediate Emissions Scenario (RCP4.5) in Southwest Michigan. Source: USGCRP 2023-TN9762.

Climate Variable	Projected Change (in.) by Midcentury
Annual Precipitation	1 to 2
Annual Actual Evapotranspiration	1 to 2
Maximum Annual Snow Water Equivalent	-0.2 to -1.0
Average Summer (June–August) Soil Moisture	-0.05 to -0.1
Annual Runoff	0.1 to 0.5
Annual Climatic Water Deficit	0.5 to 1

In addition to these precipitation changes, the region is expected to experience a reduction in maximum annual snow water equivalent and a decline in summer soil moisture (June–August). Lower summer moisture levels, combined with higher temperatures, could increase the risk of flash droughts during the summer, while elevated winter and spring runoff could heighten flooding risks. Current precipitation patterns show sub-annual variability, with rapid shifts between extreme wet and dry periods, which may further exacerbate these risks.

Finally, the projected annual climatic water deficit, which measures the gap between available water and vegetation demand, is expected to rise by 0.5 to 1 in. (1.3 to 2.4 cm) by midcentury relative to 1991–2020. This suggests that, although winter and spring flooding may pose significant challenges, drier summer conditions are likely to persist, potentially affecting water availability in the region.

F.3 Environmental Consequences of Preparation to Resumption of Power Operations and the Resumption of Power Operations

The potential effects of climate change were considered for all resources areas using the assessment methodology described in NUREG-2226 (NRC 2019-TN6136: Appendix L). Starting from the table (NRC 2018-TN5405) that identifies plausible connections between nuclear power station resource area concerns and likely climate change-caused alterations to the existing environment, the NRC staff generated a resource table specific to the Palisades region by removing irrelevant USGCRP climate impacts and NRC resource area issues from the master table. For example, climate impacts related to sea level rise were removed because of the site's inland location. The NRC staff used the site-specific resource table (PNNL 2024-TN10878) to assess whether the potential effects of climate change would alter the environmental impacts of the proposed action described in Section 3 of this EA.

The NRC staff concluded the expected impact determinations (not significant) assigned in Section 3 of this EA would not be altered by the projected effects of climate change. The NRC staff provides the following resource-specific justifications.

Land Use and Visual Impacts

Projected climatological changes are not expected to impact land use or visual resources at Palisades. Changes in temperature and humidity could slightly alter the visual appearance or frequency of vapor plumes from the cooling towers, but the staff does not expect that those changes would be noticeable because vapor plumes from operation are an occasional occurrence under certain atmospheric conditions and winds off the lake can dissipate plumes

close to the ground. Other visual impacts of operating the plant, would not substantially be affected by climate change. The site's industrial zoning remains appropriate, with no reclassification needed, even as regional ecological plans evolve to address climate changes. Access to land and water resources, including Lake Michigan, will remain stable, with only minor access restrictions possible if lake levels fluctuate. Overall, land use and zoning designations at Palisades are expected to remain consistent, with no major construction anticipated due to climate-related factors. The NRC staff expects that climate change would not alter conclusions made in this EA.

Meteorology and Air Quality

Climatological changes may have a minor impact on air quality and meteorology during the resumption of power operations. Projected increases in temperature, humidity, and lake surface water temperature could lead to a small increase in the aerosol concentrations within the cooling tower plume; however, this impact is expected to be minor as the substantial majority of aerosol concentrations in the plume are directly attributable to plant operations and are not significantly influenced by environmental conditions. Similarly, air quality impacts may see a slight increase in ground level ozone levels but are not significant enough to change the overall impact assessment as the precursor emissions attributable to Palisades are minimal. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Water Resources

Midcentury climatological changes, including increased winter and spring runoff and warmer Lake Michigan surface temperatures, may slightly alter surface runoff and infiltration patterns in southwest Michigan. However, these changes will be managed under applicable State and Federal water quality standards, such as the National Pollutant Discharge Elimination System permit, with best management practices in place. Although variability in Lake Michigan water levels and ice cover may occur, the volume of effluent discharges from Palisades will remain minimal compared to the lake's capacity, resulting in no significant impact on water quality or ice cover. Water use by Palisades is projected to remain minor relative to Lake Michigan's total availability, with no substantial effect on regional water resources or other users. Climate change is not expected to have a significant change in the consumptive water use for the cooling towers because evaporation from the cooling towers might increase under a warming climate but would not be distinguishable from an inter- and intra-annual variability in current evaporation amounts. Climate change would have a minor impact on the volume of intake water because the warming experienced at the depth of the intake structure, 35 feet below, would be negligible especially when compared to the heat load removed by plant systems. Thus, despite probable shifts in hydrology due to climate projections, Palisades resumption of power operations are required to comply with environmental regulations, resulting in minimal impact on water quality and availability. The NRC staff expects that climate change would not alter conclusions made in this EA.

Ecological Resources

Projected increases in temperature and precipitation are not expected to substantially alter how Palisades affects the terrestrial habitats on the site and surrounding landscape. Climate changes could potentially alter the hydrology of wetlands in the area, including potentially suitable habitat for the eastern Massasauga and several State-listed species, but the Palisades facilities would not substantially influence these changes. The vegetational composition of natural upland habitats in the region could also change, potentially affecting wildlife, but the

presence of the Palisades facilities would not influence those changes. Increased precipitation could eventually allow more mesic vegetation and invasive plants to establish in the specialized open dune habitat presently suitable for Pitcher's thistle, but the Palisades facilities would not alter the dynamics of that change. If climate changes alter the water elevation in Lake Michigan, the width and littoral dynamics of the beaches in the region could change, affecting habitat for the rufa red knot and piping plover. However, the presence of the Palisades facilities would only influence the directly adjoining beaches, which have already been too heavily disturbed by armoring to provide suitable habitat for these species.

Projected increases in temperature and precipitation are not expected to significantly impact Palisades' effect on the aquatic ecology of Lake Michigan. The plant's influence extends to less than 0.0006 percent of the Lake, and potential changes in water levels or minor temperature increases have not historically resulted in notable ecological impacts. While a slight warming of Lake Michigan may affect biodiversity and food web dynamics, the localized discharges from Palisades, which affect a small area, are unlikely to cause noticeable changes to the broader aquatic ecosystem. Additionally, because the volume of water moving through the screen would not noticeably increase, any increases in impingement and entrainment would not be noticeable. Climatological changes may benefit invasive species more tolerant of warmer temperatures, but Palisades' limited area of influence is not expected to significantly alter the presence of such species. Enhanced coordination for aquatic resource protection may be needed, but the overall impact on aquatic ecology remains minimal. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Historic and Cultural

While rising temperatures and increased runoff during spring and winter could potentially expose additional historical and cultural resources at the Palisades site, no impacts from climatological changes are expected on currently identified resources. There are no historic properties or other historic and cultural resources identified within the area of potential effects. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Socioeconomics

The resumption of operations at Palisades is not expected to have a significant impact on local socioeconomic factors, including housing, public schools, recreational resources, emergency services, or transportation infrastructure. Although southwest Michigan may face increased rainfall and flood risks midcentury, potentially challenging transportation resilience, the plant's operations are not anticipated to affect these infrastructure systems. Impacts on employment, income, output, and tax revenue are projected to remain stable, with no additional climate change mitigation measures required. Therefore, anticipated climatological changes are unlikely to alter the established socioeconomic impacts for Palisades. The NRC staff expects that climate change would not alter conclusions made in this EA.

Environmental Justice

The EJ analysis for the Palisades site found no significant subsistence behaviors, cultural practices, or resource dependencies within the EJ affected environment. Although combined stressors from pollution, climate change, and the resumption of power operations could potentially exacerbate health disparities, the assessment projects these effects as not

disproportionately high and adverse. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Human Health, Waste Management, Transportation and Accidents

Projected midcentury climate changes could influence the prevalence of etiological agents and occupational health risks; however, existing worker protection regulations are expected to remain effective or adapt as necessary. Climate change is not anticipated to alter operational noise levels at Palisades, so noise-related impacts should remain unchanged. While potential impacts from electromagnetic fields are uncertain, regulatory measures are expected to adjust to maintain occupational and public safety. Overall, nonradiological health impacts, including noise, etiological agents, and occupational risks, are projected to remain minimal. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Climatological changes are not expected to impact radiological exposure levels or doses for humans or non-human biota at Palisades. Ongoing compliance with radiological regulations will ensure the safety of workers, the public, and the environment through established monitoring protocols and exposure limits. Consequently, the radiation health impacts outlined in this environmental assessment are anticipated to remain unchanged. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Projected climatological changes are not anticipated to affect nonradiological health, nonradiological waste, transportation of radioactive materials, or the likelihood of accidents at Palisades. Noise, etiological agents, and occupational injury risks will continue to be regulated to ensure the protection of human health, while compliance with applicable Federal, State, and local requirements will govern nonradioactive and mixed waste management. The transportation of radioactive materials will remain mitigated through adherence to U.S. Department of Transportation regulations. Therefore, the NRC staff expects that climate change would not alter conclusions made in this EA.

Furthermore, Palisades' engineered safety features reduce the likelihood and mitigate the consequences of hypothetical accidents, as required by NRC safety regulations. As stated in the 2024 LR GEIS (2024 LR GEIS – ref):

> Adaptation of nuclear power plants to climate change is addressed through the NRC's existing regulations. NRC regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform safety functions. Furthermore, nuclear power plants are required to operate within technical specifications in accordance with their NRC-issued operating license, which includes specifications for coping with natural phenomena hazards. Any change in technical specifications would require the NRC to conduct a review before allowing licensees to make operational changes because of changing environmental conditions.
>
> Additionally, the NRC continually evaluates nuclear power plant operating conditions and physical infrastructure through its reactor oversight program to ensure ongoing safe operations… If climate change happens more quickly or changes more substantially than what is currently forecasted, the NRC will evaluate the new information to determine whether any safety-related changes are needed at existing nuclear power plants.

F.4 Greenhouse Gases

As described in the 2024 LR GEIS, gases found in the Earth's atmosphere that trap heat and play a role in the Earth's climate are collectively termed greenhouse gases (GHGs). These GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), water vapor (H2O), and fluorinated gases, such as hydrofluorocarbons (HCFs), perfluorocarbons, and sulfur hexafluoride. Operations at nuclear power plants release GHGs from stationary combustion sources (e.g., diesel generators, pumps, diesel engines, boilers), refrigeration systems, electrical transmission and distribution systems, and mobile sources (worker vehicles and delivery vehicles). However, the GHG emissions from nuclear power plants are typically very minor because such plants do not normally combust fossil fuels to generate electricity.

The NRC staff estimated the life-cycle greenhouse gas (GHG) emissions of various activities associated with the preparations for resumption of power operations, resumption of power operations, and return to decommissioning for Palisades. The GHG emission estimates include direct emissions from the nuclear facility and indirect emissions from workforce and fuel transportation, decommissioning, and the uranium fuel cycle. The NRC staff estimated these emissions for the Palisades site using best available data from various sources.

Emissions from truck deliveries and workforce traffic were considered as described in Section 3.3.1 for the preparations for resumption of power operations. Carbon dioxide (CO_2) emissions from supplier trucks was estimated with 3,000 truck deliveries over 18 months related to preparations for the resumption of power operations (HDI 2024-TN10670: RAI-GEN-1). An equivalency factor of 0.991 for CO_2 to total GHG is used to account for the emissions from other GHGs including methane and nitrous oxide (Chapman et al. 2012-TN2644: combined license (COL)/ESP-ISG-026 Appendix A; NRC 2014-TN3768).

During the resumption of operations, CO_2, and a small quantity of methane and N_2O will be emitted from natural gas boilers and diesel equipment as discussed for criteria pollutants. The applicant calculated these emissions for operations using standard emission factors like other pollutants (HDI 2024-TN10670: RAI-MET-6). The GHG emissions for workforce traffic during 40 years of operations have been provided for a 1,000 MW reactor in COL/ESP-ISG-026, Appendix A (NRC 2014-TN3768). These estimates were scaled down for 7 years of operation and 800 MWe power output. Similarly, these emissions were scaled down for the projected 18-month preparations duration.

Section 3.12.1 of the 2024 LR GEIS discusses other sources of GHG emissions from nuclear power plants, including sulfur hexafluoride used in electric power transmission and distribution applications (substations, circuit breakers, and other switchgear). Fluorinated gas emissions from refrigerant sources and from electrical transmission and distribution systems can result from leakage, servicing, repair, or disposal of sources. While the NRC staff does not have specific information for Palisades, NRC staff conservatively estimates that these gases are present in the transmission systems at Palisades as these gases are commonly used in transmission systems. However, even if present, they would not be significant contributors to total GHGs for Palisades. This is based on the NRC's analysis presented in Section 4.12.1 of the LR GEIS that shows that the quantified GHG emissions from nuclear power plant operations, when compared to annual State-level GHG emissions, or annual county-level GHG emissions, or replacement power alternatives, are orders of magnitude lower across all nuclear power plant sites presented in Table 3.12-2. Additionally, the 2024 LR GEIS found that the environmental impacts would be the same or similar at all nuclear plant sites, and that the

impacts of GHG emissions on climate change from continued operations and refurbishment during the initial LR and SLR terms and any refurbishment activities would be SMALL.

The indirect GHG emissions from uranium fuel cycle is also provided in COL/ESP-ISG-026 Appendix A that accounts for fossil fuel combustion for centrifuge enrichment and process heat. These emissions were also scaled down for 7 years of operations and 800 MWe for the Palisades unit.

Decommissioning activities include SAFSTOR workforce for a period of 40 years and demolition activities for 10 years that include emissions from fossil fuel fired equipment and workforce. Staff included an estimate of Greenhouse Gas Emissions from decommissioning because the potential approval of the Federal actions would delay the impacts of decommissioning by up to 7 years. The decommissioning emissions for 1,000 MW power plant in COL/ESP-ISG-026 was scaled to the 800 MWe capacity of Palisades.

Table F-2 below provides the emissions estimates for each of these activities. The estimated emissions of the proposed actions are 1,444,739 MT CO_2(eq)—this includes emissions from preparation activities and resumption of operations. The total life-cycle emissions (which also include decommissioning) were estimated to be about 1,474,000 MT CO_2(eq).

Table F-2 Nuclear Power Plant Life-Cycle Greenhouse Gas Emissions Estimates for Preparation Activities at Palisades Nuclear Plant (18 months), Operations (7 years) and Decommissioning

Phase	Activities	GHG Emissions (CO_2[eq]) MT
Preparation Activities	Truck Deliveries	4,199
Preparation Activities	Preparation Workforce	7,371
Operational Phase	Plant Operations	129
Operational Phase	Uranium Fuel Cycle	1,414,000
Operational Phase	Operations Workforce	19,040
Decommissioning Phase	SAFSTOR Workforce	8,000
Decommissioning Phase	Decommissioning Equipment	15,200
Decommissioning Phase	Decommissioning Workforce	6,400
Total		**1,474,339**

CO_2eq = carbon dioxide equivalent; GHG = greenhouse gas; MT = metric ton(s).

F.5 Conclusions

The NRC staff concludes that the potential effects of climate change would not alter the impact determinations in this EA for the preparation for the resumption of power operations and for the resumption of power operations at Palisades.

F.6 References

Global Change Research Act of 1990. 15 U.S.C. § 2921 et seq. TN3330.

NRC (U.S Nuclear Regulatory Commission). 2018. “Climate Change Master Table.” Washington, D.C. ADAMS Accession No. ML18022A104. TN5405.

NRC (U.S. Nuclear Regulatory Commission). 2019. *Environmental Impact Statement for an Early Site Permit (ESP) at the Clinch River Nuclear Site*. NUREG-2226, Washington, D.C. ADAMS Package Accession No. ML19087A266. TN6136.

USGCRP (U.S. Global Change Research Program). 2023. *The Fifth National Climate Assessment*. A.R. Crimmins, C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. Washington, D.C. Available at https://doi.org/10.7930/NCA5.2023. TN9762.

APPENDIX G

PROJECTS CONSIDERED IN CUMULATIVE EFFECTS

In determining the cumulative effects associated with activities related to the preparation for resumption of power operations and the resumption of power operations of Palisades Nuclear Plant, the U.S. Nuclear Regulatory Commission (NRC or Commission) staff evaluated the combination of the past, present, and reasonably foreseeable actions or projects along with what has been assessed in the 2006 SEIS (NRC 2006-TN7346). The NRC staff's analyses of the potential incremental effects of the proposed Federal actions when added to the environmental effects of other past, present, and reasonably foreseeable actions are presented within the discussion of each resource area in Section 3 of this environmental assessment. Table G-1 below provides a list of projects and actions that the NRC staff considered for its cumulative effects impact analysis. However, because of the uniqueness of each environmental resource area evaluated and its associated geographic area of analysis, Section 3 does not consider or explicitly evaluate every project and action listed in Table G-1.

