

10 CFR 50.82(a)(4)

December 23, 2020

U.S. Nuclear Regulatory Commission  
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Palisades Nuclear Plant  
Docket Nos. 50-255 and 72-007  
Renewed Facility Operating License No. DPR-20

**Subject:** Post Shutdown Decommissioning Activities Report including Site-Specific  
Decommissioning Cost Estimate for Palisades Nuclear Plant

- Reference:**
- [1] Letter from ENOI to US NRC, “Certification of Permanent Cessation of Power Operations, Palisades Nuclear Plant, Docket No. 50-255,” dated September 28, 2017, (ADAMS Accession No. ML17271A233).
  - [2] Letter from ENOI to US NRC, “Supplement to Certification of Permanent Cessation of Power Operations, Palisades Nuclear Plant, Docket No. 50-255,” dated October 19, 2017, (ADAMS Accession No. ML17292A032).
  - [3] Letter from ENOI to US NRC, “Application for Order Consenting to Transfers of Control of Licenses and Approving Conforming License Amendments, Palisades Nuclear Plant Docket Nos. 50-255 and 72-007, and Renewed Facility Operating License No. DPR-20 and Big Rock Point Docket Nos. 50-155 and 72-043, License No. DPR-6,” dated December 23, 2020.
  - [4] Letter from Holtec Decommissioning International, LLC to US NRC, “Request for Exemptions from 10 CFR 50.82(a)(8)(i)(A) and 10 CFR 50.75(h)(1)(iv),” dated December 23, 2020.

Pursuant to 10 CFR 50.82(a)(4), Holtec Decommissioning International, LLC (HDI) is submitting a Post Shutdown Decommissioning Activities Report (PSDAR) for the Palisades Nuclear Plant (Palisades). By letters dated September 28, 2017 and October 19, 2017, Entergy Nuclear Operations, Inc. (ENOI) notified the Nuclear Regulatory Commission (NRC) that it would permanently cease power operations at Palisades no later than May 31, 2022 (References 1 and 2).

By letter dated December 23, 2020, ENOI, on behalf of itself, Entergy Nuclear Palisades, LLC (ENP), Holtec International (Holtec), and HDI, requested that the NRC consent to: (1) the indirect transfer of control of Renewed Facility Operating License No. DPR-20 for Palisades and the general license for the Palisades Independent Spent Fuel Storage Installation (ISFSI) and Facility Operating License No. DPR-6 for Big Rock Point and the general license for the Big Rock Point ISFSI to Holtec; and (2) the transfer of ENOI's operating authority (i.e., its authority to conduct licensed activities at Palisades) to HDI

(Reference 3). The enclosed document provides the HDI PSDAR describing the decommissioning plan to be implemented following NRC approval of the requested license transfers and the sale of Entergy Nuclear Palisades from Entergy to Holtec.

The enclosed PSDAR has been developed consistent with Regulatory Guide 1.185, Revision 1, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report". This PSDAR includes HDI's Site-Specific Decommissioning Cost Estimate (DCE) as Enclosure 1. The site-specific DCE for decommissioning Palisades illustrates that adequate funding is available in the Nuclear Decommissioning Trust (NDT) fund to complete license termination. In addition to the license termination costs, site restoration and spent nuclear fuel management costs are included in this estimate; however, pursuant to regulatory requirements, the non-radiological estimates are segregated and listed separately. In parallel with the submittal of this PSDAR, HDI is submitting a request for NRC approval of an exemption to use NDT funds for spent fuel management and site restoration activities (Reference 4).

This PSDAR is contingent upon NRC approval of the License Transfer Agreement (LTA), completion of the transfer of the Palisades licenses, and sale closure.

ENOI has reviewed the contents of this letter and is aligned.

In accordance with 10 CFR 50.82(a)(4)(i), a copy of the PSDAR is being provided to the State of Michigan by transmitting a copy of this letter and its enclosure to the designated State Officials.

This letter contains no new regulatory commitments.

If you have any questions, please contact me at (856) 797-0900, x3813 or via email at [a.sterdis@holtec.com](mailto:a.sterdis@holtec.com).

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Enclosure: Post Shutdown Decommissioning Activities Report and Site-Specific  
Decommissioning Cost Estimate for Palisades Nuclear Plant

cc: w/ Enclosure

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State of Michigan

# **Palisades Nuclear Plant Post-Shutdown Decommissioning Activities Report**



**Prepared by  
Holtec Decommissioning International, LLC  
and  
Comprehensive Decommissioning International, LLC**

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**Acronyms**

ACM	Asbestos Containing Material
ALARA	As Low As Reasonably Achievable
BMP	Best Management Practices
BOE	Basis of Estimate
CDI	Comprehensive Decommissioning International, LLC
CFR	Code of Federal Regulations
CPM	Critical Path Method
DCE	Decommissioning Cost Estimate
DOE	Department of Energy
EC	European Commission
ENP	Entergy Nuclear Palisades
ENOI	Entergy Nuclear Operations, Inc.
FSS	Final Status Survey
GEIS	Generic Environmental Impact Statement
GTCC	Greater Than Class C
HDI	Holtec Decommissioning, International, LLC
Holtec	Holtec International
IAEA	International Atomic Energy Agency
ISDC	International Structure for Decommissioning Costing
ISFSI	Independent Spent Fuel Storage Installation
LLMW	Low-Level Mixed Waste
LLRW	Low Level Radioactive Waste
LTA	License Transfer Application
LTP	License Termination Plan
LSA	Low Specific Activity
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDGLE	Michigan Department of Environment, Great Lakes, and Energy
MWt	Megawatts-Thermal
NDT	Nuclear Decommissioning Trust
NEA	Nuclear Energy Agency
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission technical report designation
OECD	Organization for Economic Cooperation and Development
Palisades	Palisades Nuclear Plant
PWR	Pressurized Water Reactor
RPV	Reactor Pressure Vessel
PSDAR	Post Shutdown Decommissioning Activities Report
RVI	Reactor Vessel Internals
SCO	Surface Contaminated Object

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SEIS	Supplemental Environmental Impact Statement
SFP	Spent Fuel Pool
SME	Subject Matter Expert
SNF	Spent Nuclear Fuel
SNM	Special Nuclear Material
SSC	Structures, Systems and Components
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WBS	Work Breakdown Structure
WCS	Waste Control Specialists
WMP	Waste Management Plan
WP	Work Packages



## **1 INTRODUCTION AND SUMMARY**

### **1.1 Introduction**

In accordance with the requirements of Title 10 of the Code of Federal Regulations (CFR) 50.82, “Termination of license,” paragraph (a)(4)(i), this report constitutes the Holtec Decommissioning International, LLC (HDI) Post-Shutdown Decommissioning Activities Report (PSDAR) for the decommissioning of the Palisades Nuclear Plant (Palisades) following the scheduled permanent cessation of plant operations and permanent removal of fuel from the reactor vessels and subsequent transfer of the Part 50 and Part 72 licenses to Holtec International (Holtec) and HDI. This PSDAR is being submitted to notify the NRC of HDI decommissioning plans and planned decommissioning schedule for the decommissioning of Palisades and the unrestricted release of all portions of the site.

By letter dated October 19, 2017, Entergy Nuclear Operations, Inc. (ENOI) submitted to the U.S. Nuclear Regulatory Commission (NRC) a Notification of Permanent Cessation of Power Operations (Reference 16) for Palisades notifying the NRC of its intent to permanently cease power operations no later than May 31, 2022.

On December 23, 2020 ENOI, on behalf of itself and Entergy Nuclear Palisades, Holtec and HDI submitted a License Transfer Application (LTA) to the NRC requesting approval for the transfer of the Palisades Renewed Facility Operating License No. DPR 20 for the Palisades Nuclear Plant and the general license for the Palisades Independent Spent Fuel Storage Installation (ISFSI) and Facility Operating License No. DPR-6 for Big Rock Point and the general license for the Big Rock Point ISFSI to Holtec Palisades, LLC (Holtec Palisades) and HDI (Reference 17).

The HDI Palisades PSDAR describes the decommissioning plan to be implemented following NRC approval of the requested license transfers and the sale of the entity that owns Entergy Nuclear Palisades from Entergy to Holtec. After NRC approval of the requested license transfers and transaction closing, Entergy Nuclear Palisades will be renamed Holtec Palisades, LLC. This HDI PSDAR includes HDI’s Site-Specific Decommissioning Cost Estimate (DCE) as Enclosure 1.

The initiation of decommissioning activities by HDI will begin following the sale and license transfers, which are targeted to be completed by July 1, 2022, following Palisades’ permanent cessation of plant operations and permanent reactor defueling. In parallel with the submittal of this PSDAR, HDI is submitting a request for NRC approval of an exemption to use Palisades Nuclear Decommissioning Trust (NDT) funds for Palisades spent fuel management and site restoration activities (Reference 18). Decommissioning is expected to be completed well before 60 years following permanent cessation of operations as required by 10 CFR 50.82(a)(3). HDI has a project goal to complete decommissioning and final license termination within approximately 20 years following sale closure and license transfers.

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This PSDAR is contingent upon NRC approval of the LTA and the transfer of the Palisades licenses. If the licenses are not transferred, this PSDAR will be ineffective.

Prior to plant shutdown, ENOI, in coordination with HDI, is preparing for the safe and orderly transition from operations to permanent shutdown and reactor defueling. After transfer of the licenses is complete, the spent nuclear fuel will be transferred to the Palisades ISFSI within approximately three years. Following a period of dormancy, major decommissioning activities will commence to start and complete dismantlement and decontamination to levels that permit license termination. This PSDAR contains the following:

1. A description of the planned decommissioning activities along with a schedule for accomplishment.
2. A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements.
3. A site-specific DCE, including the projected license termination, spent fuel management, and site restoration costs.