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power

Name	Summary	Location	Status	Source
Onsite Future Project – ISFSI	Construction of a new spent fuel pad	Onsite	Reasonably Foreseeable	ML23271A140
Onsite Future Project – Subsequent License Renewal	Subsequent license renewal application	Onsite	Application expected no later than March 26, 2026	ML23271A140
Onsite Future Project – Small modular reactors	New construction	Onsite	Future	ML24086A582
Energy Facility – Donald C Cook Nuclear Power Plant	2,161 MWe pressurized water reactor	28 mi N	Operational since 1975	ML051150556
Energy Facility – Covert Generating Plant	1,100 MW combined cycle gas turbine power plant	1 mi E	Operational	Newkirk Electric Associates. Power Generation Covert Generation Plant. https://www.newkirk-electric.com/projects/power-generation/covert-generating-plant#/
Energy Facility – 48th Street Generating Station	Power station with three combustion turbine engines	30 mi N	Operational	Holland Board of Public Works. Reliable Electric. https://hollandbpw.com/en/blog/list-all/33-electric/271-reliable-electric

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
Energy Facility – Zeeland Generating Station	Power station with two natural gas combined cycle plants and two natural gas simple cycle units	40 mi N	Unknown	Consumers Energy. Natural Gas Generation. https://www.consumersenergy.com/about-us/electric-generation/natural-gas
Energy Facility – Holland Energy Park	Power station with two combustion turbine engines and one steam turbine generator	35 mi N	Operational	Holland Board of Public Works. How We Generate Electricity. https://hollandbpw.com/en/how-it-works
Transmission Infrastructure – Benton Harbor - Fair Plain	Upgrade 7 mi of transmission lines	~15 mi S	Expected construction Spring-Summer 2025	AEP Transmission. Benton Harbor – Fair Plain Transmission Line Rebuild Project. https://aeptransmission.com/michigan/BentonHarbor/
Transmission Infrastructure – Hartford Area	Upgrade 32 mi of transmission lines and equipment at a substation	Within 10 to 20 mi radius to the N, E, and S	Ongoing. Expected completion in Summer 2025	AEP Transmission. Hartford Area Improvements Project. https://aeptransmission.com/michigan/HartfordMichigan/
Transmission Infrastructure – Buchanan - Bridgman	Upgrade substation, retiring 2 mi of transmission lines, and upgrade 20 mi of transmission lines	~30 mi S and SE	Construction expected early 2026 through Summer 2027	AEP Transmission. Buchanan - Bridgman Transmission Line Project. https://aeptransmission.com/michigan/buchanan-bridgman/
Transmission Infrastructure – Fourflag	Rebuild ~8 mi of power lines	~35 mi SE	Construction expected early 2026 through Fall 2026	AEP Transmission. Fourflag Transmission Line Project. https://aeptransmission.com/michigan/FourFlag/
Transmission Infrastructure – New Buffalo	Rebuild ~20 mis of power lines	~40 mi	Construction expected early 2026 through Fall 2027	AEP Transmission. New Buffalo – Bridgman Transmission Line Rebuild Project. https://aeptransmission.com/michigan/NewBuffalo-Bridgman/

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
Transmission Infrastructure – Niles	Improvements including upgrades to substations and retiring, upgrading and building new transmission lines	~35 mi SE	Constructed expected from 2024 through 2026	AEP Transmission. Niles Area Transmission Improvements Project. https://aeptransmission.com/michigan/NilesArea/
Transmission Infrastructure – South Cass	Building new transmission lines and expanding Substation	~40 mi	Construction expected early 2025 through early 2026	AEP Transmission. South Cass County Transmission Line Project. https://aeptransmission.com/michigan/SouthCassCounty/
Transmission Infrastructure – South Bend	Rebuilding ~12 mi of transmission lines and upgrading substation	~40 mi	Construction expected early 2025 through early 2026	AEP Transmission. South Bend – Niles Transmission Line Project. https://aeptransmission.com/indiana/SouthBend-Niles/
Transmission Infrastructure – New substations (Northridge, Jaguar, Meyer)	Multiple substations construction	within 50 mi	-	ITC. ITC Michigan. https://www.itc-holdings.com/project-category/michigan/
Mining – Rosy Mound Site (sand)	Silica mine	~50 mi N (T7N R16W) Ottawa County, Michigan	Active permit since 1982	Department of Environmental, Great Lakes, and Energy. Sand Dune Mining. https://www.michigan.gov/egle/about/organization/geologic-resources-management/mining/sand-dune
Mining – Van Horn Site (sand)	Silica mine	~30 mi N Allegan County, Michigan	Active permit since 2022	Department of Environmental, Great Lakes, and Energy. Sand Dune Mining. https://www.michigan.gov/egle/about/organization/geologic-resources-management/mining/sand-dune

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
Mining – Nadeau Pit (sand)	Silica mine	~15 mi N (T2S R18W) Van Buren County, Michigan	Active permit since 1979	Department of Environmental, Great Lakes, and Energy. Sand Dune Mining. https://www.michigan.gov/egle/about/organization/geologic-resources-management/mining/sand-dune
Brownfield Project – Redevelopment	Development of a brownfield from coal, lumber, and chemical storage to construction of two residential buildings, a community center, and community garden	40 mi E	Ongoing	Michigan EGLE. RenewMI Project Viewer. https://experience.arcgis.com/experience/a3db431c6b154b87a481e1122f726101/page/Project-Viewer/?utm_campaign=splash&utm_content=RenewMI-Project-Viewer-App&utm_medium=web&utm_source=gis-app
Brownfield Project – Redevelopment	8 ac site contaminated with petroleum and metals to be converted to a mixed use residential/work-live development	40 mi E	Ongoing	Michigan EGLE. RenewMI Project Viewer. https://experience.arcgis.com/experience/a3db431c6b154b87a481e1122f726101/page/Project-Viewer/?utm_campaign=splash&utm_content=RenewMI-Project-Viewer-App&utm_medium=web&utm_source=gis-app
Brownfield Project – Redevelopment	Cleanup of the Pullman Industries Site for future development	25 mi E	Ongoing	Michigan EGLE. RenewMI Project Viewer. https://experience.arcgis.com/experience/a3db431c6b154b87a481e1122f726101/page/Project-Viewer/?utm_campaig

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
				n=splash&utm_content=RenewMI-Project-Viewer-App&utm_medium=web&utm_source=gis-app
Brownfield Project – Redevelopment	Cleanup of a 0.89 ac site contaminated with petroleum related compounds for future development	40 mi E	Ongoing	Michigan EGLE. RenewMI Project Viewer. https://experience.arcgis.com/experience/a3db431c6b154b87a481e1122f726101/page/Project-Viewer/?utm_campaign=splash&utm_content=RenewMI-Project-Viewer-App&utm_medium=web&utm_source=gis-app
Brownfield Project – Redevelopment	Cleanup of a manufacturing site contaminated with metals, cyanide, and organic compounds	50 mi NE	Ongoing	Michigan EGLE. RenewMI Project Viewer. https://experience.arcgis.com/experience/a3db431c6b154b87a481e1122f726101/page/Project-Viewer/?utm_campaign=splash&utm_content=RenewMI-Project-Viewer-App&utm_medium=web&utm_source=gis-app
Water Supply and Treatment – Community water supply	Community water supply	Throughout area	-	Michigan EGLE. Michigan Community Public Water Supplies (2019). https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/DWEHD/Community-Water-Supply/Contact-Information-Maps/community-

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
				water-supply-list-county.pdf?rev=1a5d0eb9fcd94d388749ac4233c13514
Water Supply and Treatment – Wastewater treatment facility plants	Plants include South Haven, Hartford, Benton Harbor-St. Joseph, Dowagiac, Kalamazoo, Holland, Zeeland, Allegan, and Palinwell WWTPs	Throughout area	Operating	Michigan EGLE. Michigan PFAS Action Response Team. https://www.michigan.gov/pfasresponse/investigations/wastewater
Manufacturing & Air Emission Sources – ANR Pipeline Hamilton CS	Petroleum and Natural Gas Systems	30 mi NE, Hamilton, Michigan	Operational	U.S. Environmental Protection Agency. Greenhouse Gas Reporting Program https://www.epa.gov/ghgreporting/data-sets
Manufacturing & Air Emission Sources – Reckitt/Mead Johnson Nutrition	Pediatric Nutrition Production	45 mi N, Zeeland, Michigan	Operational	U.S. Environmental Protection Agency. Greenhouse Gas Reporting Program https://www.epa.gov/ghgreporting/data-sets
Manufacturing & Air Emission Sources – Otsego Paper, Inc.	Paper Mill	32 mi E, Otsego, Michigan	Operational	U.S. Environmental Protection Agency. Greenhouse Gas Reporting Program https://www.epa.gov/ghgreporting/data-sets
Manufacturing & Air Emission Sources – Pharmacia & Upjohn Company, LLC	Chemicals	50 mi E, Kalamazoo, Michigan	Operational	U.S. Environmental Protection Agency. Greenhouse Gas Reporting Program https://www.epa.gov/ghgreporting/data-sets
Manufacturing & Air Emission Sources – The Hillshire Brands Company	Food Production	45 mi N, Zeeland, Michigan	Operational	U.S. Environmental Protection Agency. Greenhouse Gas Reporting Program https://www.epa.gov/ghgreporting/data-sets
Manufacturing & Air Emission Sources – Industrial Fabrication	Metal Fabrication	30 mi S, Bridgman, Michigan	Operational since 1983	Industrial Fabrication. Home. https://indfabrication.com/

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
Manufacturing & Air Emission Sources – VDI Manufacturing	Molding/Tooling	36 mi E, Plainwell, Michigan	Operational since 1980s	VDI Manufacturing. Custom Injection Molding. https://vdimanufacturing.com/
Manufacturing & Air Emission Sources – Advantage Industries	Mechanical Contractor	50 mi NE, Jenison, Michigan	Operational	Advantage Industries Inc. https://www.advind.com/
Manufacturing & Air Emission Sources – Kalamazoo Industries	Machine Manufacturer	42 mi E, Kalamazoo, Michigan	Operational since 1960s	Kalamazoo Industries, Inc. Products. https://kalamazooind.com/products/?srsltid=AfmBOopr507WWPlTxT4wKWmIIHz1X6Yk5oa2Mfmog7pZtVC1f_k4meI4
Landfill – Autumn Hills Landfill	Solid waste landfill	40 mi NE, Zeeland, Michigan	Operational. Established 1992	WM. Autumn Hills Recycling and Disposal Facility. https://autumnhillslandfill.wm.com/index.jsp
Landfill – South Kent Landfill	Solid waste landfill	45 mi NE, Byron Center, Michigan	Operational. Established 1982	Kent County Public Works. South Kent Recycling & Waste Center. https://www.reimaginetrash.org/south-kent-recycling-waste-center/
Landfill – Orchard Hill Sanitary Landfill	Solid waste landfill	15 mi S, Watervliet, Michigan	Operational. Established 1976	Orchard Hill Landfill. Home. https://myorchardhill.com/
Landfill – Southeast Berrien County Landfill Authority	Solid waste landfill	35 mi S, Niles, Michigan	Operational	SEBCLA. Southeast Berrien County Landfill Authority. https://sebclandfill.com/
Landfill – Elkhart County Solid Waste	Solid waste landfill	50 mi NE, Elkhart, Indiana	Operational	Elkhart County Landfill. Landfill Drop Off Information. https://www.elkhartcountylandfill.com/landfill

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
Landfill – Westside Security Landfill	Solid waste landfill	43 mi NE, Three Rivers, Michigan	Operational	WM. Westside RDF Management Facility (Disposal). https://www.wmsolutions.com/locations/details/id/89
Transportation – Southwest Michigan Regional Airport	Airport	15 mi, S, Benton Harbor, Michigan	Operational	Southwest Michigan Regional Airport. http://www.swmiairport.com/
Transportation – Gerald R. Ford International Airport	Airport	55 mi NE, Grand Rapids, Michigan	Operational	Gerald R. Ford International Airport. https://www.grr.org/
Transportation – Kalamazoo/Battle Creek International Airport	Airport	40 mi, E, Kalamazoo, Michigan	Operational	Kalamazoo/Battle Creek International Airport. https://flyazo.com/
Transportation – Kirsch Municipal Airport	Airport	10 mi SE, Sturgis, Michigan	Operational	City of Sturgis Michigan. Kirsch Municipal Airport. http://www.sturgismi.gov/airport/
Transportation – Rebuilding I-94 from west of I-94 Business Loop to Britain Avenue	Rebuild 8 miles of freeway, replace 4 bridges, and repair 9 bridges	10 mi S, Berrien County, Michigan	Scheduled August 2023–November 2026	Michigan Department of Transportation – I-94 rebuilding project-Berrien County. https://www.michigan.gov/mdot/projects-studies/i94-rebuilding-project-berrien-county
Transportation – Rebuilding U.S.-131 from 76th Street to 100th St in Byron Township	Rebuild freeway	20 mi, NE, Grand Rapids, Michigan	Scheduled May 2024–November 2024	Michigan Department of Transportation – U.S.-131 rebuilding-Kent County. https://www.michigan.gov/mdot/projects-studies/us-131-kent-county
Parks/Recreation – Van Buren State Park	Day use and camping area with miles of trails	<5 mi, Van Buren County, Michigan	Operational	Pure Michigan. Van Buren State Park. https://www.michigan.org/property/van-buren-state-park
Parks/Recreation – Nature Conservancy's Ross Preserve	1,448 ac preserve	<5 mi, Van Buren County, Michigan	Operational	The Nature Conservancy. Ross coastal Plain Marsh Preserve. https://www.nature.org

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
				/en-us/get-involved/how-to-help/places-we-protect/ross-coastal-plain-marsh-preserve/
Parks/Recreation – Covert Township Park	50 ac with campsites	<5 mi, Van Buren County, Michigan	Operational	Pure Michigan. Covert Park Beach and Campground. https://www.michigan.org/property/covert-park-beach-and-campground
Parks/Recreation – Pilgrim Haven Natural Area	27 ac shoreline preserve	<5 mi, Van Buren County, Michigan	Operational	Southwest Michigan Land Conservancy. Pilgrim Haven Natural Area. https://swmlc.org/project/pilgrim-haven-natural-area/
Parks/Recreation – North Point Conservation Area	17 area conservation area	<5 mi, Van Buren County, Michigan	Operational	Van Buren County. North Point Conservation area. https://www.vanburencountymi.gov/438/North-Point-Conservation-Area
Parks/Recreation – Black River Preserve	120 ac preserve	6 mi, Van Buren County, Michigan	Operational	Southwest Michigan Land Conservancy. Black River Preserve. https://swmlc.org/project/black-river-preserve/
Parks/Recreation – Casco Township Nature Preserve	8 ac preserve	10 mi N, Allegan County, Michigan	Operational	Casco Township. Casco Township Parks. http://www.cascotownship.info/parks.html
Parks/Recreation – Saugatuck Harbor Natural Area	173 ac conservation area	20 mi N, Allegan County, Michigan	Operational	Land Conservancy of West Michigan. Saugatuck Harbor Natural Area. https://naturenearby.org/portfolio_page/explore/saugatuck-harbor-natural-area/
Parks/Recreation – Saugatuck Dunes State Park	1,000 ac day use and trail area	25 mi N, Allegan County, Michigan	Operational	Department of Natural Resources Michigan. Saugatuck Dunes

Table G-1 Projects and Actions U.S. Nuclear Regulatory Commission Staff Considered for Cumulative Effects Impact Analysis for the Resumption of Power Operations Activities at Palisades Nuclear Power (Continued)

Name	Summary	Location	Status	Source
				State Park https://www2.dnr.state.mi.us/parksandtrails/Details.aspx?id=491&type=SPRK
Parks/Recreation – Grand Mere State Park	1,100 ac park	25 mi S, Berrien County, Michigan	Operational	Department of Natural Resources Michigan. Grand Mere State Park. https://www2.dnr.state.mi.us/parksandtrails/Details.aspx?id=450&type=SPRK
Parks/Recreation – Warren Dunes State Park	1,500 ac park	32 mi S, Berrien County, Michigan	Operational	Department of Natural Resources Michigan. Warren Dunes State Park. https://www2.dnr.state.mi.us/parksandtrails/Details.aspx?id=504&type=SPRK
Parks/Recreation – Holland State Park	142 ac park with two campgrounds	32 mi, N, Ottawa County, Michigan	Operational	Department of Natural Resources Michigan. Holland State Park. https://www.michigandnr.com/parksandtrails/Details.aspx?id=458&type=SPRK
Parks/Recreation – Warren Woods State Park	311 ac park	38 mi S, Berrien County, Michigan	Operational	Department of Natural Resources Michigan. Warren Woods State Park. https://www2.dnr.state.mi.us/parksandtrails/Details.aspx?id=505&type=SPRK
Parks/Recreation – Various private campgrounds and parks on Lake Michigan shoreline and nearby	-	-	Operational	-

E = east; GHGRP = Greenhouse Gas Reporting Program; ISFSI = Independent spent fuel storage installation; Michigan EGLE = Michigan Department of Environment, Great Lakes, and Energy; N = north; NE = northeast; PFAS = polyfluoroalkyl substances; S = south; SE = southeast.
Note: Source lists contains company/organization name and page title. All links were accessed in September 2024.

G.1 References

NRC (U.S. Nuclear Regulatory Commission). 2006. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 27: Regarding Palisades Nuclear Plant, Final Report.* NUREG-1437, Supplement 27, Washington, D.C. ADAMS Accession No. ML062710300. TN7346.

APPENDIX H

DISCUSSION OF CANCER RISKS AT AND AROUND PALISADES NUCLEAR PLANT

The U.S. Nuclear Regulatory Commission (NRC or Commission) staff developed this appendix in response to the number of the public comments received during the NRC's scoping process concerning thyroid cancer in the immediate vicinity of Palisades Nuclear Plant (Palisades). These comments concern potential human health effects such as cancer from radiation exposure and are described in the scoping meeting summary (NRC 2024-TN10605).

To ensure a complete and independent assessment of cancer risks near Palisades was performed, the NRC staff coordinated with the Michigan Department of Health and Human Services to obtain the most up-to-date information regarding cancer incidence and mortality rates in the State of Michigan and the nearby areas surrounding Palisades. The NRC's mission is to protect the public health and safety and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities. The NRC's regulations in Title 10 *Code of Federal Regulations* (10 CFR) Part 20 (TN283) set forth regulatory standards for radiological protection to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation on humans. The standards are based, in part, on the recommendations of standards-setting organizations. Radiation standards reflect extensive scientific study by national and international organizations. The NRC actively participates in and monitors the work of these organizations to keep current on the latest trends in radiation protection. If the NRC determines that there is a need to revise its radiation protection regulations, it will initiate a rulemaking. The models recognized by the NRC are for use by nuclear power reactors to calculate dose incorporate conservative assumptions and account for differences in gender and age to ensure that workers and members of the public are adequately protected from radiation.

Radiation may cause cancers. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold, dose response model is used to describe the relationship between radiation dose and adverse impacts such as incidence of cancer. Simply stated, in this model, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks. Based on this theory, the NRC conservatively establishes regulatory limits for radioactive effluents and radiation exposures for workers and members of the public. Although the public dose limit in 10 CFR Part 20 (TN283) is 100 millirem (mrem) (1 millisievert [mSv]) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Additionally, 10 CFR 20.1301(e) requires each nuclear power reactor to comply with applicable environmental radiation standards in 40 CFR Part 190 (40 CFR Part 190-TN739), such as the total annual whole body dose to a member of the public outside the facility does not exceed to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well-measured, well-monitored, and known to be very small. Light-water-cooled nuclear reactor effluent must meet the as low as reasonably achievable requirements of 10 CFR Part 50 Appendix I (TN249). The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

In addition to NRC's requirements to monitor radioactive effluents (routine and inadvertent) discharged into the environment, the NRC requires each nuclear power plant to maintain a monitoring and surveillance program under the regulations at 10 CFR Part 50, Appendix I (TN249), such as with a radiological environmental monitoring program (REMP). The regulations in 10 CFR Part 50, Appendix I require the quantification of the environmental impacts associated with radioactive effluent releases from the plant as reported in the annual environmental operating report. Implementation of the REMP requires continuous monitoring of the environment, starting before the plant operates to establish background radiation levels and continuing throughout its operating lifetime to monitor radioactivity in the local environment. This provides a mechanism for determining the levels of radioactivity in the environment to ensure that any accumulation of radionuclides released into the environment will not become significant as a result of plant operations. This implementation also measures radioactivity from other nuclear facilities that may be in the area (i.e., other nuclear power plants, hospitals using radioactive material, research facilities, or any other facility licensed to use radioactive material). Thus, 10 CFR Part 50, Appendix I requires monitoring of the cumulative effects from all sources of radioactivity in the vicinity of the power plant. To obtain information on radioactivity around the plant, samples of environmental media (e.g., surface water, groundwater, drinking water, air, milk, locally grown crops, locally produced food products, river, ocean, or lake sediment, and fish and other aquatic biota) are collected from areas surrounding the plant for analysis to measure the amount of radioactivity, if any, in the samples. The media samples reflect the radiation exposure pathways (i.e., inhalation, ingestion, and physical location near the plant) to the public from radioactive effluents released by the nuclear power plant and from background radiation (i.e., cosmic sources and naturally occurring radioactive material, including radon and global fallout). The 10 CFR Part 20, Appendix B standards limit the amount of radioactivity in the sample media, which, if exceeded, must be reported to the NRC, and the licensee must conduct an investigation. The REMP verifies that measurable concentrations of radioactive materials and levels of radiation in the environment are not higher than expected when compared against data on the amount of radioactive effluent discharged. As part of its environmental review, the NRC staff reviews REMP reports to look for adverse data or evidence of a buildup of radioactivity in the environment.

The State of Michigan conducts an independent REMP program through the Michigan Department of Environment, Great Lakes, and Energy (MEGLE 2016-TN10744). The Michigan Radiation Environmental Monitoring Program monitors ambient radiation levels, and collects air, water, precipitation, and milk samples from areas surrounding all of the nuclear power plants in Michigan, including Palisades. This program has been operated by the State since 1958. The collected and analyzed data is published periodically and is currently reported through 2016. The NRC staff reviewed the data from Michigan Environment, Great Lakes, and Energy pertaining to Palisades and compared it to the information contained within annual REMP reports published by the facility's operators and reported to the NRC. The NRC staff did not find an observable difference between the values reported by the facility operators and the data determined by Michigan Radiation Environmental Monitoring Program.

Cancer statistics are tracked at the national, State, and county level. The U.S. Centers for Disease Control, National Environmental Health Public Health Tracking Network (CDC 2024-TN10845) and the University of Kentucky Cancer Surveillance Program (University of Kentucky 2014-TN10851) provide publicly available graphical information systems to visualize health statistics. The health statistics for Van Buren, Berrien, Cass, Kalamazoo, and Allegan counties, along with statistics for the State of Michigan, were reviewed by NRC staff. Total cancer rates and thyroid cancer rates were reviewed on these levels from 2006 (the year of publication of the license renewal) to the most recent data available. These statistics are shown in Table H-1

below and indicate that occurrences of cancer and thyroid cancer in the area surrounding Palisades do not vary from rates regionally.

Table H-1 Age-Adjusted Incidence Rate of Thyroid Cancer Per 100,000 Individuals in a Population in Select Michigan Counties in Over 5 Years (CDC 2024-TN10845)

County	Start Year	End Year	5 Year Thyroid Cancer Incidence Rate Per 100K Persons
Allegan	2001	2005	5.1
Allegan	2006	2010	9.8
Allegan	2011	2015	9.8
Allegan	2016	2020	11.1
Berrien	2001	2005	6.4
Berrien	2006	2010	9.3
Berrien	2011	2015	9.5
Berrien	2016	2020	8.4
Cass	2001	2005	NA
Cass	2006	2010	NA
Cass	2011	2015	10.8
Cass	2016	2020	9.5
Kalamazoo	2001	2005	8.1
Kalamazoo	2006	2010	12.6
Kalamazoo	2011	2015	11.8
Kalamazoo	2016	2020	9.2
Van Buren	2001	2005	7.6
Van Buren	2006	2010	5.8
Van Buren	2011	2015	8.5
Van Buren	2016	2020	9.9
Michigan State Average	2001	2005	8.4
Michigan State Average	2006	2010	11.7
Michigan State Average	2011	2015	13.4
Michigan State Average	2016	2020	11.6

Although a number of studies of cancer incidence in the vicinity of nuclear power facilities have been conducted, there are no studies to date that definitively demonstrate a correlation between radiation dose from nuclear power facilities and cancer incidence in the general public. The following is a listing of radiation health studies that the NRC recognizes:

- In 1990, at the request of Congress, the National Cancer Institute conducted a study of cancer mortality rates around 52 nuclear power plants and 10 other nuclear facilities. The study covered the period from 1950 to 1984 and evaluated the change in mortality rates before and during facility operations. The study concluded there was no evidence that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby (NCI 2011-TN10889).
- In June 2000, investigators from the University of Pittsburgh found no link between radiation released during the 1979 accident at the Three Mile Island Nuclear Generating Station and cancer deaths among nearby residents. Their study followed 32,000 people who lived within 5 mi (8 km) of the plant at the time of the accident (Talbott et al. 2000-TN10890).

- The American Cancer Society in 2001 concluded that although reports about cancer clusters in some communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population. Likewise, there is no evidence that links strontium-90 with increases in breast cancer, prostate cancer, or childhood cancer rates. Radiation emissions from nuclear power plants are closely controlled and involve negligible levels of exposure for nearby communities (ACS 2001-TN10891).
- In 2000, the Illinois Public Health Department compared childhood cancer statistics for counties with nuclear power plants to similar counties without nuclear plants and found no statistically significant difference (IDPH 2000-TN10895).
- The Connecticut Academy of Sciences and Engineering, in January 2001, issued a report on a study around the Haddam Neck Nuclear Power Plant in Connecticut and concluded radiation emissions were so low as to be negligible and found no meaningful associations to the cancers studied (CASE 2001-TN10892).
- In 2001, the Florida Bureau of Environmental Epidemiology reviewed claims that there are striking increases in cancer rates in southeastern Florida counties caused by increased radiation exposures from nuclear power plants. However, using the same data to reconstruct the calculations on which the claims were based, Florida officials were not able to identify unusually high rates of cancers in these counties compared with the rest of the State of Florida and the Nation (FDOH 2001-TN10894).
- The United Nations Scientific Committee on the Effects of Atomic Radiation analyzed radiation exposures as a result of the Fukushima Daichi Nuclear Power Station accident in March of 2011. The report concluded that no adverse health effects among Fukushima residents have been documented that are directly attributable to radiation exposure from the accident. Furthermore, the report identifies that an increase of thyroid cancers detected in exposed children is the result of ultrasensitive screening procedures revealing thyroid abnormalities not previously documented in the population and not from the exposure itself (UNSCEAR 2022-TN10916).
- Nuclear workers provide valuable information on the effects of ionizing radiation in contemporary exposure scenarios relevant to workers and the public. A 2023 article presented in the International Journal of Epidemiology titled, “Ionizing Radiation and Solid Cancer Mortality Among U.S. Nuclear Facility Workers,” included an analysis of greater than 100,000 nuclear workers in the United States, exposed to an average 2,650 mrem (26.5 mSv) of external penetrating ionizing radiation. This study notes that higher rates of solid cancers including lung cancers were observed for workers of five nuclear facilities between the years of 1944 to 2016. The analysis given in the article bolsters the body of evidence suggesting there are radiogenic risks associated with several types of solid cancers (Kelly-Reif et al. 2023-TN10917).
- In 1957 a fire at the Sellafield Windscale reactor site resulted in an emission of nearly 50,000 Curies (1,800 Terabecquerel) of iodine-131 to the atmosphere. This resulted in doses to children up to 10 rads (100 milligray). A longitudinal study was conducted to track individuals impacted during the release. The study tracked 193,500 individuals born between 1950 and 1980 in areas both impacted and not impacted by the release. The study determined that there were no increased rates of thyroid cancer in the impacted individuals when compared to those born in non-impacted areas or in impacted areas after the release (McNally et al. 2024-TN10893).

- The State of Michigan Department of Health and Human Services, Department of Environmental Health conducted a review of the thyroid cancer statistics for the area of Covert Township in Michigan (MDHHS 2024-TN10866). The State identified six instances of thyroid cancer in Covert Township from 1985 to 2021. The small number of recorded cases in a population of 2,510 was too low to conduct viable statistical analysis with other comparable locations. No temporal patterns were identified with regards to thyroid cancer for the location during the review. The data was obtained from the Michigan Cancer Surveillance Program. It is important to note that part-time residents with a separate primary residence or individuals that were diagnosed after moving away from the county would not be identified as individuals diagnosed in Covert Township.

As discussed in Section 3.11.1 of this environmental assessment, in the 2006 supplemental environmental impact statement (NRC 2006-TN7346) the maximum annual total effective dose equivalent (TEDE) for the maximally exposed individual (over the 5-year period of 2000–2005) was reported as 7.53×10^{-3} mrem, with the TEDE including estimates for liquid and gaseous effluents. The average occupational radiation exposure TEDE dose for the operational years 2006 to 2021 ranged from 0.09 rem to 0.39 rem (NRC 2024-TN9915). These dose results confirm that Palisades was operating in compliance with 10 CFR Part 50 (TN249), Appendix I, 10 CFR Part 20 (TN283), and 40 CFR Part 190 (TN739) for members of the public and occupational dose limits.

The monitoring program under NRC regulation and those conducted by the State of Michigan indicate that the emissions from Palisades are very low and a small fraction of the regulatory limits. That program data in conjunction with the above studies indicate that nuclear plant emissions are unlikely to contribute to cancer rates in the location population.

H.1 References

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.” TN249.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations.” TN739.

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APPENDIX I

SUPPLEMENTAL INFORMATION PERTINENT TO SECTION 106 CONSULTATION AND THE HISTORIC AND CULTURAL RESOURCES REVIEW

I.1 National Historic Preservation Act Section 106 Consultation

The National Historic Preservation Act of 1966, as amended (NHPA) (TN4157), requires Federal agencies to consider the effects of their undertakings on historic properties and consult with applicable Federal, State, Tribal, local groups or agencies, individuals, and organizations with demonstrated interest in the undertaking before taking the action. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places. The historic preservation review process (Section 106 of the NHPA) is outlined in regulations issued by the Advisory Council on Historic Preservation (ACHP) in 36 CFR Part 800 (TN513), "Protection of Historic Properties." In accordance with 36 CFR Part 800.8(c) (TN513), "Use of the NEPA Process for Section 106 Purposes," the U.S. Nuclear Regulatory Commission (NRC or Commission) has elected to use the National Environmental Policy Act of 1969 process to comply with its obligations under Section 106 of the NHPA.

Federal, government-to-government consultation as part of the 2006 SEIS (NRC 2006-TN7346) focused on engaging with the Advisory Council on Historic Preservation, Michigan SHPO, and 12 federally recognized Indian Tribes. The NRC initiated consultation with the Advisory Council on Historic Preservation, Michigan State Historic Preservation Office (Michigan SHPO), and 35 federally recognized Indian Tribes via a letter dated July 1, 2024, with the Michigan SHPO, the ACHP and 35 federally recognized Indian Tribes. All consultation letters are presented in Appendix E to this environmental assessment (EA), with individual contacts presented in Appendix D to this EA.

On July 10, 2024, NRC staff met the Michigan SHPO to provide an overview and discuss the proposed undertaking and answer questions from the letter dated July 1, 2024.

On July 16, 2024, the NRC held a non-public, virtual, Tribal information meeting. Seven federally recognized Indian Tribes participated. The purpose of this meeting was to share details about the proposed undertaking and the scoping process (which was still open and the NRC was still accepting comments at that time).

On September 11, 2024, the NRC held an in-person site visit and information session at Palisades Nuclear Plant (Palisades) for federally recognized Indian Tribes. Two Indian Tribes participated in-person with virtual attendees present. The information session included a presentation outlining the proposed project, undertaking and Federal actions, Federal agencies involved, past land disturbance at Palisades, the anticipated area of potential effects, the NRC's environmental review schedule, and potential future projects at the Palisades site (subsequent license renewal and small modular reactor project) which would be captured in the NRC's cumulative effects review. Additionally, the NRC relayed that these potential future projects would be separate undertakings under Section 106 of the NHPA. The NRC held a separate in-person tour and information session with the Michigan SHPO on September 12, 2024. The NRC sent a summary of the in-person site visit and information session with all federally recognized Indian Tribes on October 9, 2024.

By emails dated September 18, 2024, and October 2, 2024 (NRC 2024-TN10879), the NRC sent Holtec's archaeological survey report (SEARCH 2024-TN10846) to federally recognized Tribes for review and comment. To date, no comments regarding the archaeological report have been received. On November 4, 2024 (NRC 2024-TN10879), Holtec sent its historic and cultural resource procedures to address inadvertent discoveries and notification protocols to federally recognized Indian Tribes. To date, no comments have been received.

As identified in the NRC's initial consultation letter dated July 1, 2024, the NRC staff transmitted a second consultation letter identifying the Palisades area of potential effects to the Michigan SHPO, ACHP, and federally recognized Indian Tribes on November 5, 2024 (see Appendix E to this EA).

Further communication and consultation occurred with the Michigan SHPO on August 13, 2024, when Holtec transmitted copies of their cultural resource procedures to the Michigan SHPO for review. The Michigan SHPO responded by letter and provided comments on these procedures on October 23, 2024. Holtec also submitted its archaeological survey report (SEARCH 2024-TN10846) and architectural survey report (Theriot and Travisano 2024-TN10847) for review and concurrence to the Michigan SHPO.

On September 18, 2024, the Michigan SHPO concurred with the archaeological survey identifications and eligibility determinations for Palisades (MI SHPO 2024-TN10850). On October 2, 2024, the Michigan SHPO responded by letter and requested additional information for the architectural survey report for their review (MI SHPO 2024-TN10873). Holtec updated its architectural survey and resubmitted it to Michigan SHPO on October 22, 2024. On November 6, 2024, Michigan SHPO determined that the containment building could not be considered separately from the remaining parts of the Palisades facility and did not rise to the level of significance required for listing in the NRHP under Criteria C for Architecture/Engineering (MI SHPO 2024-TN10844).

I.2 Historic Land Disturbance Photographs and Maps

In 1965, Consumers Power Company and the Detroit Edison Company completed a joint study to identify suitable locations in Michigan for a proposed nuclear power plant (AEC 1972-TN10603). Of the locations studied, Consumers Power Company selected Palisades due to its location being: (1) immediately adjacent to Lake Michigan, (2) near existing and nearby railroad facilities, and (3) close to existing transmission line infrastructure. Palisades was also selected because it was the location of a former sand quarry. In 1966, grading and vegetation clearing activities began at Palisades.

The following set of historical photographs and maps visually depict the land disturbance that occurred at Palisades between 1966 and 1971 (Figure I-1 through Figure I-17). Two historic aerial photographs depict the landscape at Palisades prior to construction in 1955 and 1960 (Figure I-1 and Figure I-2). These historical photographs help visualize the previous disturbance that occurred in sand dune locations to the south and southeast of the Palisades reactor vessel building, and in the immediate area where both cooling towers exist today.