This PSDAR has been developed consistent with Regulatory Guide 1.185, “Standard Format and Content for Post-Shutdown Decommissioning Activities Report” (Reference 1). The PSDAR is based on currently available information, and the plans discussed herein may be modified as additional information becomes available or conditions change. As required by 10 CFR 50.82(a)(7), the NRC will be notified in writing, with copies sent to the State of Michigan, before performing any decommissioning activity inconsistent with, or making any significant schedule change from, those actions and schedules described in the PSDAR, including changes that significantly increase the decommissioning cost.

## **1.2 Background**

Palisades is a single unit pressurized water reactor with a licensed thermal power of 2565.4 MWt. Palisades is located along the eastern shore of Lake Michigan in Covert Township, approximately four and one-half miles south of South Haven, Michigan, and consists of the pressurized water reactor, other associated plant equipment, and related site facilities. Palisades is also the site of the generally licensed Palisades ISFSI. Palisades is currently owned by Entergy Nuclear Palisades (ENP) and operated by ENOI.

A brief history of the major milestones related to Palisades’ construction and operational history is as follows:

- Operating License Issued (Provisional): March 24, 1971
- Operating License Issued (Full Term): February 21, 1991

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- Renewed Operating License Approved: January 17, 2007
- Renewed Operating License Expiration: March 24, 2031

Pursuant to 10 CFR 50.51(b), “Continuation of license,” the license for a facility that has permanently ceased operations continues in effect beyond the expiration date to authorize ownership and possession of the facility until the NRC notifies the licensee in writing that the license has been terminated.

During the period that the license remains in effect, 10 CFR 50.51(b) requires that the licensee:

1. Take actions necessary to decommission and decontaminate the facility and continue to maintain the facility (including storage, control, and maintenance of the spent fuel) in a safe condition.
2. Conduct activities in accordance with all other restrictions applicable to the facility in accordance with NRC regulations and the 10 CFR 50 renewed facility operating license.

10 CFR 50.82(a)(9) states that power reactor licensees must submit an application for termination of the license at least two (2) years prior to the license termination date, and that the application must be accompanied, or preceded, by a License Termination Plan (LTP) to be submitted for NRC approval.

### **1.3 Decommissioning Approach**

The decommissioning approach for the Palisades project is to initiate decommissioning following shutdown, reactor defueling, license transfers and sale closure. The HDI schedule assumes that spent fuel and Greater Than Class C (GTCC) waste are removed from the site by 2040 and NRC license termination occurs in 2041. To meet this goal, once the licenses are transferred, the decommissioning objectives are:

- a. Decommissioning of Palisades and site restoration of all areas.
- b. Department of Energy (DOE) acceptance of Spent Nuclear Fuel (SNF) from the Palisades ISFSI.
- c. NRC termination of the Palisades licenses and final site release when decommissioning is complete.
- d. Final site restoration of the site.

The HDI decommissioning approach for Palisades is described in the following sections.

- Section 2.0 describes the planned decommissioning activities and the general timing of their implementation.
- Section 3.0 presents the overall decommissioning schedule and milestones, including the spent fuel management activities, in a project timeline.

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- Section 4.0 provides an analysis of expected decommissioning costs, including the costs associated with spent fuel management and site restoration.
- Section 5.0 describes the basis for concluding that the environmental impacts associated with decommissioning Palisades are bounded by the NRC GEIS related to decommissioning.
- Section 6.0 provides the list of references.
- Enclosure 1: Palisades Site-Specific Decommissioning Cost Estimate

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## **2 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES**

HDI will contract with Comprehensive Decommissioning International, LLC (CDI) to decommission Palisades. HDI will also be required to manage the spent fuel during decommissioning because of the DOE's failure to perform its contractual obligation to remove spent fuel in a timely manner. To explain the basis for projecting the cost of managing SNF, a discussion of spent fuel management activities for the site is included herein.

Prior to the sale and license transfers, ENOI will perform activities to permanently shut down and defuel the reactor and place the plant in a safe storage condition. To facilitate efficient transition of the plant to decommissioning, ENOI, in coordination with HDI, will direct the decommissioning planning and preparation activities that will facilitate transitioning to the HDI decommissioning plan.

In conjunction with HDI, CDI developed the decommissioning scope, schedule, and associated cost estimate for Palisades. CDI adopted the International Structure for Decommissioning Costing (ISDC) Work Breakdown Structure (WBS) (Reference 3) and corresponding WBS dictionary to develop the Palisades site-specific DCE and decommissioning schedule. The ISDC, developed jointly by the Organization for Economic Cooperation and Development (OECD)/Nuclear Energy Agency (NEA), the International Atomic Energy Agency (IAEA) and the European Commission (EC), provides a method for developing standardized itemization of decommissioning costs. The ISDC WBS is a delivery-based, hierarchical structure that is identified as the international standard cost structure for nuclear facility decommissioning and is organized into eleven (11) groups. Of the eleven principal work groups, Activity 03-Additional Activities for Safe Enclosure and Entombment and Activity 09-Research and Development are not applicable to the decommissioning approach planned for the Palisades decommissioning.

Because the ISDC WBS is organized differently than those traditionally used for US domestic decommissioning estimates, to facilitate a comparison of projected Palisades decommissioning costs to the NRC Reference PWR decommissioning costs contained in NUREG/CR 5884, "Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station," the decommissioning activities have been organized into periods similar to those described in NRC guidance. (Reference 4).

For consistency with the DCE format found in Regulatory Guide 1.202, "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Reactors," (Reference 5) the ISDC WBS has also been mapped into project periods. In addition to the periods described in the Regulatory Guide, Period 5 was established to account for costs that fall into the Spent Fuel Management and Site Restoration phases, and Period 6 was established for instances where costs that are applicable to multiple periods are identified and quantified. The mapping of the 11 ISDC WBS elements to the project periods, is shown

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in Table 2-1.

**Table 2-1 WBS Elements Mapped to Periods**

Period	Period Title	WBS Elements
1	Pre-Decommissioning Planning and Preparation	01.02.01 Pre-decommissioning actions
2	Plant Deactivation	01.02.02 Facility Shutdown Activities
3	Safe Storage Operations	01.02.10 Fuel and Nuclear Material (until fuel on pad)
4	Dismantlement	01.02.04 Dismantling Activities Within the Radiological Controlled Area
		01.02.05 Waste Processing, Storage and Disposal
		01.02.07 Conventional Dismantling, Demolition, and Site Restoration (LTP portion only)
5	Ongoing ISFSI Operations	01.02.10 Fuel and Nuclear Material (after fuel on pad)
6	Program Management	01.02.06 Site Infrastructure and Operation
		01.02.08 Project Management, Engineering and Support
		01.02.11 Miscellaneous Expenditures
<i>Note: WBS 01.02.03 and 01.02.09 are not used in the cost model</i>		

The major decommissioning activities and the general sequence for performing the activities are discussed in more detail in the sections that follow. The project decommissioning schedule is shown in Figure 3-1.

## **2.1 Period 1 Pre-Decommissioning Planning & Preparation**

### **2.1.1 Pre-Decommissioning Planning and Preparation (Pre-License Transfer)**

HDI and CDI are working with ENOI to understand and support the Palisades plan for permanent shutdown, reactor defueling, and preparations for safe storage. These efforts are focused on facilitating the safe, compliant, and efficient license transfers and transition to radiological decommissioning once the license transfers are complete.

The transition activities ensure that the decommissioning organization is fully prepared to assume the responsibilities of Palisades decommissioning. Alignment with ENOI will begin well in advance of license transfers and sale closure. HDI will prepare a Transition Plan describing the process for conducting an orderly and effective transition in alignment with

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the NRC license transfers, site permits, licenses, etc. to HDI.

**2.1.2 Period 1 – Pre-Decommissioning Planning and Preparation Activities**

This section discusses the activities that will be performed by HDI and CDI prior to license transfers, and those that will be performed following license transfers.

At the time of sale and license transfers, Palisades will be in a defueled condition. HDI's decommissioning planning considers the Palisades shutdown, defueling, and safe storage transition activities in determining the expected plant condition at license transfers. In the time leading up to, and following, the sale/closure and license transfers, the following activities will be performed:

- Final Decommissioning planning
- Procurement of services, materials, and supplies.
- Stakeholder interaction.
- Development of the decommissioning As Low as Reasonably Achievable (ALARA) budget.
- Development of a Waste Management Plan (WMP), including determination of transportation and disposal container requirements and pathways.
- Performance of safety, security, and environmental studies, as required.
- Review of the Palisades reclassification of plant structures, systems, and components (SSCs).
- Licensing and permitting actions necessary to reflect the permanently defueled plant configuration

During Period 1, planning and preparing for the decontamination and dismantlement of Palisades will begin by completing the following activities:

- Finalize the decommissioning organization, including integration of incumbent plant staff and CDI personnel. Palisades personnel will be incorporated into the decommissioning organization according to their expertise and the position that they held within ENOI. Staffing and configuration requirements are expected to change during the period of decommissioning, principally dependent upon changes in license requirements, due to changes in the status of the spent fuel being stored onsite.
- Review the established Palisades policies, programs, and procedures for ongoing activities to support the transition to the HDI Decommissioning Management Model. The HDI model facilitates the conversion to HDI fleet policies, programs and procedures that adapt to the evolving plant status during decommissioning. The HDI Management Model, currently in use at Oyster Creek and Pilgrim decommissioning sites, support site continued safe and compliant operations in accordance with NRC regulations and licenses. The NRC requirements and functional needs for the anticipated plant conditions and decommissioning activities will be assessed, and the

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transition to HDI fleet policies, procedures and programs will be executed using the appropriate NRC regulatory change processes.