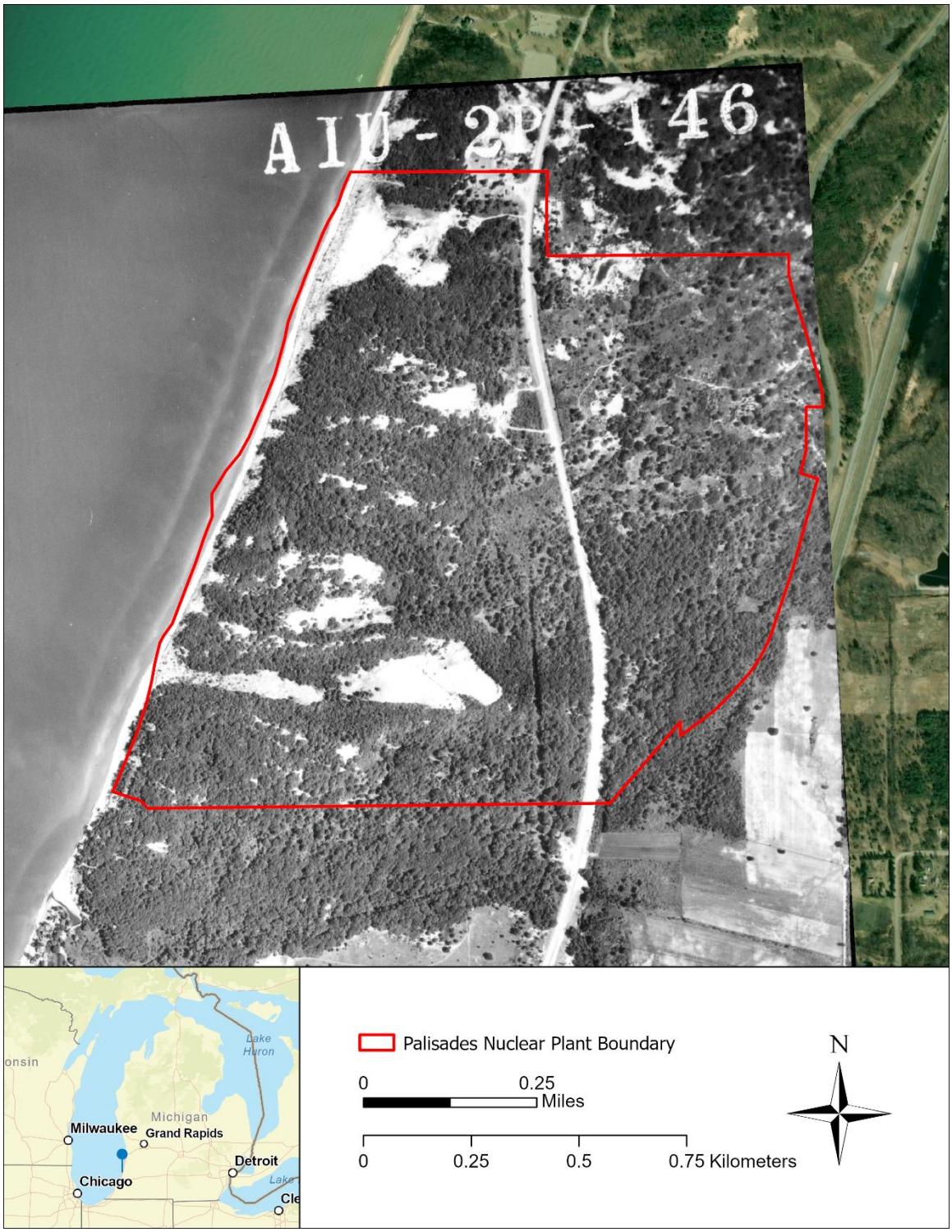

Figure I-1 The Palisades Nuclear Plant Site Boundary Overlain with a 1955 Historic Aerial Photograph from the RS&GIS Aerial Imagery Archive, Michigan State University. Source: www.rsgis.msu.edu.

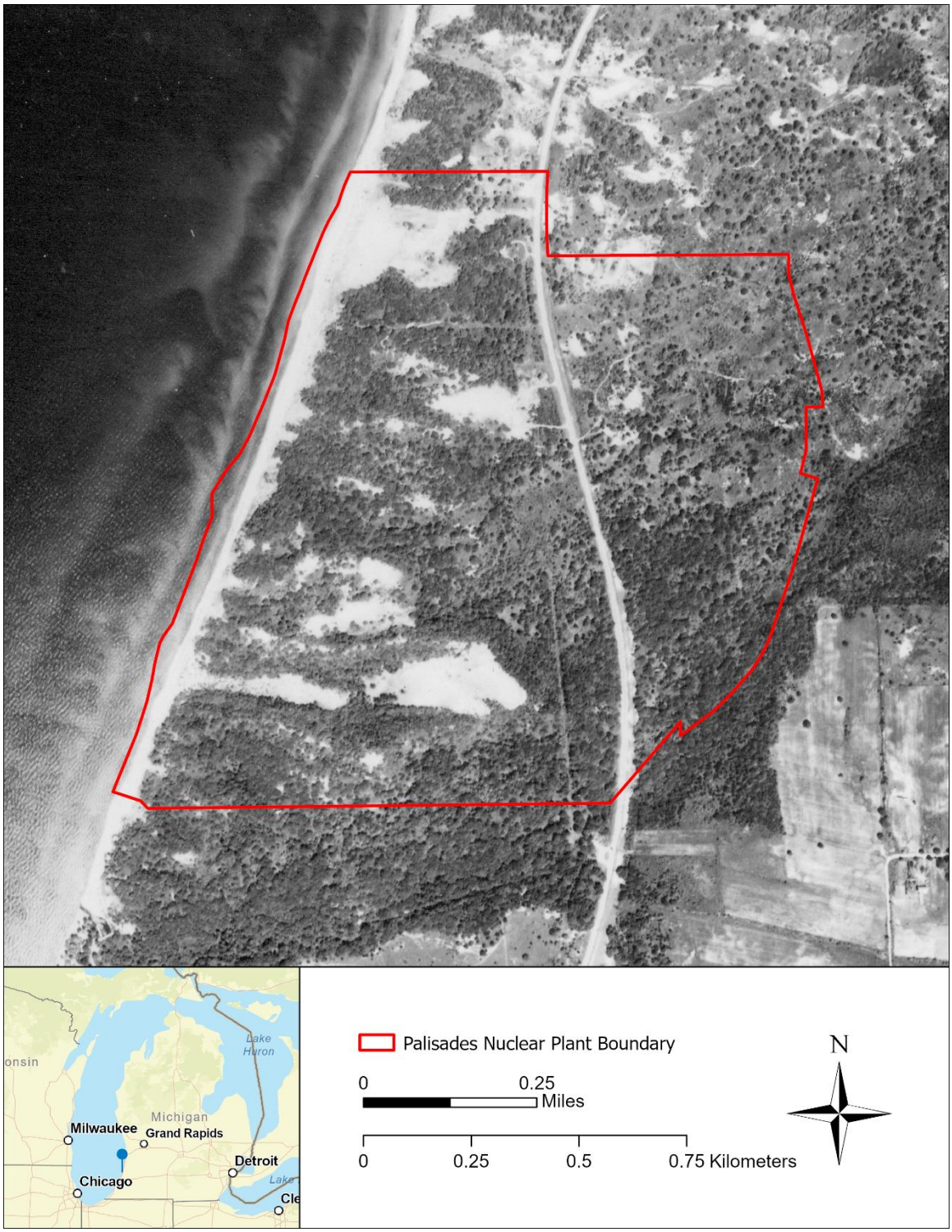

Figure I-2 **The Palisades Nuclear Plant Site Boundary Overlain with a 1960 Historic Aerial Photograph from the RS&GIS Aerial Imagery Archive, Michigan State University. Source: www.rsgis.msu.edu.**

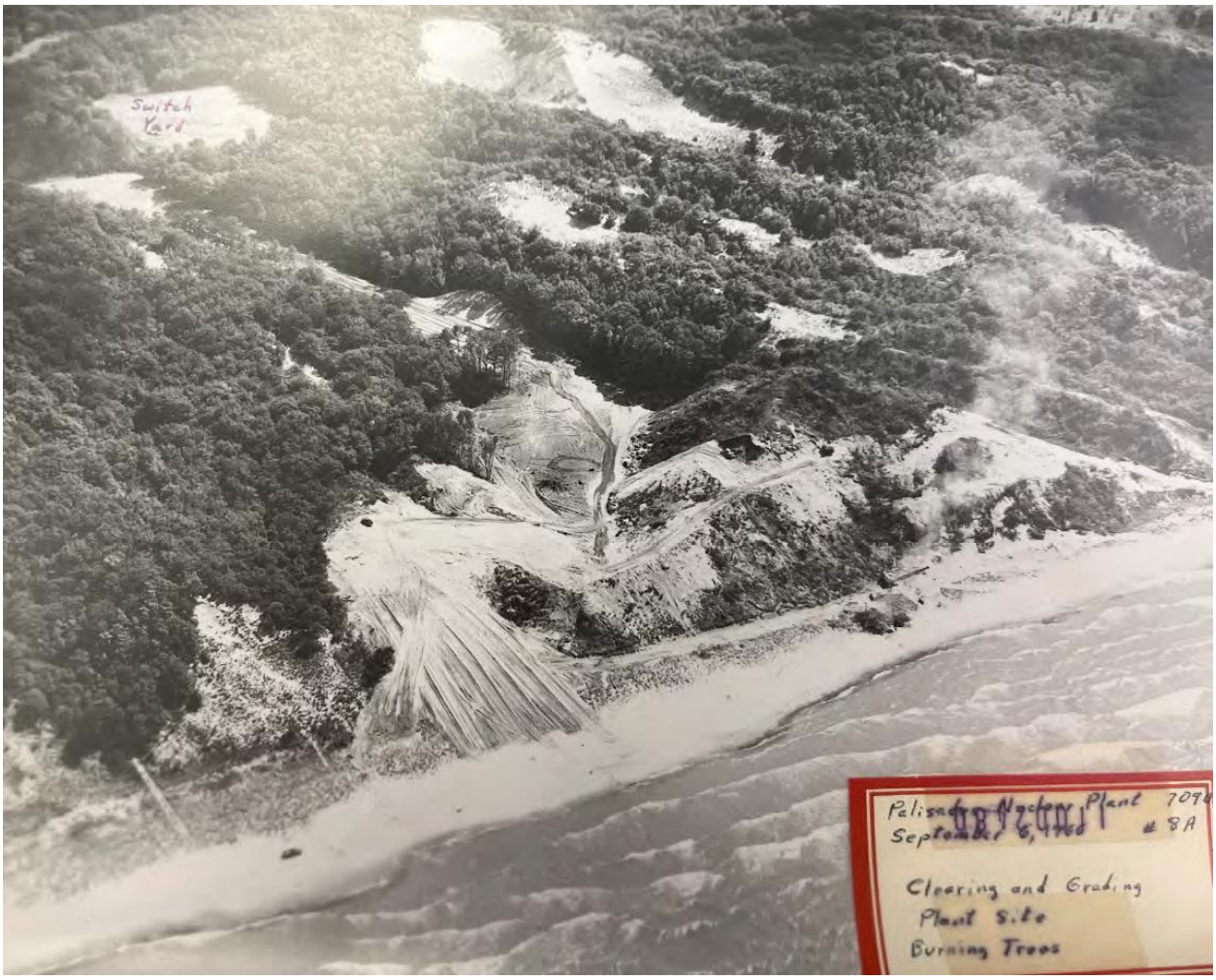

Figure I-3 The Palisades Nuclear Plant Site on September 6, 1966, Showing the Early Stages of Vegetation Clearing and Grading. The Original Photograph Caption States, "burning trees." Source: SEARCH 2024-TN10846.

Figure I-4 Heavy Equipment Operating on the Beach on the Northern Portion of the Palisades Nuclear Plant Site on September 22, 1966. Photograph Looking to the Northwest. Source: HDI 2024-TN10670.

Figure I-5 Heavy Equipment Grading the Beach at the Palisades Nuclear Plant Site on October 17, 1966. Photograph Looking to the North. Source: HDI 2024-TN10670.

Figure I-6 A Photograph from December 1966 Looking Southwest across the Palisades Nuclear Plant Site Showing the Extent of Land Grading Activities at That Time. Note the Cleared Vegetation and Road Cut into the Sand Dune behind the Crane. Source: HDI 2024-TN10670.

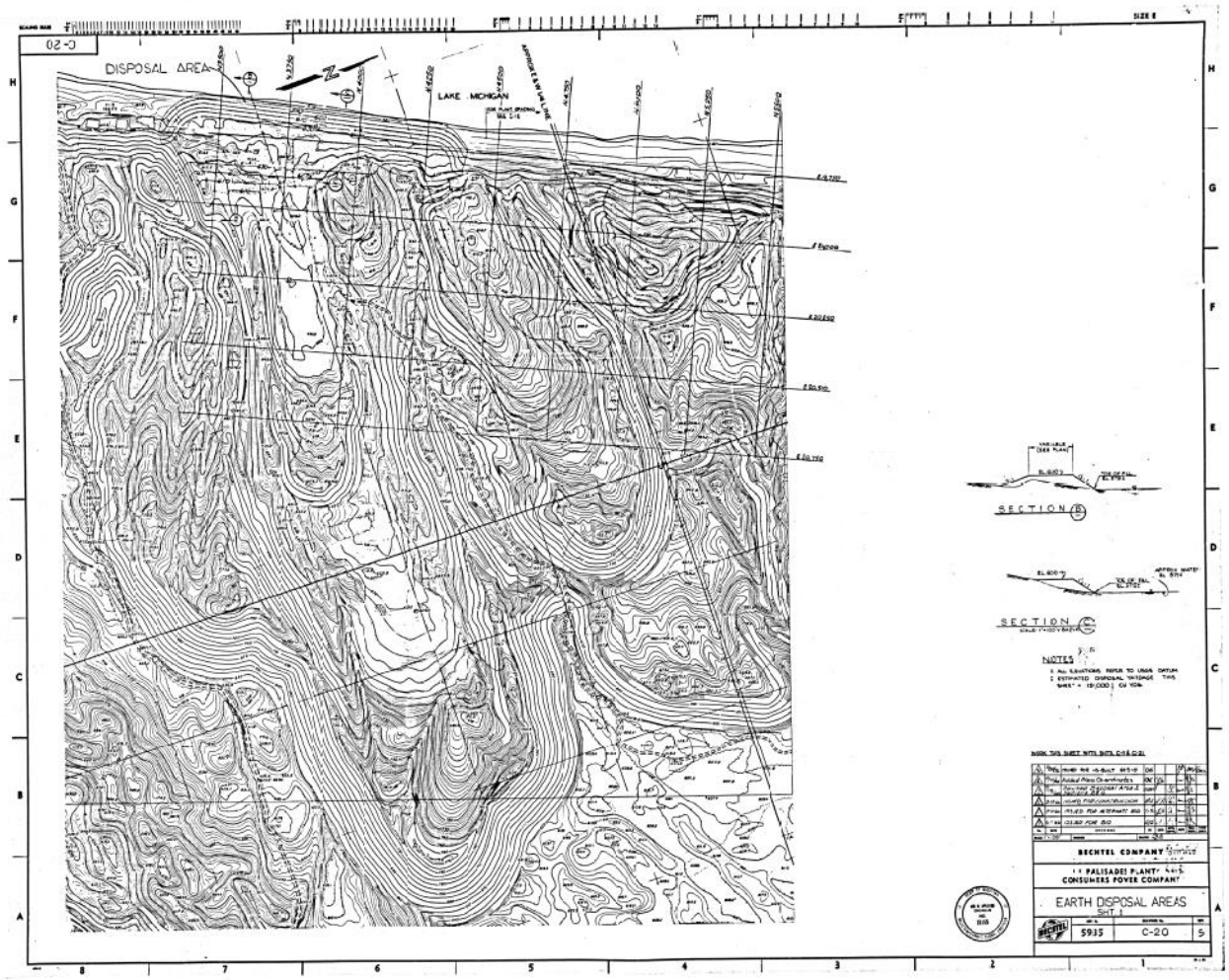

Figure I-7 A Topographic Map Highlighting the Disposal Area along the Shore of Lake Michigan for Construction of Palisades Nuclear Plant. Source: HDI 2024-TN10670.

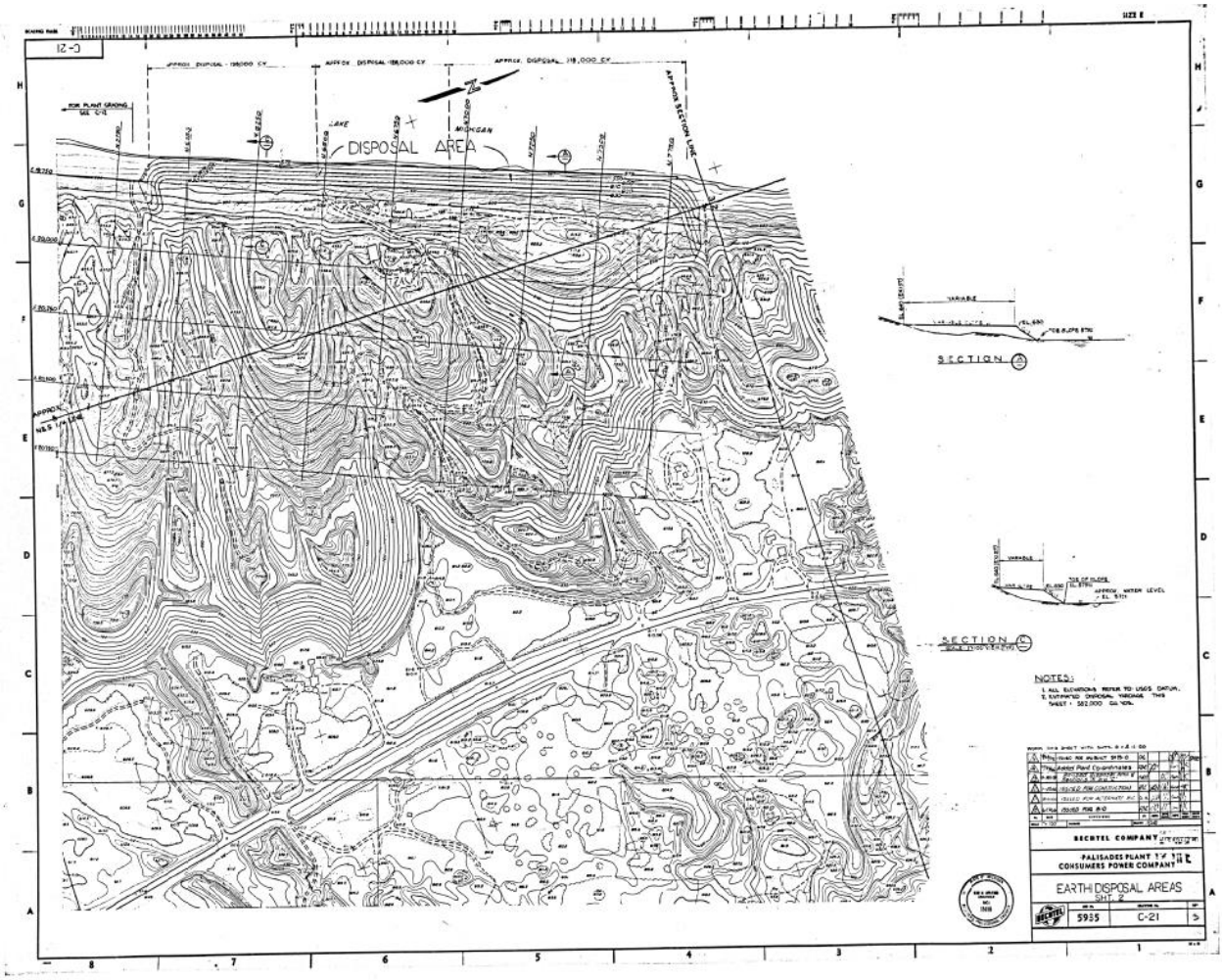

Figure I-8 A Topographic Map Highlighting the Disposal Area along the Shore of Lake Michigan for Construction of Palisades Nuclear Plant. Source: HDI 2024-TN10670.

Figure I-9 A Photograph from April 25, 1967, Looking Northeast over Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Right of the Circular Footprint of the Future Reactor Vessel Building and the Land Grading and Vegetation Clearing along the Beach to the South of the Site. The Original Photograph Caption States, "The lake is washing sand from the south disposal area." Source: HDI 2024-TN10670.

Figure I-10 A Photograph from April 25, 1967, Looking Northeast over Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Right of the Circular Footprint of the Future Reactor Vessel Building and the Land Grading and Vegetation Clearing along the Beach to the South of the Site. The Original Photograph Caption States, "The lake is washing sand from the south disposal area." Source: HDI 2024-TN10670.

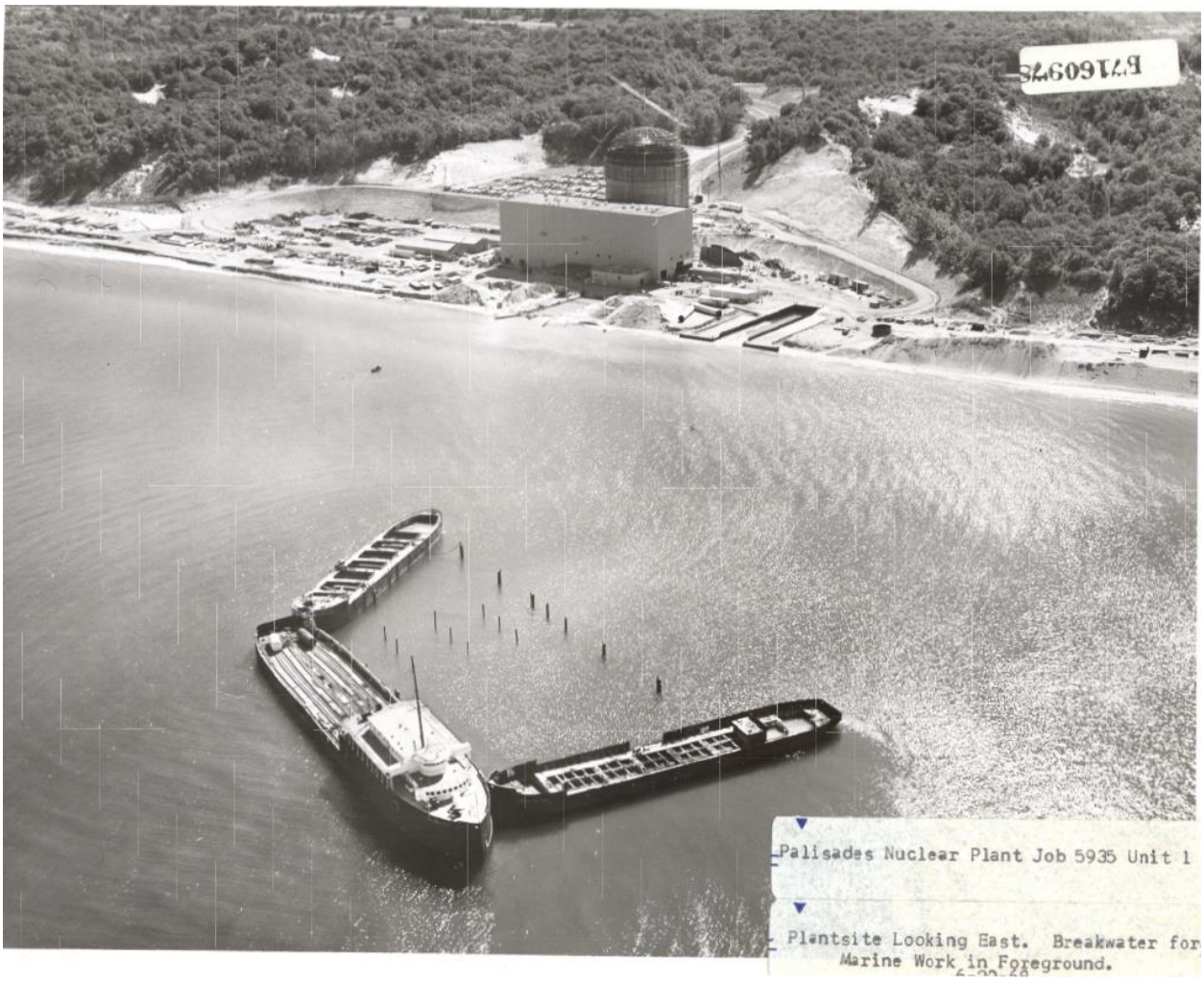

Figure I-11 A Photograph from June 1968, Looking South over Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Right of the Reactor Vessel Building and the Land Grading and Vegetation Clearing along the Beach to the South of the Site. Source: HDI 2024-TN10670.

Figure I-12 A Photograph from August 31, 1967 Looking Southeast from the Auxiliary Building Foundation of Palisades Nuclear Plant. Note the Cleared Vegetation and Road Cut into the Sand Dune behind the Crane. The Existing Transmission Pole on Top of the Sand Dune Is Located Where the Current Transmission Lines and Structures Are Located Today. The Sand Dune Has Already Undergone Revegetation. Source: HDI 2024-TN10670.

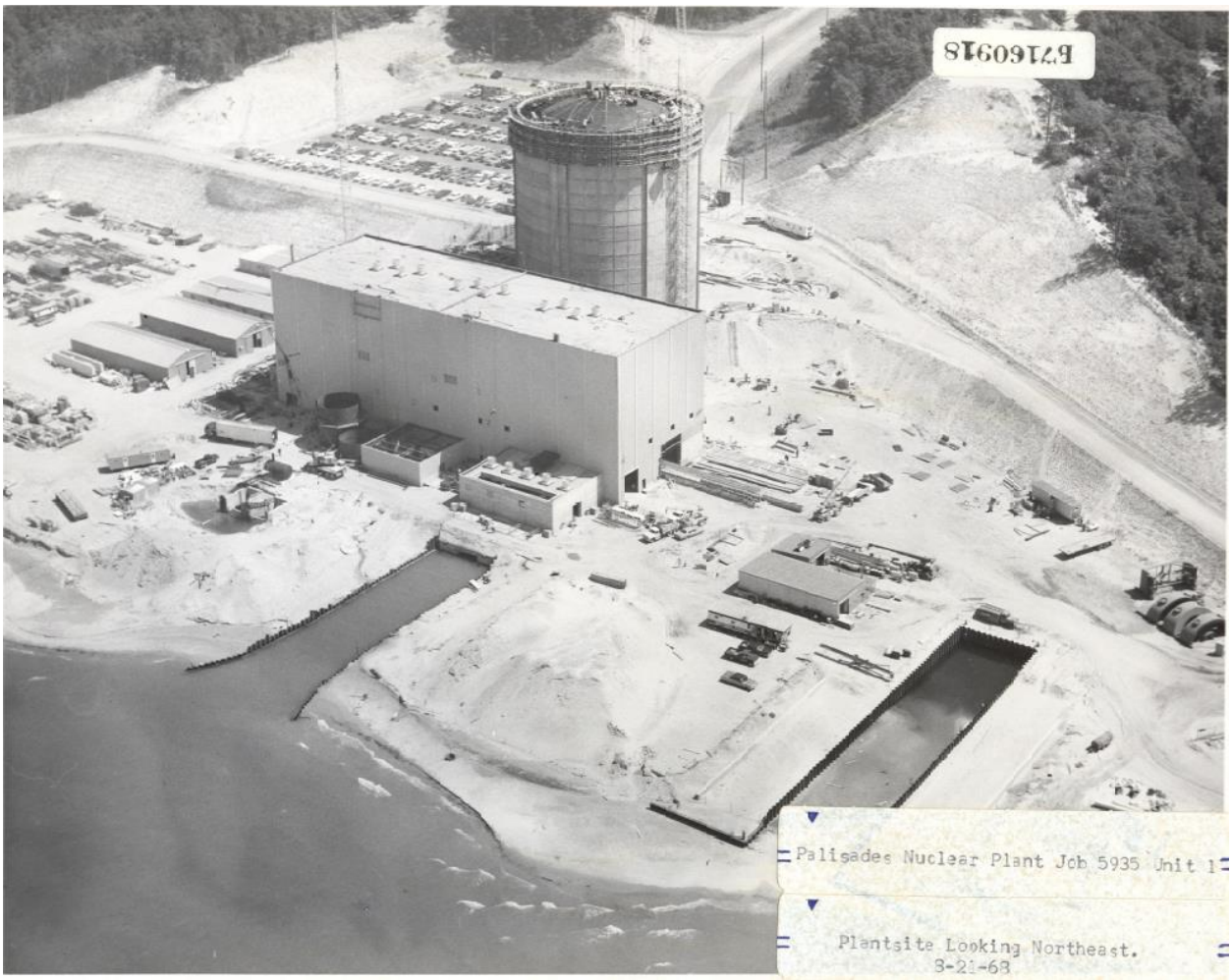

Figure I-13 A Photograph from August 31, 1967 Looking Southeast from the Auxiliary Building Foundation of Palisades Nuclear Plant. Note the Cleared Vegetation and Road Cut into the Sand Dune behind the Crane. The Existing Transmission Pole on Top of the Sand Dune Is Located Where the Current Transmission Lines and Structures Are Located Today. The Sand Dune Has Already Undergone Revegetation. Source: HDI 2024-TN10670.

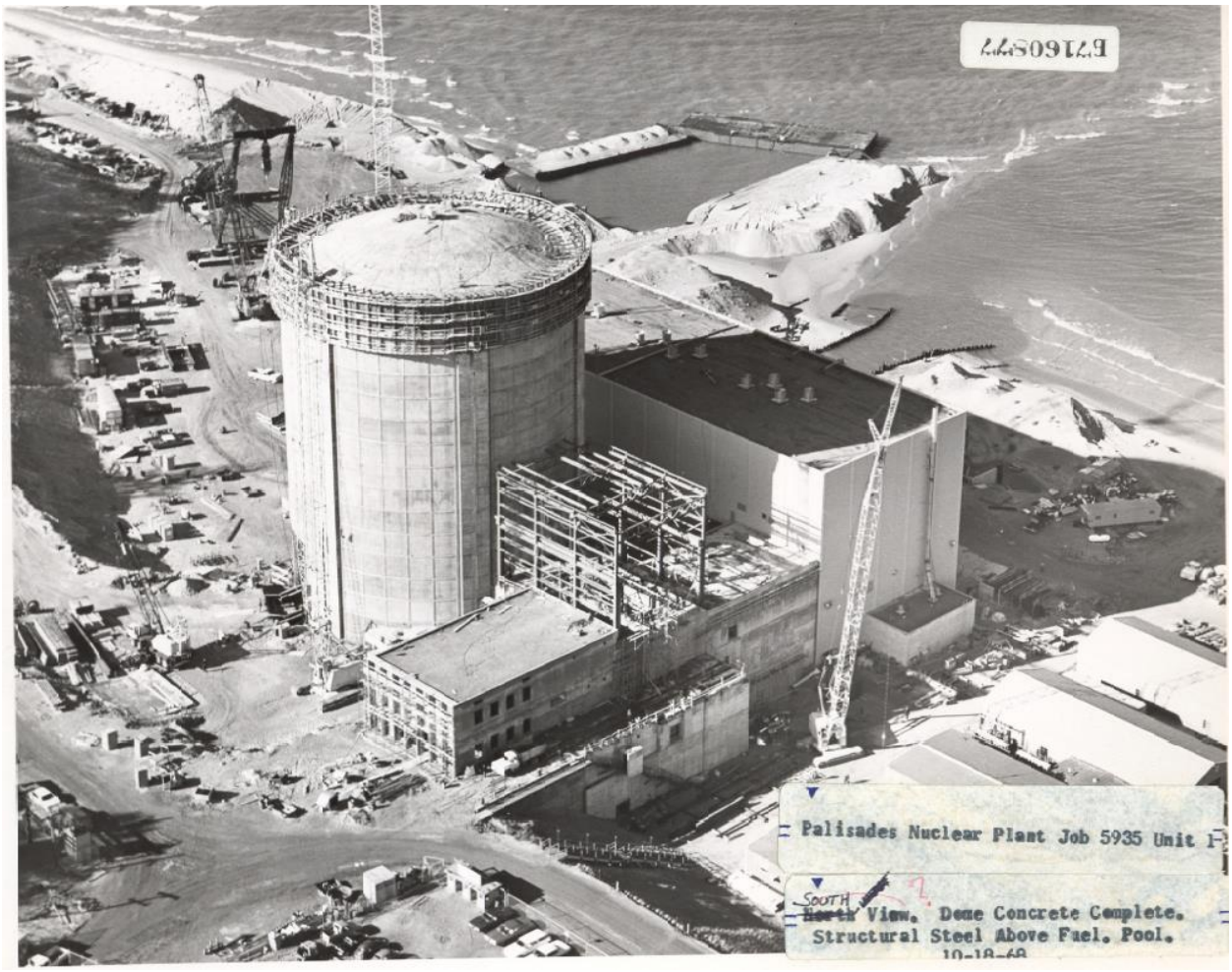

Figure I-14 A Photograph from October 18, 1968, Looking South over Palisades Nuclear Plant Site. Source: HDI 2024-TN10670.

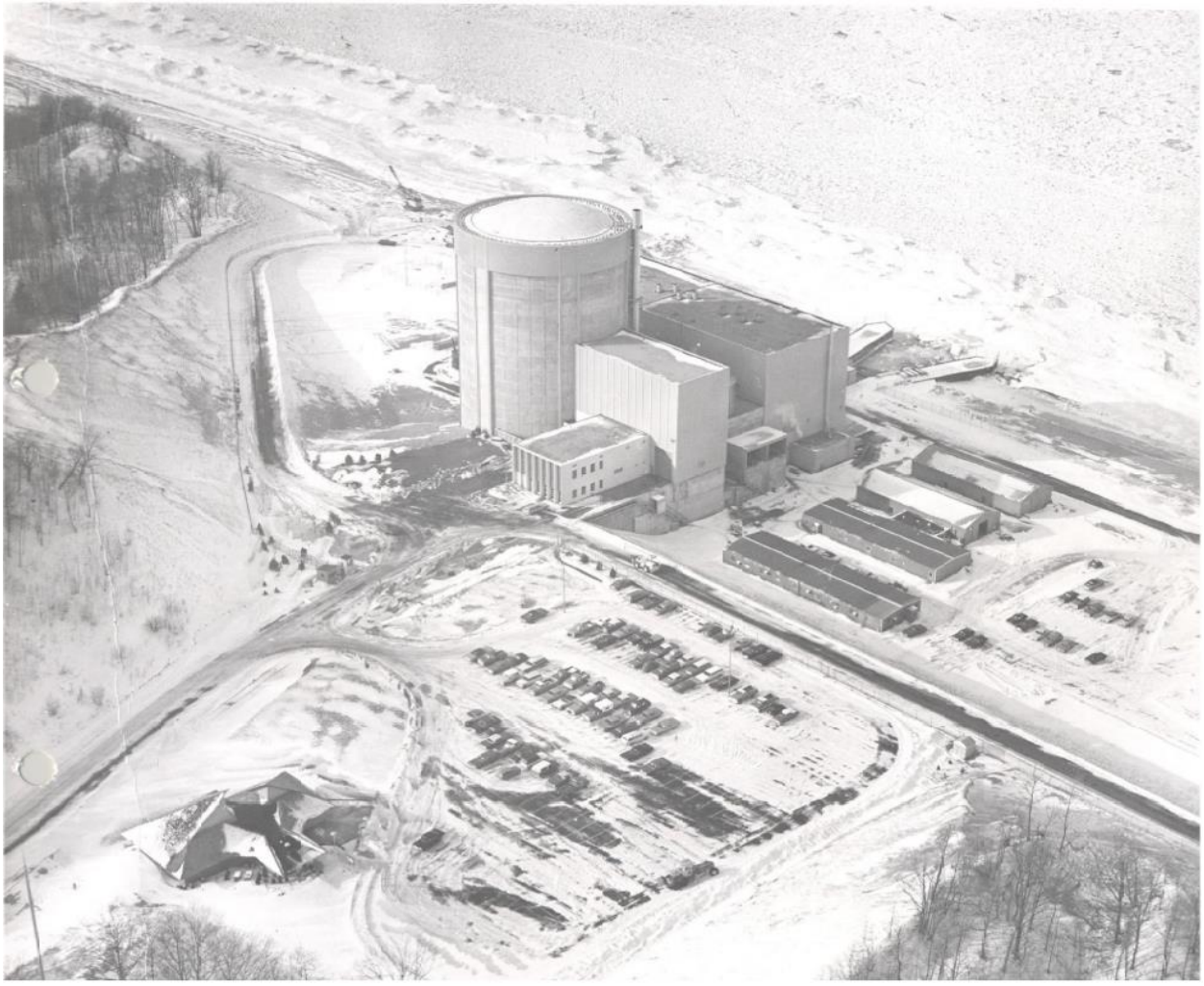

Figure I-15 An Undated Photograph Looking Southwest over Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Left of the Reactor Vessel Building. Source: HDI 2024-TN10670.