- Develop decommissioning Work Packages (WPs), including the radiation work permits and job hazard analyses to support the WPs. Focus will be on the earliest activities in the schedule. To get input from the labor force who will be performing the work, area walkdowns with Subject Matter Experts (SMEs) and other appropriate personnel will be performed while preparing the WPs.
- Conduct site wide characterization activities so that radiological, regulated, and hazardous wastes are identified, categorized, and quantified to support decommissioning, waste management planning and site characterization. Surveys will be conducted to establish the contamination and radiation levels throughout the plant. This information will be used in developing procedures to ensure that hazardous, regulated, and radiologically contaminated areas are remediated, and to ensure that worker exposure is controlled.
- Finalize waste transportation and disposal contracts.
- Hold joint ENOI/CDI/HDI executive status and readiness review sessions for the purpose of ensuring the safe, secure transition to the Palisades decommissioning phase

### **2.2 Period 2 – Plant Deactivation**

Many of the activities associated with termination of operations, plant stabilization, isolation, and initial inspection will be completed by ENOI. In the period between permanent reactor defueling and sale closure/license transfers, ENOI will execute activities to deactivate the plant. The plant deactivation activities include the following:

1. Continuing operation and maintenance of the systems required to maintain the spent fuel management and safe storage within NRC regulations and facility license requirements.
2. Isolating power equipment and installation of temporary power systems in preparation for decommissioning of the turbine generator.
3. Removing combustibles and chemicals to permit fire protection system modifications.

Following the sale closure/license transfers, deactivation activities and other activities required to prepare the Palisades for decommissioning will continue, as necessary.

### **2.3 Period 3 - Safe Storage Operation**

The activities in this period include preparations for, and conduct of, fuel movement to an onsite dry fuel storage facility. This period concludes once the fuel has been removed from the spent fuel pool (SFP) and placed into long-term storage at the ISFSI. Safe storage operation activities include the following:

- Transfer of SNF to dry storage canisters.



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- Movement of fuel to long-term storage at the ISFSI.
- Transfer existing canisters from West to East ISFSI Pad.
- Operation and maintenance of the ISFSI until the spent fuel is removed from the SFP and placed in the ISFSI.

## **2.4 Period 4 - Dismantlement**

The scope of Period 4 includes the dismantling and decontamination of the plant systems and structures. The work scope described in this section concludes with the removed components packaged, placed in containers, and transported to storage, treatment, or disposal. The waste will be properly packaged, shipped, and tracked until properly disposed. The decommissioning strategy utilizes free or conditional release for a majority of the plant demolition materials. Although the primary decommissioning strategy is focused on bulk removal of contaminated waste materials, experience at Oyster Creek and Pilgrim has identified effective and efficient decontamination and offsite processing techniques. The end state of this work scope is to have the buildings cleared of all radioactive and hazardous components and declared ready for free release or demolition. Targeted decontamination activities such as system purge and surface wipe-down will be performed as required to maintain worker exposure ALARA.

### **2.4.1 Asbestos Containing Material, Hazardous, and Universal Waste Removal**

An extensive asbestos survey and abatement of Asbestos Containing Material (ACM) is one of the first priorities. Asbestos removal is planned prior to dismantling SSCs. Work boundaries will be established and set up with containment structures, tents, glove bags, ventilation, etc., for ACM removal. Final verification survey of all facilities will be performed to ensure all ACM has been removed prior to dismantlement and decontamination.

Removal of hazardous and universal waste<sup>1</sup> will also be conducted prior to dismantling SSCs, as constrained by the accessibility of the waste material. The waste will be placed in the proper containers for transportation to the appropriate treatment, storage, and disposal facilities.

### **2.4.2 Site Characterization**

To supplement plant historical knowledge, site wide characterization activities will be performed prior to and during the decommissioning process. The characterization will further the identification, categorization, and quantification of radiological, regulated, and hazardous wastes. Surveys will be conducted to establish the contamination and radiation

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<sup>1</sup> Universal waste is a category of waste materials designated as “hazardous waste” but containing materials that are commonly generated by a wide variety of establishments. US Environmental Protection Agency’s (USEPA) universal waste regulations streamline the hazardous waste management standards for these wastes. It is identified in 40 CFR 273.9 by the USEPA and applies to four (4) specific categories of materials that can be managed as universal wastes: batteries, pesticides, mercury-containing equipment and lamps. States may have corollary regulations regarding these materials, as well as additional materials.

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levels throughout the plant. The information will be used in developing overall plans to ensure that hazardous, regulated, and radiologically contaminated areas are remediated, and to ensure that worker exposure is controlled. As decontamination and dismantlement work proceeds, surveys will be conducted to maintain current site characterization, and to ensure that decommissioning activities are adjusted accordingly.

#### **2.4.3 Segmentation and Dismantling of the RVIs and RPV**

After the dormancy period, decommissioning and demolition activities will include review of segmentation work packages, tooling specification, fabrication and cutting and package plan development. Segmentation of the Reactor Vessel Internals (RVI) followed by Reactor Pressure Vessel (RPV) segmentation will commence promptly. The RVI highly activated core grid segments are expected to generate most of the GTCC waste.

The GTCC waste that is generated during segmentation activities will be placed in dry storage canisters, transferred from the reactor building and stored at the Palisades ISFSI.

#### **2.4.4 Fuel Pool and Reactor Cavity Dismantlement**

After the fuel has been removed from the SFP, the segmentation contractor will perform the fuel pool inspection. The pool will be inspected with underwater cameras and radiation monitors to identify any radioactive material or debris remaining after fuel movement. Remote handling tools or vacuuming will be used to remove contamination found during the inspection. If any fuel or Special Nuclear Material (SNM) fragments are identified, a regulatory compliant process will be used to remove and store the fragments.

Following the dormancy period, the fuel racks will be removed from the pool, segmented, and size-reduced for disposal as Low-Level Radioactive Waste (LLRW). The SFP liner will be removed after the pool has been drained and decontaminated.

#### **2.4.5 Large Component Dismantlement**

The WPs developed in Period 1 will be used to remove the large components and the plant systems by building or area, to avoid impacting other critical path work. Access limitations, crane availability, and radiological conditions will drive the technology used for cutting and segmenting components and piping. Systems and/or components will be breached, air gapped, and purged to eliminate liquid waste prior to segmenting. While many large components are expected to be radiologically contaminated, they are not expected to require pre-dismantling decontamination. Spray fixative will be applied on components, or openings of piping will be capped to control contamination. Depending on the contamination levels and configuration of the segmented large components, CDI will either place the segments in an appropriate shipping container or send the component for disposal as its own package with suitable wrapping or capping.

The turbines, main condenser, moisture separator reheaters, feedwater pumps and heaters, and steam and feedwater piping are not expected to be radiologically contaminated. The

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subcontractor will remove large parts of the turbines (such as the low-pressure portion) intact and send the components offsite for disposal as intact packages suitably wrapped. The generator is not part of the contaminated steam system and can be removed whole for recycling or reuse.

The primary loop large components, including the steam generators and pressurizers will be removed from the Containment Building. The auxiliary plant boilers, storage tanks, and the diesel generators will be removed.

### **2.4.6 Radioactive Waste Management**

A major component of the decommissioning work scope for Palisades is the packaging, transportation, and disposing of contaminated/activated equipment, piping, concrete, and soil. A WMP will be developed in Period 1 to incorporate the most cost-effective disposal strategy, consistent with regulatory requirements and disposal/processing options for each waste type. Characterization will be performed with systems and components in place to determine the waste classification, maximizing the use of non-destructive assay techniques, and direct instrumentation readings correlated with hard analytical data gathered via direct smears and sampling. Palisades decommissioning will include a number of discrete waste stream profiles and a range of shipping packages. A range of reusable and single use containers will be used, and some items will be transported as sealed components without containerization (they become their own packaging).

Most waste will meet Class A including large volumes of low activity wastes. For transportation, the majority of LLRW will be shipped as Low Specific Activity (LSA), or Surface Contaminated Object (SCO) definitions. LLRW will be managed in accordance with the WMP, transportation, and commercial disposal facility requirements. This includes characterizing contaminated materials, packaging, transporting, and disposal at a licensed LLRW disposal facility.

For Class B and C waste, an import petition will be filed with the Texas Compact Commission to gain approval to dispose of out-of-compact waste at the Waste Control Specialists (WCS) facility in Texas. The guidance in NUREG-2155, "Implementation Guidance for Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material" (Reference 6) will be used for radioactive material that meet the form, concentration, and quantity-of-concern criteria in 10 CFR 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material."

### **2.4.7 Waste Transportation**

The transportation approach for hazardous, Class A, LSA, or SCO classes of waste is to use a combination of truck and rail to support bulk quantity removal of waste. Since there is no active rail at Palisades, a truck will be used to deliver the waste to a transload facility. The waste transportation process will be fully defined in the WMP to include the estimated number of shipments, the disposal facilities, and applicable requirements. As discussed earlier, HDI may elect to ship large plant components by barge.

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#### **2.4.8 Removal of Mixed Wastes**

Low-Level Mixed Waste (LLMW) generation will be minimized through appropriate characterization, as well as the demolition techniques employed. The majority of mixed waste is likely lead, used as either shielding or in paints and coatings applied during construction or operations (i.e., fixing contamination). As mixed wastes are identified, they will be managed in accordance with applicable federal and state regulations. Mixed wastes from Palisades will be transported by authorized and licensed transporters and shipped to authorized and licensed facilities.

#### **2.4.9 License Termination including Final Status Surveys**

In accordance with the requirements of 10 CFR 50.82(a)(9), an LTP will be submitted to the NRC at least two (2) years prior to the anticipated date of final license termination and site release. The License Termination Plan will include: a site characterization, description of the remaining dismantling/removal activities, plans for remediation of remaining radioactive materials, developed site-specific Derived Concentration Guideline Levels (DCGLs), plans for the Final Status (radiation) Survey (FSS), designation of the end use of the site, an updated cost estimate to complete the decommissioning, and associated environmental concerns.