Figure I-16 A Photograph from June 28, 1969, Looking South over Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Left of the Reactor Vessel Building and the Land Grading and Vegetation Clearing along the Beach to the South of the Site. This Location Is Where Both Cooling Towers Exist Today. Source: HDI 2024-TN10670.

Figure I-17 A Photograph from November 22, 1969, Looking Northeast over the Palisades Nuclear Plant Site. Note the Cleared Vegetation and Road Cut into the Sand Dune to the Right of the Reactor Vessel Building and the Land Grading and Vegetation Clearing along the Beach to the South of the Site. Source: HDI 2024-TN10670.

I.3 References

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APPENDIX J

ECOLOGY ANALYSES AND TABLES

J.1 State-Listed Terrestrial Species

The U.S. Nuclear Regulatory Commission (NRC or Commission) reviewed the information in the 2006 supplemental environmental impact statement regarding State-listed species, Holtec's exemption request (Holtec 2023-TN10538), updated lists of species known to occur in Van Buren and Berrien counties (MNFI 2024-TN10861, MNFI 2024-TN10862), and other information provided by the applicant (HDI 2024-TN10670: RAI-GEN-3, Attachment 2) and incorporates these species lists by reference. Table J-1 and Table J-2 below present the 58 State-listed species that have been observed in these two counties since 2000.

Two State-listed species have been observed at the Palisades site: the endangered prairie vole and the threatened eastern box turtle (HDI 2024-TN10670: RAI-GEN-3, Attachment 2). The prairie vole is a small rodent that has not been seen in Van Buren County since 1960 and Berrien County since 1962 (MNFI 2021-TN10874).

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles

Group	Scientific Name	Common Name	State Status[a]	Habitats[b]	Year Last Observed in Van Buren or Berrien County
Bird	*Centronyx henslowii*	Henslow's sparrow	E	Old field and pasture habitats such as weedy or grassy fields and meadows often in low-lying or damp areas with widely scattered shrubs.	2007
Bird	*Ixobrychus exilis*	Least bittern	T	Tall, dense stands of emergent vegetation over water 4–30 in. deep and are typically only a few meters from a nearby opening.	2014
Bird	*Parkesia motacilla*	Louisiana waterthrush	T	Broad forested areas along clear streams and may nest right on the stream bank in exposed roots.	2021
Mammal	*Myotis lucifugus*	Little brown bat	T	Often forage around streams, ponds, and lakes. Maternity roosts in human-made structures (barns, houses, large buildings, and the underside of bridges), tree hollows and under loose bark.	2005

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles (Continued)

Group	Scientific Name	Common Name	State Status[(a)]	Habitats[(b)]	Year Last Observed in Van Buren or Berrien County
Vascular plant	*Asclepias purpurascens*	Purple milkweed	T	Occurs in dry to mesic prairies and savannas, dry open roadsides, along railroads, and in fencerows.	2008
Vascular plant	*Baptisia lactea*	White or prairie false indigo	T	Associated with patterned fen complexes, the margins of shallow lakes/intermittent wetlands, within coastal plain marshes, and lakeplain wet-mesic prairies.	2017
Vascular plant	*Boechera dentata*	Rock cress	T	Floodplain forests and adjacent steep banks and high bluffs, usually in sites with thick canopies and less than 20% ground cover.	2021
Vascular plant	*Carex crus-corvi*	Raven's-foot sedge	E	Wet floodplain forests and buttonbush depressions.	2015
Vascular plant	*Carex seorsa*	Sedge	T	Pine barrens, other savanna and prairie types, openings within coniferous and oak forests, and on limestone pavement.	2006
Vascular plant	*Collinsia verna*	Blue-eyed Mary	T	Moist soil rich beech-maple forests with a rich humus layer, and on levees and terraces within floodplain forests.	
Vascular plant	*Corydalis flavula*	Yellow fumewort	T	Floodplain forests and mesic hardwood forests in southwestern Lower Michigan.	2022
Vascular plant	*Cypripedium candidum*	White lady slipper	T	Alkaline wetlands in southern Lower Michigan, particularly prairie fens and occasionally in lakeplain wet and wet-mesic prairies along coastal areas in the Thumb region.	2022
Vascular plant	*Dichanthelium leibergii*	Leiberg's panic-grass	T	Found in dry to wet-mesic prairies, savannas, and openings in oak forest.	2013
Vascular plant	*Dichanthelium microcarpon*	Small-fruited panic-grass	X	Moist woods and thickets in or near forested and unforested wetlands.	2019

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles (Continued)

Group	Scientific Name	Common Name	State Status[a]	Habitats[b]	Year Last Observed in Van Buren or Berrien County
Vascular plant	*Dichanthelium polyanthes*	Round-seed panic-grass	E	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain and outwash landscapes.	2019
Vascular plant	*Eryngium yuccifolium*	Rattlesnake-master or button snakeroot	E	Sedge and grass-dominated portions of prairie fen complexes, including thickets along stream drainage; sandy soils and wet prairies in former oak savannas and oak barrens, often in small remnants along power lines and railroad rights-of-way.	2016
Vascular plant	*Eutrochium fistulosum*	Hollow-stemmed Joe-pye weed	T	Low, sunny, rich woods and floodplains	2021
Vascular plant	*Filipendula rubra*	Queen-of-the-prairie	T	Known primarily within the State distribution from prairie fens in southwest Lower Michigan, principally in glacial interlobate areas where these alkaline, groundwater fed systems usually occur, especially in association with lake and river complexes and other large drainages.	2004
Vascular plant	*Fraxinus profunda*	Pumpkin ash	T	Floodplain forests in southern Lower Michigan, usually in lower bottoms. Also found in deciduous swamps.	2006
Vascular plant	*Hieracium paniculatum*	Panicled hawkweed	T	Associated with sandy oak woods, particularly on old dunes.	2021
Vascular plant	*Hydrastis canadensis*	Goldenseal	T	Southern hardwood forests, as well as moist ravines and portions of riparian forests.	2006
Vascular plant	*Ipomoea pandurata*	Wild potato vine or man-of-the-earth	T	Woods and thickets, open fields, roadsides, and sandy ground.	2019
Vascular plant	*Isotria verticillata*	Whorled pogonia	T	Successional bogs, successional oak and red maple forest in lower slope position and in seasonally inundated, acid hardwood swamps with diverse microtopography (hummocks	2022

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles (Continued)

Group	Scientific Name	Common Name	State Status[a]	Habitats[b]	Year Last Observed in Van Buren or Berrien County
				and hollows), within a matrix of upland oak forest.	
Vascular plant	*Juncus brachycarpus*	Short-fruited rush	T	Areas with a fluctuating water table such as coastal plain marshes, sandy lake edges, dune swales, seepages, sandy marshes, sandy and peaty edges of wetlands, and intermittent wetlands.	2011
Vascular plant	*Juncus scirpoides*	Scirpus-like rush	T	Found in areas with a fluctuating water table such as coastal plain marshes, sandy lake edges, dune swales, seepages, sandy marshes, sandy and peaty edges of wetlands, and intermittent wetlands.	2021
Vascular plant	*Lechea pulchella*	Leggett's pinweed	T	Edges of seasonally inundated intermittent wetlands.	2015
Vascular plant	*Lygodium palmatum*	Climbing fern	E	Michigan's single known locality for this disjunct species is a larch and poison sumac thicket on the edge of a sedge marsh. Elsewhere occurs in moist thickets and woods in acid soil.	2015
Vascular plant	*Mertensia virginica*	Virginia bluebells	T	First and second bottoms of riparian forests.	2016
Vascular plant	*Mimulus alatus*	Winged monkey flower	T	Moist open woods and stream banks.	2015
Vascular plant	*Morus rubra*	Red mulberry	T	Forested floodplains, wet-mesic swamps, and bluffs, including wooded dunes.	2010
Vascular plant	*Panax quinquefolius*	Ginseng	T	Rich shaded forests with loamy soils and heavy canopies.	2023
Vascular plant	*Panicum verrucosum*	Warty panic-grass	T	Areas with a fluctuating water table such as coastal plain marshes, sandy lake edges, dune swales, seepages, sandy marshes, sandy and peaty edges of wetlands, and intermittent wetlands.	2014
Vascular plant	*Phlox maculata*	Wild sweet William	T	Moist prairies and fens.	2013

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles (Continued)

Group	Scientific Name	Common Name	State Status[a]	Habitats[b]	Year Last Observed in Van Buren or Berrien County
Vascular plant	*Polemonium reptans*	Jacob's ladder	T	Frequently inhabits prairie fens, wet prairies, and mesic floodplains.	2005
Vascular plant	*Primula meadia*	Shooting star	E	Wet-mesic to mesisaic prairies and prairie fens.	2013
Vascular plant	*Rhexia mariana*	Maryland meadow beauty	T	Areas with a fluctuating water table such as coastal plain marshes, sandy lake edges, dune swales, seepages, sandy marshes, sandy and peaty edges of wetlands, and intermittent wetlands.	2021
Vascular plant	*Scleria reticularis*	Netted nut rush	T	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain landscapes.	2015
Vascular plant	*Silene stellata*	Starry campion	T	Dry, open woodlands on sandy soils, dry-mesic forest on or just above the upper margin of river floodplains, and savanna and prairie remnants.	2015
Vascular plant	*Silphium integrifolium*	Rosinweed	T	Prairie remnants along roads and railroad tracks or in cemeteries, in wet-mesic prairies and fens on peaty mucks and loams, and on dry-mesic to mesic loams and sandy loams.	2009
Vascular plant	*Silphium laciniatum*	Compass plant	E	Mesic and dry-mesic prairie remnants, and degraded habitats along rights-of-way outside the core range of the species.	2009
Vascular plant	*Silphium perfoliatum*	Cup plant	T	River floodplains in forest openings and edges.	2010
Vascular plant	*Smallanthus uvedalia*	Yellow-flowered leafcup	T	Rich woods and moist borders of swamps.	2018
Vascular plant	*Symphyotrichum sericeum*	Western silvery aster	T	Found in openings within oak-pine barrens, often in bowl prairies, dry banks, and old fields.	2009
Vascular plant	*Tipularia discolor*	Cranefly orchid	E	Beech groves or rich mesic forests dominated by hemlock, sugar maple, yellow birch, and	2019

Table J-1 State-listed Endangered and Threatened Terrestrial Species That Are Not Federally Listed and That Have Been Observed in Berrien or Van Buren County, Michigan since 2000 Are Not Amphibians or Reptiles (Continued)

Group	Scientific Name	Common Name	State Status[(a)]	Habitats[(b)]	Year Last Observed in Van Buren or Berrien County
				beech. It is often found at the base of slopes or flats along streams.	
Vascular plant	*Trichostema dichotomum*	Bastard pennyroyal	T	Oak savanna areas in southern Lower Michigan.	2008
Vascular plant	*Triphora trianthophora*	Nodding pogonia or three birds orchid	T	Rich beech-maple forests and old wooded dune forests with well-developed humus layers.	2023
Vascular plant	*Valeriana edulis var. ciliata*	Edible valerian	T	Alkaline fens in southern Lower Michigan.	2013

(a) State Status: E = State Endangered, T = State Threatened; X = Presumed Extirpated but would be treated as State Threatened.
(b) Habitat information compiled from Michigan Natural Features Inventory (MNFI 2023-TN10757, MNFI 2023-TN10758).

Table J-2 Amphibians and Reptiles Listed as State Endangered or Threatened That Have Been Observed in Berrien and Van Buren Counties Before 2000 or That are Listed as Species of Special Concern and Have Been Observed in Berrien and Van Buren Counties

Group	Scientific Name	Common Name	State Status[(a)]	Habitats[(b)]	Last Seen in Counties
Amphibian	*Acris blanchardi*	Blanchard's cricket frog	T	Open edges of permanent and temporary ponds, lakes, floodings, bogs, seeps, slow-moving streams, and rivers.	2021
Amphibian	*Ambystoma opacum*	Marbled salamander	-	Most common in moist lowland forests but also can occur in upland forests and dry, forested rocky hillsides.	1966
Amphibian	*Lithobates palustris*	Pickerel frog	SC	Freshwater aquatic and wetland habitats, including fens, bogs, marshes, shrubby/open wet meadows, forested wetlands, ponds, slow-moving streams, springs, and backwater sloughs or swamps.	2018

Table J-2 Amphibians and Reptiles Listed as State Endangered or Threatened That Have Been Observed in Berrien and Van Buren Counties Before 2000 or That are Listed as Species of Special Concern and Have Been Observed in Berrien and Van Buren Counties (Continued)

Group	Scientific Name	Common Name	State Status[(a)]	Habitats[(b)]	Last Seen in Counties
Reptile	*Clemmys guttata*	Spotted turtle	T	Clean, shallow bodies of standing or slow-flowing water with muddy or mucky bottoms and aquatic or emergent vegetation. Frequently found on land in open habitats, especially during mating and nesting seasons.	2020
Amphibian	*Necturus maculosus*	Mudpuppy	SC	Permanent waters including rivers, perennial streams, ponds, inland lakes, Great Lakes bays and shallows, reservoirs, canals, and ditches.	2009
Amphibian	*Siren intermedia nettingi*	Western lesser siren	E	Ponds, ditches, sluggish streams, shallow lakes, and backwater sloughs.	2021
Reptile	*Clonophis kirtlandii*	Kirtland's snake	T	Open wetlands such as wet prairies, prairie fens, wet meadows and marshes, but they also occur in openings or along the edges of forested wetlands and floodplains.	1965
Reptile	*Emydoidea blandingii*	Blanding's turtle	SC	Clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms and adjacent terrestrial habitats: ponds, marshes, swamps, bogs, wet prairies, river backwaters, embayments, sloughs, slow-moving rivers, and lake shallows and inlets.	2021
Reptile	*Opheodrys vernalis*	Smooth green snake	SC	Moist, grassy habitats, including prairies, savannas, meadows, old fields, pastures, roadsides, vacant lots, stream borders, and marsh and lake edges. Also can be found in open moist deciduous and pine forests and along forest edges.	2001
Reptile	*Pantherophis spiloides*	Gray rat snake	SC	Usually occur in forests, primarily deciduous forests. Also use adjacent open habitats including shrubby fields, prairies and marsh and bog edges. Often found in or around barns, outbuildings, old foundations and trash dumps.	2019

Table J-2 Amphibians and Reptiles Listed as State Endangered or Threatened That Have Been Observed in Berrien and Van Buren Counties Before 2000 or That are Listed as Species of Special Concern and Have Been Observed in Berrien and Van Buren Counties (Continued)

Group	Scientific Name	Common Name	State Status[(a)]	Habitats[(b)]	Last Seen in Counties
Reptile	*Terrapene carolina carolina*	Eastern box turtle	T	Known from site (HDI 2024-TN10670 Enclosure 3, Attachment 2). Forested habitats with sandy soils near a source of water such as a stream, pond, lake, marsh or swamp; adjacent thickets, old fields, pastures, or vegetated dunes. Access to unshaded nesting sites in sandy, open areas, is critical for successful reproduction.	2021

(a) State Status: T = State Threatened; SC = Species of Concern.
(b) Habitat information compiled from Michigan Natural Features Inventory (MNFI 2023-TN10758).

J.2 Eagles and Migratory Birds

The Palisades site is located in the Mississippi flyway, an important bird migration route which extends from the Gulf Coast to the Arctic Circle. Migrant birds often fly at night, landing to rest early in the morning. Suitable habitats that allow migratory birds to feed, rest, and avoid predators are called stopovers. Large natural barriers may create crowded stopover locations because flights over the barriers mean long stretches without opportunities to rest or feed. Along the Mississippi flyway, Hudson Bay and the Great Lakes are major barriers. Many species of migratory birds likely use the Palisades site and vicinity during the spring and fall migrations.

Two regulations govern management of eagles and other migratory birds. The Bald and Golden Eagle Protection Act (16 *United States Code* [U.S.C.] 668-668d-TN1447) extends regulatory protections to the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*). The Act prohibits anyone without a permit from the U.S. Secretary of the Interior from “taking” bald eagles or golden eagles, including their parts, nests, or eggs. The Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.-TN3331) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale any migratory bird or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued under Federal regulations.

J.3 Terrestrial Invasive Species

The Southwest by Southwest Corner Cooperative Invasive Species Management Area, which includes the location of the Palisades site, has identified 12 terrestrial species as specific targets for detecting and controlling if found (Van Buren CD 2024-TN10877): three insects (Asian long-horned beetle [*Anoplophora glabripennis*], hemlock wooly adelgid [*Adelges tsugae*] and spotted lanternfly [*Lycorma delicatula*]), one fungal disease (oak wilt [*Bretziella fagacearum*]), and eight plants (black swallowwort [*Cynanchum louiseae*]; pale swallowwort [*Cynanchum rossicum*]; Chinese yam [*Dioscorea polystachya*]; flowering rush [*Butomus umbellatus*], Japanese knotweed [*Fallopia japonica*]; Japanese stiltgrass [*Microstegium vimineum*]; kudzu [*Pueraria montana* var. *lobata*]; and common reed [*Phragmites australis*]).

J.4 Aquatic Biota Community Descriptions

Plankton

Plankton are small and often microscopic organisms that drift or float in the water column. In some nearshore areas, there is excessive growth of the nuisance algae *Cladophora* spp. and toxic blooms of cyanobacteria occur in Green Bay, Wisconsin. While cyanobacteria that produces cyanotoxins have been found in inland lakes in Michigan there were no reported blooms in Lake Michigan during 2022 or 2023 (MEGLE 2024-TN10716). Overall, in the last 10 years invasive mussels have reduced the amount of algae present, altering the food web and decreasing the amount of food available to higher trophic levels (State of the Great Lakes 2022-TN10759) (Table J-3 of this environmental assessment [EA]). A decline in spring phytoplankton levels has also been observed, primarily caused by a decrease in diatoms that are selectively consumed by invasive zebra and quagga mussels (EPA 2024-TN10717). In the 2000s, zooplankton biomass rapidly declined, including the loss of cladocerans in 2004, and has since stabilized at reduced levels (Table J-3 of this EA), resulting in a dominance of calanoid copepods as the oligotrophic zooplankton community (State of the Great Lakes 2022-TN10719). This long-term decline of zooplankton has contributed to a lower overall abundance of prey fish, which are discussed later.

Macrophytes

Aquatic macrophytes are large plants, both emergent and submerged, that inhabit shallow water areas. Macrophytes within Lake Michigan include duckweed, cattails, and rushes. The U.S. Environmental Protection Agency Coastal Wetland Monitoring Program considers the coastal wetland vegetation in the southeast side of Lake Michigan to be degraded but less so when compared to plant communities in Lakes Ontario and Erie (EPA 2023-TN9721). The U.S. Environmental Protection Agency attributes this to less nutrient runoff and less invasive species as compared to the other Great Lakes. The areas directly adjacent to Palisades Nuclear Plant (Palisades) are sandy beaches, suggesting a relatively high-energy shoreline without much, if any, terrestrial vegetation.

Benthic Invertebrates

Benthic invertebrates inhabit the bottom of the water column and its substrates. They include macroinvertebrates (clams, crabs, oysters, and other shellfish) as well as certain zooplankton. Researchers have studied Lake Michigan benthic invertebrates since 1931 (Robertson and Alley 1966-TN10786). The invasion by first the zebra mussels in 1993 (*Dreissena polymorpha*) and then quagga mussels in 2004 (*Dreissena rostriformis bugensis*) led to further declines in phytoplankton during the last 20 years (Nalepa et al. 2009-TN10720). During that time *Diporeia* spp. and Sphaeriida (bivalves) declined in abundance; however, Oligochaeta (aquatic worms) increased (Mehler et al. 2020-TN10760). Over this same period quagga mussels outcompeted zebra mussels and became the dominant benthic macroinvertebrate in the Lake Michigan southern basin by density (65 percent), followed by Oligochaeta (29 percent), Chironomidae (4.7 percent), *Diporeia* sp. (1.7 percent), and Sphaeriidae (0.3 percent) (Mehler et al. 2020-TN10760; Nalepa et al. 2010-TN10960). Overall changes in the primary production in the southern basin have been driven by changes in phosphorus loading and the invasion of zebra and quagga mussels (Mehler et al. 2020-TN10760). Zebra and quagga mussels are invasive, filter feeders that densely colonized benthic environments, causing significant changes to ecosystem functions, such as increased light penetration, altered nutrient cycles, and reduced phytoplankton abundance (EPA 2024-TN10721). Quagga mussels are now

the most abundant benthic organisms in Lake Michigan, contributing to overall lower phosphorus levels and decreased phytoplankton biomass. *Diporeia* is a benthic amphipod that feeds on algae, mainly diatoms, that settle to the lake floor (Nalepa et al. 2000-TN10722). This benthic amphipod is prey to most of the fish species in Lake Michigan (State of the Great Lakes 2022-TN10723). *Diporeia*, once the most abundant benthic organism at depths below 98 ft (30 m), have been in decline since invasive *Dreissena* mussels (the genus that contains quagga and zebra mussels) arrived and outcompeted them by depleting food sources in the water column (Edlund et al. 2021-TN10761). Samples taken in 2015 showed that *Diporeia* abundances at depths below 295 ft (90 m) have decreased by 58 percent in the last decade and are rare at depths above 295 ft (90 m) (Table J-3 of this EA)(State of the Great Lakes 2022-TN10723).

Juvenile and Adult Fish

The Michigan Department of Natural Resources (MDNR) is responsible for managing fisheries in the State and Palisades is located within the Southern Lake Michigan Management Unit. Managed fisheries in the vicinity of the plant include trout (brown [*Salmo trutta*], non-native rainbow [*Oncorhynchus mykiss*], and steelhead [*Oncorhynchus mykiss irideus*]), salmon (Salmonidae), largemouth bass (*Micropterus salmoides*), perch (*Perca* spp.), walleye (*Sander vitreus*), and whitefish (*Coregonus* spp.). Walleye are stocked into waterbodies in the Southern Lake Michigan Management Unit in early spring, late spring, and fall by MDNR (MDNR 2019-TN10724).

MDNR along with U.S. Geological Survey and U.S. Fish and Wildlife Service (FWS) conduct yearly prey fish sampling in Lake Michigan using bottom trawling and acoustic surveys of the mid and upper water column each year. In 2021 the bottom trawl collected alewife (*Alosa pseudoharengus*, non-native), bloater (*Coregonus hoyi*), rainbow smelt (*Osmerus mordax*, non-native), deepwater sculpin (*Myoxocephalus thompsonii*), slimy sculpin (*Cottus cognatus*), ninespine stickleback (*Pungitius pungitius*), and round goby (*Neogobius melanostomus*, invasive) (Warner et al. 2021-TN10725). The survey estimated total biomass of prey fish at 2.14 lb/ac (2.4 kg/ha), the fifth lowest recorded result since 1972, concurring with a trend of biomass density below 8.9 lb/ac (10 kg/ha) since 2010 (Warner et al. 2021-TN10725). The 2021 prey fish community was dominated by alewives (28 percent), round gobies (27 percent), and bloaters (24 percent) (Warner et al. 2021-TN10725). The acoustic survey was dominated by bloaters (67 percent) (Table J-3 below), although the dominant prey fish species vary, and in recent years the overall abundance has not (Warner et al. 2021-TN10725). However, there have been considerable declines in alewife, rainbow smelt, and yellow perch populations in Lake Michigan since the 1970s and 80s.

J.5 State of the Great Lakes Aquatic Habitat and Species Assessment

Table J-3 State of the Great Lakes Aquatic Habitat and Species Assessment, 2010–2020

Indicator	Status	10-Year Trend	Details
Phytoplankton	Fair	Deteriorating	A reduction in phytoplankton and consequent diminution in seasonality has occurred. Lower levels of primary production could be reducing resources for higher trophic levels.
Zooplankton	Good	Unchanging	The oligotrophic zooplankton community has been dominated by calanoid copepods since the early 2000s. Decreases in zooplankton biomass with loss of cladocerans was evident in 2004.
Benthos	Good	Unchanging	Overall oligotrophic condition, no significant long-term or 10-year trends observed in the trophic condition of the lake.
Diporeia spp.	Poor	Deteriorating	*Diporeia* spp. abundances continue to decline in Lake Michigan.
Native Prey Fish Diversity	Fair	Unchanging	78% of prey fish community are native fish species (data from 2018–2020).

Source: Data presented in table here adapted from the State of the Great Lakes (State of the Great Lakes 2022-TN10726).

J.6 State-listed Aquatic Species

Table J-4 State-listed Aquatic Species That May Occur Within 1 mi (1.6 km) of Palisades Nuclear Plant

Scientific Name	Common Name	Type	Habitat	State Status	Last Observed
Faxonius immunis	calico crayfish	Crayfish	Calico crayfish often inhabit slow-moving or stagnant waters and are resistant to conditions with low dissolved oxygen and high turbidity.	Special Concern	2015
Coregonus artedi	lake herring or cisco	Fish	Lake herring are found in deep inland lakes as well as the Great Lakes at depths ranging from 18 to 53 m. They can be found in shallower depths (9–12 m) when spawning over rocky substrates.	Threatened	1995
Coregonus zenithicus	shortjaw cisco	Fish	The shortjaw cisco is a deep, cold water species that spawns at depths of 36 to 73 m over clay substrates.	Endangered	1994
Fundulus dispar	starhead topminnow	Fish	Starhead topminnows occur in quiet vegetated waters.	Special Concern	2016

Table J-4 State-listed Aquatic Species That May Occur Within 1 mi (1.6 km) of Palisades Nuclear Plant (Continued)

Scientific Name	Common Name	Type	Habitat	State Status	Last Observed
Lepisosteus oculatus	spotted gar	Fish	The spotted gar requires clear, quiet water with abundant aquatic vegetation. It occurs in backwater areas of rivers, lakes and wetlands. Like other gar species, it is tolerant of warm water with low dissolved oxygen levels. They spawn in shallow, warm water.	Special Concern	2013
Alasmidonta viridis	slippershell	Mussel	The slippershell typically occurs in creeks and headwaters of rivers in sand or gravel substrates. Occasionally, they occur in larger rivers and lakes and in mud substrates.	Threatened	2022
Lasmigona compressa	creek heelsplitter	Mussel	The creek heelsplitter is found in creeks and small rivers in a variety of substrates.	Special Concern	2009
Lasmigona costata	flutedshell	Mussel	The flutedshell is found in small and medium rivers, and in Lake St. Clair and Lake Erie. They are often found in sandy mud and cobble substrates.	Special Concern	2022
Pleurobema sintoxia	round pigtoe	Mussel	The round pigtoe occurs in mud, sand, or gravel substrates of medium to large rivers.	Special Concern	2009

Sources: Data presented in table from MNFI 2024-TN10861, MNFI 2024-TN10862, MNFI 2024-TN10734.

J.7 Biological Evaluation

J.7.1 Endangered Species Act Section 7 Consultation

As a Federal agency, the NRC must comply with the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.-TN1010), for any action authorized, funded, or carried out by the agency. The NRC proposed action is to reauthorize nuclear power operations at the Palisades in Covert Township, Michigan and refueling of the reactor. Under Section 7 of the ESA, the NRC must consult with the FWS and the National Marine Fisheries Service (NMFS) (“the Services” [collectively] or “Service” [individually]), as appropriate, to ensure that the proposed action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. The U.S. Department of Energy (DOE) is also consulting at this time with the FWS under Section 7 for the Palisades project. The DOE proposed action is a decision whether to provide Federal financial assistance for refueling and resumption of power generation activities at Palisades pursuant to Holtec’s loan guarantee agreement with DOE that was issued pursuant to the Energy Policy Act of 2005.

The ESA, and the regulations that implement ESA Section 7 at Title 50 of the *Code of Federal Regulations* (CFR) Part 402 (50 CFR Part 402-TN4312), describe the consultation process that Federal agencies must follow in support of agency actions. As part of this process, the Federal agency proposing the action (the action agency) must request that the Services (1) provide a list of any listed or proposed species or designated or proposed critical habitats that may be present in the action area, or (2) request that the Services concur with a list of species and critical habitats that the Federal agency has created (50 CFR 402.12(c)). In recent years, most action agencies, including NRC, have used an online database developed by the FWS, termed Information for Planning and Consultation, to obtain this preliminary information rather than directly communicating with FWS. If the preliminary information reveals that listed species or critical habitats may be present, the action agency then typically prepares a biological assessment or biological evaluation to evaluate the potential effects of the action and determine whether the species or critical habitats are likely to be adversely affected (50 CFR 402.12(a); 16 U.S.C. 1536(c)-TN4459).

Biological assessments are required for any Federal agency action that is a “major construction activity” (50 CFR 402.12(b) (TN4312). A major construction activity is a construction project or other undertaking having construction-type impacts that is a major Federal action significantly affecting the quality of the human environment under the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.)(NEPA)(51 FR 19926-TN7600). However, the proposed action to reauthorize Palisades is not a major construction activity and therefore does not require the preparation of a biological assessment. Nonetheless, the NRC staff still must consider the impacts of this action on federally listed species and designated critical habitats. This consideration is presented below as a biological evaluation. Whether through a biological assessment or biological evaluation, if an action agency such as NRC finds that a proposed action “may affect” ESA-protected species or habitats, it must seek written concurrence from the relevant Service(s) under ESA Section 7.

To provide a biological evaluation to support its consultation, the NRC staff has incorporated its analysis of the potential impacts of the Palisades action into Table J-5, below. The NRC staff define preparation for resumption of operations at Palisades to be those proposed activities listed in Table 3-1 of this EA, and operational impacts at Palisades to be those associated with operating and maintaining a nuclear facility (as described in NRC 2024-TN10161). The NRC staff based its biological evaluation on information received using Information for Planning and Consultation, with the most recent update on January 15, 2025.

The NRC staff structured its biological evaluation in accordance with definitions from 50 CFR 402.12(f) (TN4312). Sections 3.6.1 and 3.7.1 of this EA define and describe the action area and state that no critical habitat for listed species occurs within it. Table J-5 describes each ESA-protected species potentially present in the action area, assesses the potential effects of the proposed action on each species, and presents the NRC’s effect determination for each of species. Table J-6 compares the conclusions from this 2024 biological evaluation with those developed for a supplemental environmental impact statement prepared by NRC in 2006 for license renewal of the Palisades plant. Finally, Section 4.2 addresses the potential effects of the no-action alternative.

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
Indiana bat	**Baseline Information:** According to the recovery plan (FWS 2007-TN934), the Indiana bat is a flying, insectivorous mammal that hibernates in caves and mines and forms maternity roosts in mature trees over 5-in. diameter at breast height, especially trees with exfoliating bark. It roosts and forages in forested or semi-forested areas. Threats include disturbance to the hibernacula, loss and fragmentation of forested swarming and roosting habitat, chemical contaminants, collision with wind turbines, and white-nose syndrome. **Site Occurrence:** The Indiana bat is not known to occur on the Palisades site. Individuals may be present in the area in spring, summer, and fall in very low numbers. Forest habitat that could potentially be used by federally listed bat species does occur in undeveloped areas of the site (Holtec International 2023-TN10538: pp. 94–95), which the applicant has modeled to be on the site's eastern and southern portions (SMR 2024-TN10713: p. 8). **Preparation Impacts:**[1-5] Proposed activities would occur only in previously developed areas of site, and no forest would be disturbed (Figure 3-5 of this EA). Preparation activities are expected to occur over an 18-month period. The applicant has estimated that approximately 3,000 truck deliveries would take place over this period (HDI 2024-TN10670: RAI-GEN-1). Temporary increases in noise and traffic over this time period are unlikely to alter Indiana bat use of the site. Bat collisions with vehicles and human-made structures at nuclear power plants are not well documented but are likely rare based on available information (NRC 2024-TN10161: p. 3-63). **Operations Impacts:**[1-5] For the 2006 SEIS (NRC 2006-TN7346), operational impacts were determined to be NLAA. Proposed operational activities are anticipated to be similar in magnitude and frequency as the previous operations characterized in the SEIS. No forest would be disturbed. Indiana bats, if present in the area, have likely already acclimated to the noise, vibration, and general human disturbances associated with site maintenance, infrastructure repairs, and other site activities. Holtec reports no bat incidents at the Palisades site and states that it would consult with FWS as an administrative control for any unanticipated construction or tree removal activities during operations (Holtec International 2023-TN10538: pp. 94–95). The NRC staff recognizes that individuals may have to reacclimate to the resumption of past operational conditions, but based on the relatively short duration of the shutdown it is the staff's professional judgment that the adverse effects would not be substantial.	NLAA

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
northern long-eared bat (NLEB)	**Baseline Information:** According to the final rule (80 FR 17974-TN4216), the NLEB is a flying, insectivorous mammal found across much of the eastern and north-central United States and all Canadian provinces (80 FR 17974-TN4216). It predominantly overwinters in hibernacula including underground caves and mines. In spring, summer, and fall it uses forest habitats and roosts individually or in colonies underneath tree bark or in cavities or crevices of live trees and snags greater than 3 in. (8 cm) in diameter at breast height. Threats include white-nose syndrome, human disturbances of hibernacula and roosts, collision with wind turbines, chemical contaminants, and loss of summer habitat from forest management and conversion. **Site Occurrence:** Same as Indiana bat. **Preparation and Operations Impacts:**[1-5] Same as Indiana bat for preparation activities. Although not evaluated in the 2006 SEIS (NRC 2006-TN7346), the NRC staff expects that operational impacts would be as for Indiana bat, based on the similar species biology, habitat uses, and expected types, magnitude, and frequency of operational activities.	NLAA
tricolored bat	**Baseline Information:** According to a status assessment (FWS 2021-TN8589), the tricolored bat is a flying insectivorous mammal found across much of the eastern and north central United States in parts of southern Canada, Mexico, and Central America. It overwinters in caves and abandoned mines, but also in road culverts. In the spring, summer, and fall it occupies forest habitats and roosts in foliage of live and dead trees. Threats include white-nose syndrome, human disturbances of hibernacula and roosts, collision with wind turbines, loss of summer habitat from forest management and conversion, and climate change. **Site Occurrence:** Same as Indiana bat. **Preparation and Operations Impacts:**[1-4] Same as Indiana bat for preparation activities. Although not evaluated in the 2006 SEIS (NRC 2006-TN7346), the NRC staff expects that operational impacts would be the same as for Indiana bat, based on similar species biology, habitat use, and expected types, magnitude, and frequency of operational activities.	NLAA
eastern massasauga	**Baseline Information:** According to a species status assessment (FWS 2016-TN10881), the eastern massasauga is a small venomous rattlesnake that prefers wetland and prairie habitats. An ambush predator, it preys on small mammals, amphibians, and reptiles. Threats include wetland habitat loss and fragmentation from development and agriculture, establishment of woody species and invasive plants, hydrologic alteration, habitat management practices (e.g., prescribed fire, mowing), vehicle mortality, human persecution, collection, predation, and disease. **Site Occurrence:** The species is not known from the Palisades site but is known to occur nearby, within 1 mi (1.6 km) of the site; NRC 2006-TN7346: p. 2-47). Potential occurrence during the species' active season includes habitats occurring in undeveloped areas of the site, including wetlands, dunes, forest edges, scrub-shrub forest, and open woodlands. **Preparation Impacts:**[1-5] No activities are proposed in or adjacent to wetlands or other suitable habitats. It is possible that individuals in undeveloped areas of the site could experience infrequent injury or mortality	NLAA