The NRC-approved LTP will be used to perform the FSS, which will demonstrate that the remediated site can be released for unrestricted use and the licenses can be terminated. The survey planning approach and site release criteria are defined by the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (Reference 7) protocol and will be used to demonstrate that the site release criteria have been met.

#### **2.4.10 Site Restoration**

During demolition, above-ground structures will be removed to a nominal depth of three (3) feet below the surrounding grade level. Characterization surveys will then be performed in the remainder of the below ground structures and any areas with activity exceeding established DCGLs will be removed. Final Status Surveys, including NRC verification surveys, will be conducted. Once the NRC approves the Final Status Surveys, the affected area(s) will be backfilled with suitable fill materials, graded, and appropriate erosion controls established. Site restoration activities will begin in non-radiological areas after demolition of buildings and structures outside the radiological controlled area. Final site restoration will be completed after decommissioning and demolition activities are completed.

### **2.5 Period 5 - Ongoing ISFSI Operations**

After fuel is moved to the ISFSI, the site will enter a dormancy period in which the plant will be maintained in a compliant and safe state. The spent fuel and GTCC waste will remain on the ISFSI until it is transferred to the DOE. The ISFSI will be staffed by a security force. In addition, personnel will be assigned to maintain the ISFSI and comply

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with the ISFSI license requirements. Fuel and GTCC waste shipping will be performed when repositories for this type of waste are developed by the DOE. Approximately two (2) GTCC canisters are estimated to be required for decommissioning activities. Following the removal of the spent fuel and GTCC waste, the ISFSI site will be decommissioned, remediated, and surveyed per the LTP. Following FSS and NRC approval, final license termination will occur.

### **2.6 Period 6 – Program Management**

Program management costs include infrastructure and operation, management, and fees that are applicable to decommissioning Periods 1 through 4. These costs include the following:

- Site infrastructure and operation costs, including security, maintenance, site upkeep, operation of support systems, and environmental monitoring.
- Project management, engineering, and support including the core management group, scheduling and cost control, quality assurance, health and safety, records management, general administration and accounting, warehousing, engineering, regulatory, and support services.
- Regulatory fees, taxes, and insurance.

### **2.7 Changes to Management and Staffing**

Following license transfers and sale closure, the management team will be comprised of HDI corporate leadership resources, supported by CDI leadership resources. The CDI management team will include Holtec personnel along with incumbent site personnel. This includes Palisades personnel who transfer to HDI and CDI upon closure of the sale. These personnel will be integrated into the decommissioning organization according to their expertise and previous positions held while the plant was operating. Additionally, corporate support from Holtec and/or SNC-Lavalin will be provided in areas such as legal, financial reporting systems, information technology, procurement, and human resources.

The number of site personnel will vary throughout the life of the project, with increased or decreased staffing levels required as decommissioning activities ramp up or down, or as requirements for security and emergency planning are reduced. The staffing projections after license transfers and sale closure are described in Section 3 of the Enclosure 1 of this PSDAR.

### **3 SCHEDULE OF PLANNED DECOMMISSIONING ACTIVITIES**

#### **3.1 Palisades Decommissioning Schedule**

Figure 3-1 Palisades Decommissioning Schedule, provides a project timeline that presents the high-level project schedule and milestones for decommissioning, including spent fuel storage and licensing. The schedule provided here assumes that the sale closure and license transfers occur by July 1, 2022 and ends following ISFSI decommissioning and final license termination in 2041.



#### **4 ESTIMATE OF EXPECTED DECOMMISSIONING AND SPENT FUEL MANAGEMENT COSTS**

The HDI site-specific DCE for the decommissioning of Palisades following the scheduled cessation of plant operations and an assumed license transfer date prior to July 1, 2022 is included as Enclosure 1 to this PSDAR. CDI prepared the site-specific DCE and schedule for HDI using several sources including the following:

- Information compiled by HDI and CDI during an extensive due diligence period.
- Input and professional judgment of experienced specialty subcontractors and SMEs.
- Real time experience and executed contracts from Holtec-owned nuclear decommissioning sites.

The site-specific DCE is based on regulatory requirements, site conditions, Basis of Estimate (BOE) assumptions, LLRW disposal standards, high-level radioactive waste management options, and site restoration requirements. The methods utilized to estimate decommissioning costs were based on the professional judgment of the experienced SMEs, considering the nature of the work, degree of scope definition, availability of quantifiable cost and pricing data, among other factors. The decommissioning costs presented in this report are reported in 2020 dollars. Escalation of future decommissioning costs over the remaining decommissioning project life cycle are excluded.

The detailed decommissioning project schedule is used as the foundation for developing the DCE model and the risk model. The schedule baseline is a detailed Critical Path Method (CPM) schedule developed with input from the key decommissioning subcontractors and SMEs. The schedule and cost estimate are based on the ISDC WBS and corresponding WBS dictionary.

The site-specific DCE for decommissioning Palisades demonstrates that adequate funding is available in the NDT fund to complete license termination. In addition to the license termination costs, site restoration, and spent nuclear fuel management costs are included in this estimate; however, pursuant to regulatory requirements, the non-license termination cost estimates are segregated and listed separately.

The cost to decommission the site, safeguard the spent fuel until it can be transferred to the DOE, and restore the impacted area of the site is estimated to be \$644 million in 2020 dollars. The summary of the costs estimated for License Termination, Spent Fuel Management, and Site Restoration activities are presented in Table 4-1.



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**Table 4-1 Palisades Decommissioning Cost Summary (thousands of 2020 dollars)**

<b>Cost Category</b>	<b>License Termination</b>	<b>Spent Fuel</b>	<b>Site Restoration</b>	<b>Total</b>
Decontamination	7,697			7,697
Removal	109,357		21,433	130,790
Packaging	34,984		4,043	39,028
Transportation	31,674		2,736	34,411
Disposal	34,609		2,682	37,291
Off-site Waste Processing	5,880			5,880
Program Management	145,736	32,602	3,373	181,712
Corporate A&G	-	-	-	-
Spent Fuel (Direct Expenditures)		123,230		123,230
Insurance and Regulatory Fees	23,809	5,309	194	29,312
Energy	7,679			7,679
Characterization and Licensing Surveys	7,926			7,926
Property Taxes	8,589	4,981	217	13,787
Miscellaneous Equipment / Site Services	25,273			25,273
Spent Fuel Pool Isolation	-	-	-	-
<b>Grand Total</b>	<b>443,215</b>	<b>166,122</b>	<b>34,679</b>	<b>644,015</b>

## **5 ENVIRONMENTAL IMPACTS**

### **5.1 Environmental Impact of Palisades Decommissioning**

HDI has concluded that the environmental impacts associated with planned Palisades site-specific decommissioning activities are less than and bounded by the previously issued environmental impact statements and site-specific analysis summarized in this report. 10 CFR 50.82(a)(4)(i) requires that the PSDAR include, " ... a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements." The following discussion provides the reasons for reaching this conclusion and is based on previously issued environmental impact statements:

1. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors" (herein referred to as the GEIS) (Reference 2).
2. NUREG-1496, "Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities" (Reference 8)
3. NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 27, Regarding Palisades Nuclear Plant, Final Report, October 2006 (herein referred to as the SEIS) (Reference 9).
4. NUREG-1437, Revision 1, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, June 2013 (SEIS, Revision 1) (Reference 10).

#### **5.1.1 Onsite/Offsite Land Use**

The NRC concluded in the GEIS (Reference 2) that the experience of plants being decommissioned has not included any need for additional land offsite. Consistent with this determination, HDI does not anticipate any changes in land use beyond the site boundary during decommissioning.

##### **5.1.1.1 Onsite Land Use**

Palisades has sufficient previously disturbed area onsite (due to construction or operations activities) for use during decommissioning.

Stormwater discharges from the site are currently regulated by an existing National Pollutant Discharge Elimination System (NPDES) Permit No. MI0001457 (Reference 15), and any construction activities that would disturb one acre or greater of soil not covered by

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the existing permit would require a stormwater permit from the Michigan Department of Environment, Great Lakes, and Energy (MDGLE) prior to proceeding with the activity. The NPDES permit, and any MDEGLE stormwater permit contain best management practices (BMPs) to control sediment and erosion effect on water courses and wetlands.

HDI may elect to ship large plant components by barge. Use of barge transportation to remove waste and provide waste disposal transportation could provide an opportunity for improving project schedule and costs. A barge slip or landing, and if needed dredging to allow navigation of vessels to the slip for loading and transport of selected wastes, may be constructed adjacent to the facility. HDI will evaluate this opportunity through the use of commercial infrastructure or development at site. The onsite slip would be evaluated, designed, permitted, constructed, and operated in accordance with applicable federal, state, and local permits, and required certifications. HDI would seek to avoid any disturbance of sand dunes protected under the Michigan Natural Resources Environmental Protection Act. If constructed, applicable BMPs will be implemented during construction and operation of the slip. This land use would be for a short duration. No changes to land use patterns would result from the use of barge transportation.

HDI concludes that the impacts of Palisades decommissioning on onsite land use are bounded by the GEIS.

#### **5.1.1.2 Offsite Land Use**

Section 4.3.1 of the GEIS (Reference 2) concluded that the impacts on land are not detectable or destabilizing and are small for facilities having only onsite land use changes resulting from large component removal, structure dismantlement, and LLRW packaging and storage. These decommissioning activities will be conducted on previously disturbed land within the site boundary.

The NRC concluded in the GEIS that the experience of plants being decommissioned has not included any needs for additional land offsite. Consistent with this determination, HDI does not anticipate any changes in land use beyond the site boundary during decommissioning.

If HDI elects to use barge transportation, construction of a barge slip or landing and dredging for navigation may be needed. If dredging is necessary, it will be conducted under U.S. Army Corps of Engineers (USACE) and appropriate MDEGLE permits.

HDI concludes that the impacts of Palisades decommissioning on offsite land use are bounded by the GEIS.

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### **5.1.2 Water Use**

After the shutdown of the reactor, the operational demand for dilution (makeup) water will be dramatically decreased. The amount of water used by the service water system after shutdown will also be reduced over time. The need for cooling water will continue to decrease as the heat load of spent fuel in the SFP declines due to radioactive decay, and as spent fuel is relocated from the SFP to the ISFSI.

After the shutdown of reactor, the use of potable water will decrease commensurate with the expected decrease in site staffing levels. For these reasons, Section 4.3.2 of the GEIS (Reference 2) concluded that water use at decommissioning nuclear reactor facilities is significantly smaller than water use during operation.

The GEIS also concluded that water use during the decontamination and dismantlement phase will be greater than that during the storage phase. There are no anticipated unique water uses associated with the decommissioning of Palisades that are not addressed by the evaluation of the reference facility in the GEIS.

Therefore, HDI concludes that the impacts of Palisades decommissioning on water use are bounded by the GEIS.

### **5.1.3 Water Quality (Non-Radiological)**

During the planning, defueling, and dormancy periods, stormwater runoff and drainage paths will be maintained in their current configuration. Regulatory mandated programs and processes designed to minimize, detect, and contain spills will be maintained throughout the decommissioning process. Federal, state, and local regulations and permits pertaining to water quality will also remain in effect.

Palisades will continue to receive potable water from the South Haven Municipal Water Authority.

Industrial and stormwater discharges to surface water from the facility are subject to the terms and conditions of the existing NPDES permit No MI0001457 (Reference 15). Areas of one acre or more disturbed during decommissioning that are not covered by the existing permits will require new stormwater permits from the MDEGLE. In addition to the specific permit requirements, selection and implementation of BMPs for stormwater that may be generated from areas disturbed by decommissioning activities is also required.

Sanitary waste is managed in an onsite treatment and disposal system (SEIS, Reference 9). As decommissioning proceeds, management of sanitary wastewater may be transitioned to temporary, contained onsite facilities with transport of the sanitary waste to offsite facilities permitted to receive, treat, and dispose of the wastes.

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During decommissioning, Palisades will comply with applicable regulations requiring reporting of hazardous materials spills, and reasonable precautions will be taken to prevent or mitigate spills of hazardous materials.

Contamination subject to MDEGLE reporting and remediation requirements, whether existing or discovered during decommissioning, will be reported to the agency and addressed through an appropriate state cleanup program or agreement with the State.

The Palisades water intake structures may be abandoned in place or removed. Demolition of Palisades structures and buildings, and related earth-moving work (digging, grading, filling), has at least a limited potential to result in erosion and sedimentation that could affect water quality, but these kinds of construction activities routinely take place around operating nuclear power plants and are subject to the provisions of state-issued, and as applicable federal, permits and appropriate BMPs.

If HDI decides to pursue this opportunity, a barge slip or landing and if needed, dredging to allow navigation of vessels to the slip or landing for loading and transport of selected wastes, may be constructed adjacent to the facility. The slip or landing will be evaluated, designed, permitted, constructed, and operated in accordance with applicable federal, state, and local permits, and required certifications. If constructed, applicable BMPs will be implemented during construction and operation of the slip or landing. If dredging is necessary, it will be conducted under USACE and appropriate MDEGLE permits and required certifications (e.g., Water Quality Certification).

The NRC found in the GEIS (Reference 2) that the impact of dredging to remove accumulated sediments in the vicinity of intake and discharge structures, and to maintain barge shipping, has only localized effects on water quality that tend to be short-lived, and that the impact of dredging on water quality is small for all nuclear plants.

The GEIS (Reference 2) concludes that the impacts of decommissioning on non-radioactive aspects of water quality are small and will be neither detectable nor destabilizing. The SEIS (Reference 9) found that there would be no impacts on water quality associated with Palisades decommissioning beyond those discussed in the GEIS.

Therefore, HDI concludes that the impacts of Palisades decommissioning on water quality are bounded by the GEIS.

#### **5.1.4 Air Quality**

There are many types of decommissioning activities listed in Section 4.3.4 of the GEIS (Reference 2) that have the potential to affect non-radiological air quality. For those activities applicable to decommissioning of Palisades, Palisades does not anticipate any activities beyond those listed in the GEIS that could potentially affect air quality. HDI will

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maintain existing air permits, or obtain new permits as applicable, for equipment that will be used during Palisades decommissioning. Federal, state, county and local regulations pertaining to air quality will remain in effect to regulate emissions associated with fugitive dust, criteria air pollutants, hazardous air pollutants, and ozone depleting gases.

The GEIS concluded that air quality impacts associated with decommissioning are small. The SEIS (Reference 9) found that there would be no impacts on air quality associated with Palisades decommissioning beyond those discussed in the GEIS.

Therefore, HDI concludes that the impacts of Palisades decommissioning on air quality are bounded by the GEIS.

### **5.1.5 Aquatic Ecology**

Aquatic ecology encompasses the plants and animals in the intake and discharge structures and Lake Michigan. Aquatic ecology also includes the interaction of those organisms with each other and the environment. Section 4.3.5 of the GEIS (Reference 2) evaluates both the direct and indirect impacts from decommissioning on aquatic ecology.

Direct impacts can result from activities such as the removal of shoreline structures and active dredging. Palisades' shoreline structures are similar to those present at the plants listed in Table E-2 of the GEIS, and there are no apparent discriminators based on the salient characteristics (size and location) listed in Table E-5 of the GEIS (Reference 2).

The operational area within the Palisades site boundary includes areas that may be used for moving large plant components during decommissioning from the Palisades power block to a barge slip or landing. These areas have been used during plant operation for similar activities. The GEIS (Reference 2) concludes that for decommissioning activities that do not disturb lands beyond operational areas, the effects on aquatic ecology are not detectable or destabilizing, and that effects on aquatic ecology related to use of a dock or barge loading area and dredging for barge navigation are small.

Abandonment or removal of intake and discharge facilities and other shoreline structures, and use of a barge slip or landing, including dredging if needed, will be conducted in accordance with BMPs defined in permits issued by the MDEGLE and USACE, as applicable. The NRC concluded in the GEIS (Reference 2) and confirmed in the SEIS, Revision 1 (Reference 10) that the impact of dredging on aquatic resources would be small because dredging occurs infrequently over a relatively short duration and affects relatively small areas.

The Palisades primary cooling water system is cooling tower based. In the SEIS (Reference 9), the NRC stated that impingement, entrainment, and thermal effects (heat shock) have not been found to be a problem at plants with this type of cooling system, and that operation of

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the Palisades cooling system would not contribute significant impacts on water quality and aquatic resources of southeastern Lake Michigan. As described in Section 5.1.2, the amount of cooling water withdrawn from the cooling water intake system will decrease after the reactor is shut down and defueled further reducing the potential impacts from impingement, entrainment, and thermal effects on aquatic species during the period when spent fuel continues to be stored in the SFPs. After transfer of the spent fuel to the ISFSI, the amount of water withdrawn will continue at a reduced flow rate as needed to support remaining decommissioning activities.

Any significant potential for sediment runoff or erosion on disturbed areas will be controlled in accordance with BMPs outlined in the current MDEGLE NPDES permit (Reference 15), and any new stormwater permit obtained from the MDEGLE.

The SEIS (Reference 9) found that there would be no impacts on ecological resources associated with decommissioning beyond those discussed in the GEIS. Therefore, HDI concludes that the impacts of Palisades decommissioning on aquatic ecology are bounded by the GEIS.

#### **5.1.6 Terrestrial Ecology**

Terrestrial ecology considers the plants and animals near Palisades, as well as the interaction of those organisms with each other and the environment. Evaluations of impacts to terrestrial ecology are usually directed at important habitats and species, including plants and animals that are important to industry, recreational activities, the area ecosystems, and those protected by endangered species regulations and legislation. Section 4.3.6 of the GEIS (Reference 2) evaluates the potential impacts from both direct and indirect disturbance of terrestrial ecology.

Direct impacts can result from activities such as clearing native vegetation or filling a wetland. HDI does not anticipate disturbing habitat beyond the operational areas of the units. All dismantlement, demolition, and waste staging activities are envisioned to be conducted within the operational area of the site.

Indirect impacts may result from effects such as erosional runoff, dust, or noise. Any construction activities that would disturb one acre or greater of soil would be subject to the requirements of the existing NPDES permit, or a new stormwater permit from the MDEGLE, prior to proceeding with the activity. The permits would contain BMPs to control sediment and the effects of erosion associated with the construction activity. Fugitive dust emissions will be controlled through the judicious use of water spraying. The basis for concluding that the environmental impacts of noise are bounded by the GEIS is discussed in Section 5.1.16 below.

Section 4.3.6 of the GEIS (Reference 2) concludes that if BMPs are used to control indirect disturbances and habitat disturbance is limited to operational areas, the potential impacts to

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terrestrial ecology are small. As discussed above, there are no unique disturbances to the terrestrial ecology anticipated during the decommissioning of Palisades. Accordingly, HDI concludes that impacts of decommissioning activities within the Palisades operational area would be small.

Areas within the operational and previously disturbed areas may be used to transfer large plant components and other materials to barges during decommissioning. These areas have been used during and plant operation for similar activities. Any transfer of large plant components, soil, or debris from demolition activities during decommissioning would be of short duration and would have minimal impact on terrestrial resources because the components will be transported within the previously disturbed operational area of the site that contains no unusual, rare, or sensitive plants or animals, and no important or sensitive habitats. Because no high-value terrestrial habitats will be disturbed, impacts are expected to be small and should not require mitigation beyond routine construction BMPs.