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
	from vehicles using adjoining roadways. However, the roadways on the site are separated from favorable eastern massasauga habitats by roadside clearings several feet in width, and the potential for snake collisions are no greater than for other arterial roadways in the surrounding rural landscape. **Operations Impacts:** Impacts from operational activities were determined to be NLAA in the 2006 SEIS (NRC 2006-TN7346). Proposed operational activities are anticipated to be of the same magnitude and frequency as anticipated in 2006.	
rufa red knot	**Baseline Information:** According to a species status assessment (FWS 2020-TN8850), the rufa red knot is a medium-sized shorebird known for long distance migration between its breeding habitats in the Canadian Arctic and non-breeding habitats in southeastern United States, northeastern Gulf of Mexico, and South America. It forages on aquatic invertebrate prey in shoreline habitats with large areas of exposed sediments. Threats include habitat loss from coastal development, disturbance from human activities, reduced prey availability, and increasing frequency and severity of mismatches in the timing of the annual migratory cycle relative to favorable food and weather conditions. **Site Occurrence:** The rufa red knot has been observed along an undeveloped beach in Van Buren State Park in July 2020, just north of site boundary (eBird 2024-TN10777). While undeveloped beaches in action area may provide habitat, the developed beaches adjoining the Palisades plant facilities would not. Those beaches have been narrowed and altered by past armoring, which remains in place (site observations by NRC ecologists in 2024). Adults may pass through the Palisades site moving among areas of more suitable foraging habitat along Lake Michigan before migrating to or from breeding habitat. **Preparation Impacts:**[1-5] Proposed activities would be limited to developed portions of site and would not affect habitat for red knots. Undeveloped, unarmored beaches on or near site with potential habitat would not be disturbed or altered by activities. Increased noise and human disturbance during activities along the shoreline could cause red knots to avoid the developed shoreline, if those activities were to occur during the migratory window (May 1–September 30) (FWS 2024-TN10697). However, the birds would simply avoid the developed areas and move to suitable habitat in undeveloped areas, and therefore not be adversely affected. Collisions from increased traffic would be unlikely, especially given that vehicles at Palisades would only use existing roads and not the beach. The NRC staff also recognizes in the LR GEIS that federally listed shorebirds are unlikely to collide with vehicles, given their flying speed (NRC 2024-TN10161: Section 3.6.3.1, p. 3-72). Implementation of permit requirements, environmental protection plans, and BMPs for activities would be protective of the shoreline environment. **Operations Impacts:**[1-5] The rufa red knot was not previously evaluated in 2006 SEIS (NRC 2006-TN7346; NMCCO 2005-TN10839). Undeveloped, unarmored beaches on or near site could potentially provide habitat but would not be disturbed or altered by operational activities. Holtec has a current permit (MEGLE 2020-TN10696) allowing for maintenance dredging of sand and placement of dredged materials on the beach (Section 3.6.1.1).	NLAA

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
	Dredging locations occur only in previously disturbed areas (Holtec International 2023-TN10538: p. 95). Holtec reports no new and significant information regarding bird collisions with plant structures or transmission lines (Holtec International 2023-TN10538: p. 4.3-2). Continued implementation of permit requirements, environmental protection plans, and BMPs for operational activities would be protective of the terrestrial habitats used by this species.	
piping plover (Great Lakes DPS)	**Baseline Information:** According to the recovery plan (FWS 2003-TN8841), the piping plover is a small, plump shorebird. The FWS recognizes three geographically distinct breeding populations and treats them separately in the final rule listing the species. Piping plovers of the Great Lakes Distinct Population Segment breed and raise young mainly on sparsely vegetated beaches, cobble pans, and sand spits of glacial sand dune ecosystems along the Great Lakes shoreline. They forage on exposed beach substrates for invertebrates near the surface of the sand. Foraging habitat and food availability affect chick survival, with mudflats and ephemeral pools providing higher chick survival in some locations, possibly due to greater insect prey availability. Threats include habitat loss and alteration (particularly shoreline development of breeding grounds along Great Lakes and wintering grounds along Atlantic coast), predation, and surface water contamination have contributed to further population declines after initial decline from hunting. **Site Occurrence:** The piping plover is not known from the Palisades site. The beach fronting the developed area has been too narrowed by past armoring to offer potentially suitable piping plover habitat (site observations by NRC ecologists in 2024). Undeveloped beaches on or near site could potentially provide habitat. Adults may pass through the area when moving to more suitable habitat along Lake Michigan. **Preparation and Operations Impacts:** Work would not take place in areas expected to function as breeding or foraging habitats for the piping plover. Operational impacts were not evaluated in the 2006 SEIS (NRC 2006-TN7346; NMCCO 2005-TN10839). Preparation and operational impacts would be similar to those described above for the red knot, based on similar species biology, habitat use, and expected types, magnitude, and frequency of activities.	NLAA
whooping crane	**Baseline Information:** According to a species assessment (FWS 2023-TN8854), the whooping crane is a large wading bird, standing more than 5 ft tall. It presently occurs in wild at three locations and in captivity at 12 sites. The Aransas–Wood Buffalo National Park population is only self-sustaining population (nests in Wood Buffalo National Park and adjacent areas in Canada and winters in the coastal marshes of Aransas County, Texas). Migrants travel during the day along narrow corridors in small groups under limited cloud cover, tail winds, and otherwise favorable conditions. At night, whooping cranes roost in palustrine and riverine wetlands. The species typically selects stopover sites with wide, open views that are isolated from human disturbance (NGPC 2023-TN8876). Whooping cranes tend to stop wherever they happen to be later in the day when conditions are no longer suitable for migration, therefore stopover use patterns are often unpredictable (FWS 2009-TN8856). Thus, whooping cranes could use a particular wetland pond regularly, rarely, or even just once over the course of	NE

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
	several years of migrations. Threats include direct mortality from hunting and wetland habitat loss and fragmentation. **Site Occurrence:** The whooping crane is not known from the Palisades site. Individuals from experimental populations are possible in Michigan, and even those are unlikely. Furthermore, none of the large marshes favored by the species occur on or near the Palisades site (Section 3.6.1 of the EA). **Preparation and Operations Impacts:**[1-5] No potential stopover habitat is proposed for disturbance. The whooping crane was not previously evaluated in 2006 SEIS (NRC 2006-TN7346; NMCCO 2005-TN10839). Holtec reports no new and significant information regarding bird collisions with plant structures or transmission lines (Holtec International 2023-TN10538: p. 4.3-2). Continued implementation of permit requirements, environmental protection plans, and BMPs for operational activities would be protective of habitats used by this species uses.	
Karner blue butterfly (KBB)	**Baseline Information:** The KBB is a flying insect that favors oak savanna and pine barren habitat containing blue lupine (*Lupinus perennis*) (FWS 2024-TN10778). Recent (2024) IPaC searches did not mention this species, but the NRC staff is evaluating it because it was addressed in the 2006 SEIS. **Site Occurrence:** The KBB is not known to occur on the Palisades site, and the specialized habitat it requires is not present on the site or in the surrounding landscape. **Preparation and Operations Impacts**: No preparation or operational activities would take place in or adjacent to habitat for the KBB.	NE
Mitchell's satyr butterfly (MSB)	**Baseline Information:** The MSB is a flying insect with nine known populations in Michigan (FWS 2021-TN10883), and otherwise known or suspected to occur in Alabama, Indiana, Michigan, Mississippi, Ohio, and Virginia (FWS 2021-TN10882). Primary habitat is sedge-dominated wetlands, including fens and wetland edges of beaver ponds, swamps, and seeps (FWS 1998-TN10884, FWS 2021-TN10883). Threats include wetland habitat loss from urban development and adjacent human activities, hydrologic alteration, over-collection by butterfly collectors, inadequacy of existing regulatory mechanisms, limited ability to colonize new habitat patches, infection with the reproductive bacterial parasite *Wolbachia*, and climate change (FWS 2021-TN10883: p.19-24). **Site Occurrence:** The MSB is not known to occur on the Palisades site. No sedge-dominated fens favored by the MSB are present on site (NRC 2006-TN7346: p. 4-34). **Preparation and Operations Impacts:** No preparation or operational activities will occur in or adjacent to habitat for this species.	NE
Monarch butterfly	**Baseline Information:** According to the candidate review (87 FR 26152-TN8591), the monarch butterfly is a flying insect with bright orange wings and black veins and wing borders. It is dependent on milkweeds (primarily *Asclepias* spp.) for egg-laying and larval food. North America populations migrate to Mexico or California in the fall and return in early spring. Adult monarchs feed on nectar from milkweeds and from a variety of plant species. Threats include habitat loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at	NLAA

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
	overwintering sites in Mexico, senescence and incompatible management of overwintering sites in California, urban development, drought, insecticides, and climate change effects. **Site Occurrence:** Flying adults were observed by NRC staff in September 2024 visiting the Palisades site. Widely scattered, occasional milkweed (*Asclepias* spp.) plants were observed by NRC staff in 2024 south of Van Buren State Park, on vegetated dunes close to the beach, and on dunes along the access road. Monarchs and milkweeds are known from Van Buren State Park and site vicinity based on a review of iNaturalist in 2024 (https://www.inaturalist.org/). Larvae are potentially present wherever milkweeds are present. **Preparation Impacts:**[1-5] Ground disturbance as part of preparation could disturb widely scattered milkweed plants growing amid sparse and ruderal vegetation in areas of previously disturbed soils. However, milkweed is a common, quick-growing herbaceous plant that is present at least sparsely in most areas of non-forest vegetation in the area. None of the affected areas contain dense or extensive patches of milkweed. While it is possible that a few milkweed plants containing monarch larvae could be killed, it is unlikely that the losses would noticeably affect monarch populations in the region. If a few milkweed stems are killed by herbicide applications, the losses are likewise not likely to result in noticeable effects on the regional population. Any insecticide applications would likely be limited to in or around buildings or paved areas where milkweed is not present. **Operations Impacts:**[1-5] Same as above.	
Pitcher's thistle	**Baseline Information:** Pitcher's thistle is a herbaceous perennial plant endemic to the Great Lakes region, occupying open sand dunes and low, open beach ridges along the shorelines of Lakes Michigan, Superior, and Huron (FWS 2024-TN10700). FWS has characterized Pitcher's thistle in a recovery plan prepared under the ESA (FWS 2002-TN10885). The plant, which has a deep taproot, is dependent on the ability to continually colonize patches of open, windblown dune habitat, and populations decline as vegetation density in the habitat increases through natural succession. Seedlings grow in a juvenile rosette stage before developing flower stalks at 5 to 8 years of age. Threats include development and disturbance of dune habitat, fragmentation of dune habitat, encroachment into dune habitat by invasive plants, and increased droughts caused by climate change. Additionally, purposefully introduced non-native insects used as biological control agents to control other invasive thistle species could also be adversely affecting Pitcher's thistle populations. **Site Occurrence:** Pitcher's thistle has been observed in undeveloped dune areas on the site, on open sand dune and flats (NRC 2006-TN7346: p. 2-45; HDI 2024-TN10670). The species was known from 1980s and 1990s to occur near the cooling towers. However, none was reported near the cooling towers in 2005. But 113 individuals (9 mature and 104 first year plants) were reported in 2005 in the northern end of the site on a beach grass stabilized dune community and flats adjacent to Van Buren State Park. In a field survey in 2024, 64 individuals were observed approximately 1,000 ft east of the south cooling tower, in a naturally occurring dune clearing surrounded by	NLAA

Table J-5 Biological Evaluation of Federally Listed Species under the Jurisdiction of the U.S. Fish and Wildlife Service to Occur within the Action Area (Continued)

Common Name	NRC Staff Evaluation[a,b]	NRC 2024 Staff Conclusions[c][d]
	deciduous forest. But none was observed in the previous locations where it had been once seen on the site. **Preparation Impacts:**[1,4,5] No activities such as land disturbances, mowing, or herbicide application would take place in or adjacent to areas where Pitcher's thistle is known to occur or previously occur. **Operations Impacts:**[1,4,5] In the 2006 SEIS (NRC 2006-TN7346), operational impacts were determined to be NLAA based on the following: (1) Pitcher's thistle did not occur in locations where it would be affected by operations, (2) no refurbishment or ground-disturbing activities were proposed during the LR period, (3) the applicant had pre--disturbance procedures in place to evaluate impacts to federally listed species, and (4) Michigan EGLE regulates the dune habitats, so any ground disturbance in habitat for this species would require a permit. The same assessment applies to resumption of operations at the present time. The population found in 2024 would not be affected by routine site operation or management, for the following reasons: (1) No disturbances, mowing, or herbicide application to areas where populations are known to exist; (2) continued operations and maintenance activities would be similar and be of same magnitude and frequency as previous operations; (3) dredging (MEGLE 2020-TN10696) would continue to disturb beach and dune areas, likely preventing establishment of new plants; (4) applicant has pre--disturbance procedures in place to evaluate impacts to federally listed species; (5) Michigan EGLE regulates dune habitats, so any ground disturbance in habitat for this species would require a permit; and (6) population found in 2024 separated from the mechanical cooling towers by approximately 1,000 ft of mature deciduous forest. The cooling towers are equipped with drift eliminators. Any drift would be unlikely to penetrate the dense forest, even in leaf-off conditions. See Section 3.6.3 of the EA for a discussion of cooling tower impacts on terrestrial plants.	

BMP = best management practice; DPS = Distinct Population Segment; EA = environmental assessment; EGLE = Environment, Great Lakes, and Energy; FWS = U.S. Fish and Wildlife Service; Holtec = Holtec Decommissioning International, LLC; IPaC = Information for Planning and Consultation; KBB = Karner blue butterfly; LR = license renewal; LR GEIS = license renewal generic environmental impact statement; MSB = Michell's satyr butterfly; NLAA = not likely to adversely affect; NLEB = northern long-eared bat; NRC = U.S. Nuclear Regulatory Commission; SEIS = supplemental environmental impact statement.

(a) All species in this table identified as potentially occurring within the action area via FWS IPAC reports (FWS 2024-TN10697).

(b) Applicable generic impacts considered, along with species specific factors: (1) habitat loss, degradation, disturbance, or fragmentation; and associated effects; (2) behavioral changes resulting from preparation, refurbishment or other site activities; (3) mortality or injury from collisions with nuclear power plant structures and vehicles; (4) vegetation management and pesticide application; and (5) other landscape maintenance activities, stormwater management, other ongoing operations and maintenance activities.

(c) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and National Marine Fisheries Service (NMFS) Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NLAA = may affect, not likely to adversely affect. NE = No effect.

(d) Conclusions address both preparations for resumption of power operations and resumption of power operations.

Table J-6 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Palisades Nuclear Power Plant for this proposed action and for the 2006 LR

Species	Federal Status[a]	Potentially Present in the Action Area?	2006 Effect Determination[b]	2024 Effect Determination[b]	FWS Concurrence Date[c]
northern long-eared bat	FE	Yes	n/a	NLAA	TBD
Indiana bat[d]	FE	Yes	NLAA	NLAA	
tricolored bat	PFE	Yes	n/a	NLAA	TBD
rufa red knot	FT	Yes	n/a	NLAA	TBD
piping plover	FE	Yes	n/a	NLAA	TBD
whooping crane	FE (NEP)	No	n/a	NE	TBD
eastern massasauga[e]	FT	Yes	NLAA	NLAA	TBD
Karner blue butterfly	FE	No	NE	NE	n/a
Mitchell's satyr butterfly	FE	No	NLAA	NE	n/a
Monarch butterfly	PFT	Yes	n/a	NLAA	n/a
Pitcher's thistle	FT	Yes	NLAA	NLAA	TBD

(a) Indicates protection status under the Endangered Species Act. FC = candidate for Federal listing; FE = federally endangered; FT = federally threatened; PFE = proposed for Federal listing as endangered; PFT = proposed for Federal listing as threatened; NEP = in the vicinity of the action area, this species is part of a nonessential experimental population.

(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NLAA = may affect, not likely to adversely affect. NE = No effect.

(c) The ESA does not require Federal agencies to seek FWS concurrence for "no effect" determinations. For n/a = not applicable; TBD = to be determined; the NRC will seek the FWS's concurrence following the issuance of this draft EA.

(d) Source: FWS 2022-TN10701.

(e) Source: FWS 2017-TN10702.

Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service

As discussed in Section 3.7.1.2 of this EA, no federally listed species or critical habitats under NMFS's jurisdiction occur within the action area. Therefore, the NRC staff did not engage the NMFS pursuant to ESA Section 7 for the proposed Palisades reauthorization.

J.8 Magnuson–Stevens Act Essential Fish Habitat Consultation

The NRC must comply with the Magnuson–Stevens Fishery Conservation and Management Act of 1996 (MSA), as amended (16 U.S.C. 1801 et seq.-TN7841), for any actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect any essential fish habitat (EFH) identified under the MSA.

In Section 3.7.1.2 of this EA, the NRC staff concludes that the NMFS has not designated any EFH under the MSA within the action area and that the proposed Palisades reauthorization would have no effect on EFH. Thus, the MSA does not require the NRC to consult with the NMFS for the proposed action.

J.9 National Marine Sanctuaries Act Consultation

The National Marine Sanctuaries Act of 1966, as amended (16 U.S.C. § 1431 et seq.-TN7197), authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities as national marine sanctuaries. Under Section 304(d) of the act, Federal agencies must consult with the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries if a Federal action is likely to destroy, cause the loss of, or injure any sanctuary resources.

In Section 3.7.1.2 of this EA, the NRC staff concludes that no marine sanctuaries occur near Palisades and that the Palisades reauthorization would have no effect on sanctuary resources. Thus, the National Marine Sanctuaries Act does not require the NRC to consult with the National Oceanic and Atmospheric Administration for the proposed action.