The SEIS (Reference 9) found that there would be no impacts on ecological resources associated with decommissioning beyond those discussed in the GEIS. Therefore, HDI concludes that the impacts of Palisades decommissioning on terrestrial ecology, including those outside of the operational area, are small and bounded by the GEIS.

### **5.1.7 Threatened and Endangered Species**

Section 4.3.7 of the GEIS (Reference 2) does not make a generic determination of the impact of decommissioning on threatened and endangered species, and it concludes that the adverse impacts and associated significance of the impacts must be determined on a site-specific basis. The NRC noted in the GEIS that impacts to threatened and endangered species are expected to be minor and nondetectable if decommissioning activities are confined to site operational areas.

There are five federally-listed, terrestrial species identified as potentially present in Van Buren County. There are no federally-listed aquatic species identified as potentially present in Van Buren County or in Lake Michigan along the county shoreline.

There are no critical habitats in the vicinity of Palisades.

A review of state-listed threatened and endangered species in the Palisades area was presented in the SEIS (Reference 9). The NRC identified 45 state-listed species as endangered, threatened or of special concern in Van Buren County. An updated list of threatened, endangered and special concern species potentially present in the vicinity of Palisades was obtained from the Michigan State University, Michigan Natural Features Inventory online database in July 2020. The updated list designates 113 species as endangered, threatened or of special concern in Van Buren County.



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The federally-listed threatened and endangered species potentially present in the vicinity of Palisades that were identified and addressed in the SEIS (Reference 9) have been updated through review of available U.S. Fish and Wildlife Service (USFWS) on-line information resources.<sup>2</sup>

**5.1.7.1 Protected Terrestrial Species**

The federally-listed species potentially occurring in the vicinity of Palisades are listed in Table 5.1.

**TABLE 5.1 Effect Determinations for Federally Listed Species related to Palisades Nuclear Plant**

Listed Species(a)	Common Name	Federal Status
Myotis sodalis	Indiana bat	Endangered
Myotis septentrionalis	Northern long-eared bat	Threatened
Charadrius melodus	Piping plover	Endangered
Calidrus canutus rufa	Red knot	Threatened
Sistrurus catenatus	Eastern massasauga (rattlesnake)	Threatened
Neonympha mitchelli mitchelli	Mitchell’s satyr butterfly	Endangered
Cirsium pitcheri	Pitcher’s Thistle	Threatened

In the SEIS (Reference 9) NRC noted that five, federally-listed species were potentially present in the vicinity of Palisades: the endangered Indiana Bat (*Myotis sodalis*); endangered Mitchell’s satyr butterfly (*Neonympha mitchelli mitchelli*); endangered Karner blue butterfly (*Lycaeides melissa samuelis*); threatened Pitcher’s thistle (*Cirsium pitcheri*); and candidate Eastern massasauga rattlesnake (SEIS, Reference 9).

The Karner blue butterfly is no longer identified by the USFWS or State of Michigan as potentially present in Van Buren County, and the status of the Eastern massasauga rattlesnake has been changed to threatened. The Northern long-eared bat (*Myotis septentrionalis*) and Red knot (*Calidris canutus rufa*) have been listed by the USFWS, and the Piping plover (*Charadrius melodus*) has been determined to be potentially present in the Palisades area, since issuance of the SEIS.

The Indiana bat is found in riparian, bottomland, and upland forest habitats. In the summer they roost in crevices created by the exfoliating bark of dead and dying trees. In winter they hibernate in caves. Similarly, the Northern long-eared bat prefers mines and caves during

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<sup>2</sup> USFWS Information for Planning and Consultation (IPaC) Environmental Conservation Online System (ECOS).

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the winter, and forested habitats during the summer when they roost singly or in colonies underneath bark, in cavities or in crevices of live trees and snags (dead trees). Habitat suitable for the Indiana and Northern long-eared bats may be present in the Palisades area.

The Red knot (*Calidrus canutus rufa*), a migratory bird, was federally listed as threatened in December 2014. The red knot prefers coastal beaches and rocky shores, sand, and mud flats. This bird species is migratory only in the Lake Michigan area where they are sighted most often during their fall migration in small numbers (USFWS, 2014; Reference 14). There is limited to no habitat available within or along the lake shoreline of the operational area of Palisades suitable for the short-duration, stop-over behavior of migrating Red knots; consequently, they are unlikely to be affected by decommissioning activities.

The Piping plover is a migratory bird that nests, feeds, and rears its young in open, sparsely vegetated sandy areas during spring and summer in the Great Lakes. On Lake Michigan, Piping plovers' nest on sand spits and sand beaches with wide, unforested dunes and swales or in the flat pans behind the primary dune. Piping plovers in the Great Lakes Distinct Population Segment typically arrive and nest in May. The breeding birds and their chicks leave the area in mid- to late August. The operational area shoreline adjacent to the central portion of the facility is developed with no potentially suitable habitat. It is not anticipated that areas of potentially suitable habitat for these birds will be used during decommissioning.

The Eastern massasauga rattlesnake prefers wetland areas such as bogs, ponds, or swamps, with open canopy and sedge or grass ground cover and lowland coniferous forests (e.g., cedar swamps). The snakes are active from April-May to October and hibernate in the winter in shallow burrows.

The Mitchell's satyr butterfly prefers calcareous wetlands of varying types and is threatened primarily by habitat loss and modification.

The Pitcher's thistle is a flowering plant present along Great Lakes shorelines on open sand dunes with sparse vegetation. The plant was documented as present from the early 1980s to the late 1990s in suitable habitat near the cooling towers, and in 2005 on the north end of Palisades property outside the operational area near Van Buren State Park, and no Pitcher's thistle was found near the cooling towers, or in areas of suitable habitat north or south of the facility property, in surveys conducted in 2005 (SEIS, Reference 9).

NRC concluded that continued operation of Palisades was not expected to adversely affect any federally-listed, threatened or endangered terrestrial species during the license renewal term (SEIS, Reference 9).

There appears to be sufficient space within the operational area for all decommissioning activities and temporary storage of materials and equipment. Decommissioning activities will likely involve use of heavy equipment and could produce some minor soil disturbance.

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These activities will be of short duration and take place in operational and previously disturbed areas on Palisades-owned land that has very little value as wildlife habitat. No protected terrestrial species will be affected by this activity.

**5.1.7.2 Protected Aquatic Species**

As stated in Section 5.1.7, there are no federally-listed aquatic species identified as potentially present in Van Buren County or in Lake Michigan along the county shoreline.

In the SEIS (Reference 9) the NRC stated that impingement and entrainment of fish and shellfish, heat shock or any other (Category 1) cooling system related issues would not significantly contribute to potential impacts on water quality or aquatic resources. The NRC specifically noted that impingement, entrainment, and heat shock had not been found to be a problem at operating nuclear power plants with cooling tower heat dissipation systems.

In the GEIS (Reference 2), the NRC anticipated that the potential impacts of decommissioning on aquatic threatened or endangered species will normally be no greater than and likely far less than the potential impacts of plant operations because the cooling system is not used at a unit undergoing decommissioning.

After permanent reactor shutdown and defueling, the potential for environmental impacts due to impingement/entrainment and thermal effects will be reduced by the lower flow rates and thermal differentials associated with decommissioning activities.

Discharges from the facility will be reduced to those associated with continued operation of the SFPs for several years, discharges associated with decommissioning activities, and stormwater. Flow rates will be further reduced after transfer of the spent fuel from the SFPs to the ISFSI, and shutdown of the SFPs. Discharges during decommissioning will continue to be regulated by the NPDES permit (Reference 15) or new MDEGLE stormwater permits, as applicable.

If selected as a transportation option, barging large plant components from Palisades on Lake Michigan and beyond may require construction of a barge slip or landing and dredging for barge navigation. If a barge slip or landing, or dredging, is needed, these activities will be conducted in accordance with applicable federal, state, and local permits and certifications that include consideration of environmental impacts to threatened and endangered species. In the SEIS, Revision 1 (Reference 10), the NRC noted that if dredging could affect threatened or endangered species or critical habitat, as established under the Endangered Species Act, the USACE must consult with the USFWS or the NMFS before it makes a permit decision. Barge slip or landing construction and dredging would be conducted in accordance with BMPs defined in the applicable permits issued by the MDEGLE and USACE.

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**5.1.7.3 Conclusion**

HDI anticipates that decommissioning activities at Palisades will not encroach on the habitat of any state or federally-listed terrestrial species. Any indirect (disturbance-related) impacts from construction noise and human activity are expected to be localized, of short duration, and ecologically insignificant.

When the details of decommissioning activities, such as demolition or disturbance of land areas that could affect a protected species have been finally determined and scheduled, if potential impacts associated with those activities are considered unbounded by existing environmental impact statements and evaluations, the site-specific assessment of environmental impacts to protected species in the PSDAR will be updated, or provided through a separate and appropriate permit or certification process (e.g., USACE permitting).

Based on the site-specific information presented in this section, and conclusions reached by the NRC in the GEIS (Reference 2), SEIS (Reference 9) and SEIS, Revision 1 (Reference 10) HDI concludes that Palisades decommissioning activities are unlikely to significantly affect any threatened or endangered species and will have no effect on any designated critical habitat.

Therefore, HDI concludes that the impacts of Palisades decommissioning on threatened and endangered species are analogous to those presented in the SEIS (Reference 9) and the SEIS, Revision 1 (Reference 10), and are therefore bounded by them.

**5.1.8 Radiological**

The GEIS (Reference 2) considered radiological doses to workers and members of the public when evaluating the potential consequences of decommissioning activities.

**5.1.8.1 Occupational Dose**

The occupational radiation exposure to Palisades plant personnel will be maintained ALARA and below the occupational dose limits in 10 CFR Part 20 during decommissioning. The need for plant personnel to routinely enter radiological areas to conduct maintenance, calibration, inspection, and other activities associated with an operating plant will be reduced, thus it is expected that the occupational dose to plant personnel will significantly decrease after the plant is permanently shut down and defueled.

Palisades will be within the range of the cumulative occupational dose estimates for decommissioning PWR plants of 560 - 1,215 person-rem (per reactor) provided in Table 4-1 of the GEIS (Reference 2). Palisades is bounded by the PWRs evaluated in the GEIS, and the ALARA program will be maintained to ensure that occupational dose is maintained ALARA and well within 10 CFR Part 20 limits.

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HDI concludes that the impacts of Palisades decommissioning on occupational dose are small and are bounded by the GEIS.

### **5.1.8.2 Public Dose**

Section 4.3.8 of the GEIS (Reference 2) considered doses from liquid and gaseous effluents when evaluating the potential impacts of decommissioning activities on the public. Table G-15 of the GEIS compared effluent releases between operating facilities and decommissioning facilities and concluded that decommissioning releases are lower.

The GEIS also concluded that the collective dose, and the dose to the maximally exposed individual from decommissioning activities, are expected to be well within the regulatory standards in 10 CFR Part 20 and Part 50. In Section 7.1 of the SEIS (Reference 9), no new or significant information was identified during the NRC's independent review of Palisades to indicate that public radiation dose impacts would occur during decommissioning beyond those discussed in the GEIS (Reference 2).

The expected radiation dose to the public from Palisades decommissioning activities will be maintained within regulatory limits and below comparable levels when the plants were operating through the continued application of radiation protection and contamination controls, combined with the reduced source term available in the facility.

HDI concludes that the impacts of Palisades decommissioning on public dose are small and are bounded by the GEIS.

### **5.1.9 Radiological Accidents**

The likelihood of a large offsite radiological release that impacts public health and safety after Palisades is permanently shut down and defueled is considerably lower than the likelihood of a release from the plants during power operation. This is because most of the potential releases associated with power operation are not relevant after the fuel has been removed from the reactor. Furthermore, handling of spent fuel assemblies will continue to be controlled under work procedures designed to minimize the likelihood and consequences of a fuel handling accident. In addition, emergency plans and procedures will remain in place to protect the health and safety of the public while the possibility of significant radiological releases exists.

Section 4.3.9 of the GEIS (Reference 2) assessed the range of possible radiological accidents during decommissioning and separated them into two (2) general categories, fuel related accidents and non-fuel related accidents. Fuel related accidents have the potential to be more severe, and zirconium fire accidents could produce offsite doses that exceed the EPA's protective action guides. As part of its effort to develop generic, risk-informed

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requirements for decommissioning, the NRC staff performed analysis of the offsite radiological consequences of beyond-design-basis SFP accidents using fission product inventories at 30 and 90 days, and two (2), five (5), and ten (10) years. The results of the study indicate that the risk at SFPs is low, and well within the NRC's Quantitative Health Objectives. The generic risk is low primarily due to the very low likelihood of a zirconium fire.

The potential for decommissioning activities to result in radiological releases not involving spent fuel (i.e., releases related to decontamination, dismantlement, and waste handling activities) will be minimized by use of procedures and methods designed to minimize the likelihood and consequences of such releases.

Therefore, HDI concludes that the impacts of Palisades decommissioning on radiological accidents are small and are bounded by the previously issued GEIS.

### **5.1.10 Occupational Issues**

Occupational issues are related to human health and safety. Section 4.3.10 of the GEIS (Reference 2) evaluates physical, chemical, ergonomic, and biological hazards. HDI has reviewed these occupational hazards in the GEIS and concluded that the decommissioning approach chosen for Palisades poses no unique hazards from those evaluated in the GEIS. HDI will continue to maintain appropriate administrative controls and requirements to ensure occupational hazards are minimized and that applicable federal, state, and local occupational safety standards and requirements continue to be met.

Section 4.3.10 in the GEIS concluded that impacts due to occupational issues would be small for all plants based on strict adherence to NRC and Occupational Safety and Health Administration standards, practices, and procedures. Therefore, HDI concludes that the impacts of Palisades decommissioning on occupational issues are bounded by the GEIS.

### **5.1.11 Cost**

Decommissioning costs for Palisades are discussed in Section 4.0 and in Enclosure 1 to this report. Section 4.3.11 of the GEIS recognizes that an evaluation of decommissioning cost is not a National Environmental Policy Act (NEPA) requirement. Therefore, a bounding analysis is not applicable.

### **5.1.12 Socioeconomics**

Decommissioning of Palisades is expected to result in negative socioeconomic impacts. As Palisades ceases operation and transitions through the phases of decommissioning, an overall decrease in site workforce and tax payments will occur. The lost wages of these site staff will result in decreases in revenues available to support the local economy and local

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tax authorities. Some laid-off workers may relocate, thus potentially impacting the local cost of housing and availability of public services.

Section 4.3.12 of the GEIS (Reference 2) evaluated changes in workforce and population changes, changes in local tax revenue, and changes in public services. The GEIS concluded that socioeconomic impacts of decommissioning are neither detectable nor destabilizing, and that mitigation measures are not warranted.

Therefore, HDI concludes that the impacts of Palisades decommissioning on socioeconomic impacts are bounded by the GEIS.

### **5.1.13 Environmental Justice**

Executive Order 12898 dated February 16, 1994, (Reference 11) directs federal executive agencies to make achieving environmental justice a part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations. In a policy statement published in the Federal Register on August 24, 2004 (69 FR 52040) the NRC committed to meet the general goals of the executive order related to its regulatory or licensing actions through the NEPA review process (Reference 12).

Section 4.3.13 in the GEIS (Reference 2) determined environmental justice to be an environmental impact area for which no generic conclusion could be determined due to its site-specific nature. Therefore, the GEIS indicates that site-specific assessments for each decommissioning nuclear power plant must be prepared.

In the SEIS (Reference 9), the NRC examined the geographic distribution of minority- and low-income populations within 50 miles of the site using data from the 2000 census, and through discussions with local agencies in Van Buren County. The NRC did not identify any location-dependent disproportionately high and adverse impacts affecting these populations and concluded that offsite impacts from continued operation of Palisades on minority- and low-income populations would be small with no special mitigation actions warranted.

HDI conducted a site-specific assessment of environmental justice as it relates to the effects of Palisades decommissioning. HDI examined the geographic distribution of minority and low-income populations within a 50-mile radius of Palisades using the 2014-2018 American Community Survey 5-year estimates. Census block groups containing minority populations were identified and were concentrated in Covert and Keeler in Van Buren County, the urban areas of Kalamazoo, Benton Harbor-Benton Heights-Fair Plain and South Bend-Mishawka-Elkhart, and in Berrian, Van Buren and Cass Counties. The locations and population characteristics of minority and low-income populations are similar to those evaluated by the NRC in the SEIS (Reference 9).

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HDI has determined that decommissioning impacts to all resource areas would be small, indicating that the effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. Because no member of the public will be substantially affected, there can be no disproportionately high and adverse impacts on minority and low-income populations resulting from the decommissioning of Palisades. Based on these site-specific findings, HDI concludes that the impacts of Palisades decommissioning on minority and low-income populations are small.

#### **5.1.14 Cultural, Historic and Archeological Resources**

Section 4.3.14 in the GEIS (Reference 2) determined that potential effects of decommissioning on cultural, historical, and archaeological resources would be small for all plants when the decommissioning activities are confined to the operational area. However, impacts outside the operational area "must be determined through site-specific analysis."

In the SEIS (Reference 9), the NRC reported there were no historic properties affected by the proposed license renewal in the project area and that no known sites of significance to Native Americans had been identified in the Palisades area. The NRC also reported that as far as could be determined at the time of issuance of the operating license in 1972, the existing plant should not directly affect any site eligible for registration as a National Historic Landmark.

The NRC concluded that intact archeological sites could be present within the undeveloped areas of the Palisades property and in soils below the depth of prior ground disturbance in most areas of the site (SEIS, Reference 9).

HDI anticipates that decommissioning activities will take place within the Palisades operational and previously disturbed areas. In the event ground disturbance is proposed in areas outside operational and previously disturbed areas, or historical or archeological resources are encountered during excavation, assessments, and consultation with Michigan State Historic Preservation Office will be conducted, as appropriate.

Therefore, HDI concludes that potential for impacts to cultural, historical, and archaeological resources is bounded by the GEIS.

#### **5.1.15 Aesthetic Issues**

During decommissioning, the impact of activities on aesthetic resources will be temporary and remain consistent with the aesthetics of an industrial site. In most cases, Section 4.3.15 of the GEIS (Reference 2) concludes that impacts such as dust, construction disarray, and noise would not easily be detectable offsite.

The GEIS concluded that the demolition and dismantlement of structures during



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decommissioning could result in aesthetic impacts improving fairly rapidly as a result of the removal of structures and restoration of the site. The GEIS concludes that the removal of structures is generally considered beneficial to the aesthetic impacts of the site, and that the potential aesthetic impacts of decommissioning are small.

Therefore, HDI concludes that the impacts of Palisades decommissioning on aesthetic issues are bounded by the GEIS.

### **5.1.16 Noise**

General noise levels during the decommissioning process are not expected to be any more severe than during refueling outages and are not expected to present an audible intrusion on the surrounding community. Some decommissioning activities may result in higher-than-normal onsite noise levels (i.e., some types of demolition activities). However, these noise levels would be temporary and are not expected to present an audible intrusion on the surrounding community.

Section 4.3.16 of the GEIS (Reference 2) indicates that noise impacts are not detectable or destabilizing and makes a generic conclusion that potential noise impacts are small. Based on the standard decommissioning approach proposed for Palisades, HDI concludes that the impacts of Palisades decommissioning on noise are bounded by the GEIS.

### **5.1.17 Transportation**

The transportation impacts of decommissioning are dependent on the number of shipments to and from the site, the types of shipments, the distance the material is shipped, and the radiological waste quantities and disposal plans. The shipments from the site would be primarily radioactive waste and non-radioactive waste associated with dismantlement and disposal of SSCs.

The total estimated cubic feet of radioactive waste associated with Palisades decommissioning destined for land disposal at an LLRW (Class A, B or C) disposal facility, or a future geologic repository (for GTCC) is summarized below:

- Class A: 1,128,683 cubic feet
- Class B: 605 cubic feet
- Class C: 168 cubic feet
- GTCC: 345 cubic feet

The estimated LLRW volume (Class A, B, and C) for Palisades that is destined for land disposal will be approximately 1.13 million cubic feet. Of this volume, approximately 5% to 8% or 75,000 cubic feet, is estimated to be soil contaminated at very low levels associated with building foundation, underground utility removal, and specific impacted areas

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identified during site wide characterization.

Estimated Waste Volumes are provided below.

Waste	Class	Palisades (cubic feet)	Palisades (lbs)
Low-Level Radioactive Waste	A	1,128,683	91,962,633
	B	605	73,450
	C	168	16,198
Greater than Class C Waste	GTCC	345	54,548
<b>Total</b>		<b>1,129,800</b>	<b>92,106,830</b>

The anticipated waste volumes for Palisades decommissioning are bounded by the high-end estimate of 1.5 million cubic feet in Table 4-7 of the GEIS (Reference 2) associated with decommissioning of a facility to unrestricted release conditions.

HDI's objective for decommissioning of Palisades is to achieve unrestricted release and is anticipated to include removal and offsite disposal of most, if not all, above grade structures and contaminated soil. The NRC recognized in the GEIS (Reference 2) that facilities being decommissioned with an objective of achieving unrestricted release, including removal of all structures, could result in disposal of considerable volumes of radioactive and non-radioactive waste.

HDI must comply with applicable regulations when shipping radioactive waste from decommissioning. The NRC has concluded in Section 4.3.17 of the GEIS that these regulations are adequate to protect the public against unreasonable risk from the transportation of radioactive materials. Shipments will occur over an extended period of time and will not result in significant changes to local traffic density or patterns, or significant dose to workers or the public.

Transportation approach will utilize road, road to rail (i.e., intermodal) at a transfer facility and a portion of the waste may be removed from the site by barge and transported to an appropriate offsite location where it will be transferred to railcars or trucks for shipment to an appropriate disposal facility. If implemented, road to rail transfer and or barge transportation will reduce the number of shipments from the site over local roadways. The use of barge transportation will increase marine vessel traffic in the area. It is expected that these activities will not cause a navigational safety hazard or a substantial delay in the normal movements of commercial or recreational vessels.

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Shipments of non-radioactive wastes from the site are not expected to result in measurable deterioration of affected roads or a destabilizing increase in traffic density.

The GEIS (Reference 2) concludes that both non-radiological and radiological impacts of decommissioning transportation are not detectable or destabilizing. The NRC reached a generic conclusion that for all plants, the potential transportation impacts are small. No unique features or site-specific conditions are present at Palisades that would alter these findings. Therefore, HDI concludes that the potential impacts of Palisades decommissioning on transportation are bounded by the GEIS.

### **5.1.18 Irreversible and Irrecoverable Commitment of Resources**

Irreversible commitments are commitments of resources that cannot be recovered, and irretrievable commitments of resources are those that are lost for only a period of time.

Uranium is a natural resource that is irretrievably consumed during power operation. After the plants are permanently shut down, uranium is no longer consumed. The use of the environment (air, water, land) is not considered to represent a significant irreversible or irretrievable resource commitment, but rather a relatively short-term investment. Since the Palisades site will be decommissioned to meet the unrestricted release criteria found in 10 CFR 20.1402, the land is not considered an irreversible resource. The only irretrievable resources that would occur during decommissioning would be materials used to decontaminate the facility (i.e., rags, solvents, gases, and tools), and the fuel used for decommissioning activities and transportation of materials to and from the site. However, the use of these resources is minor.

The NRC concluded in Section 4.3.18 of the GEIS (Reference 2) that the impacts of decommissioning on irreversible and irretrievable commitments of resources are small. Therefore, HDI concludes that the impacts of Palisades decommissioning on irreversible and irretrievable commitment of resources are bounded by the GEIS.

## **5.2 Environmental Impacts of License Termination**

In accordance with 10 CFR 50.82(a)(9), the site LTP will be developed and submitted for NRC at least two (2) years prior to the expected date for partial site release.

According to the schedule provided in Section 3 of this PSDAR, an LTP for the Palisades site will be developed to support a planned partial site release date in 2040. The LTP is scheduled to be submitted to the NRC in 2037. NRC final license termination will occur following the removal of spent nuclear fuel and GTCC waste from the site as well as completion of ISFSI decommissioning. As shown on the schedule provided in Section 3, ISFSI decommissioning is planned to be completed in 2041. At that time, a supplemental environmental report will be submitted as required by 10 CFR 50.82(a) (9). While detailed planning for license termination activities will not be performed until after completion of

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most of the decommissioning activities for site areas except the ISFSI, the absence of any unique site-specific factors, significant groundwater contamination, unusual demographics, or impediments to achieving unrestricted release suggest that impacts resulting from license termination will be similar to those evaluated in NUREG-1496 (Reference 8).

### **5.3 Discussion of Decommissioning in the SEIS**

Postulated impacts associated with decommissioning are discussed in Section 7.0 of the SEIS (Reference 9), which identified six (6) issues related to decommissioning as follows:

- Radiation Doses
- Waste Management
- Air Quality
- Water Quality
- Ecological Resources
- Socioeconomic Impacts

The NRC staff did not identify any new and significant information during their independent review of the Palisades license renewal environmental report at that time, the site audit, or the scoping process for license renewal. Therefore, the NRC concluded that there are no impacts related to these issues beyond those discussed in the SEIS (Reference 9) or the GEIS (Reference 2) for decommissioning. For the issues above, the SEIS for license renewal and decommissioning GEIS concluded the anticipated impacts are small. The NRC found no site-specific issues related to decommissioning and there are no decommissioning activities contemplated for Palisades that would alter that conclusion.

### **5.4 Additional Considerations**

While not quantitative, the following considerations are relevant to concluding that decommissioning activities will not result in significant environmental impacts not previously reviewed:

- The release of effluents will continue to be controlled by license requirements and plant procedures.
- Palisades will continue to comply with the Offsite Dose Calculation Manual, Radiological Environmental Monitoring Program, and the Groundwater Protection Initiative Program during decommissioning.
- Releases of non-radiological effluents will continue to be controlled per the requirements of the NPDES permit (Reference 15) and applicable MDEGLE permits.
- Systems used to treat or control effluents during power operation will either be maintained or replaced by temporary or mobile systems for the decommissioning activities.

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- Radiation protection principles used during plant operations will remain in effect during decommissioning.
- Sufficient decontamination and source term reduction prior to dismantlement will be performed to ensure that occupational dose and public exposure will be maintained below applicable limits.
- Transport of hazardous and or radioactive waste will be in accordance with plant procedures, applicable federal regulations, and the requirements of the receiving facility.
- Due diligence included Palisades information regarding the existence of alpha contamination due to failed fuel. CDI's decommissioning plan includes efforts to properly identify and monitor for alpha contamination consistent with accepted industry practices and guidelines.

Site access control during decommissioning will minimize or eliminate radiation exposure pathways to the public.

Additionally, NUREG-2157 (Reference 13) found that the generic environmental impacts of ongoing spent fuel storage are small.

## **5.5 Conclusions**

Based on the above discussions, HDI concludes that the environmental impacts associated with planned Palisades site-specific decommissioning activities will be bounded by appropriate, previously issued environmental impact statements. Specifically, the environmental impacts are bounded by the GEIS (Reference 2), SEIS (Reference 9), SEIS, Revision 1 (Reference 10) and the site-specific analyses summarized in this report.

1. The postulated impacts have already been considered in the SEIS and GEIS or addressed in the site-specific analyses summarized in this report.
2. There are no unique aspects of Palisades or of the decommissioning techniques to be utilized that would invalidate the conclusions reached in the SEIS and GEIS.
3. The methods assumed to be employed to dismantle and demolish Palisades are standard construction-based techniques fully considered in the SEIS and GEIS.

Therefore, it can be concluded that the environmental impacts associated with the site-specific decommissioning activities for Palisades will be bounded by appropriate previously issued environmental impact statements.

10 CFR 50.82(a) (6) (ii) states that licensees shall not perform any decommissioning activities, as defined in 10 CFR 50.2 that result in significant environmental impacts not previously reviewed. No such impacts have been identified.

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**Enclosure 1: Palisades Site-Specific Decommissioning Cost Estimate**



**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

Prepared by  
**Holtec Decommissioning International, LLC**  
and  
**Comprehensive Decommissioning International, LLC**

**Palisades Nuclear Plant  
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**ACRONYM LIST**

ACM	Asbestos Containing Material
ALARA	As Low As Reasonably Achievable
BOE	Basis of Estimate
CDI	Comprehensive Decommissioning International, LLC
CFR	Code of Federal Regulations
CPM	Critical Path Method
DCE	Decommissioning Cost Estimate
DGC	Decommissioning General Contractor
DOE	Department of Energy
ENP	Entergy Nuclear Palisades
ENOI	Entergy Nuclear Operations, Inc.
GTCC	Greater Than Class C
HDI	Holtec Decommissioning, International, LLC
Holtec	Holtec International
IAEA	International Atomic Energy Agency
ISDC	International Structure for Decommissioning Costing
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low Level Radioactive Waste
LTA	License Transfer Application
LTP	License Termination Plan
LSA	Low Specific Activity
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MPC	Multi-Purpose Canister
MSS	Master Summary Schedule
MWt	Megawatts-Thermal
NDT	Nuclear Decommissioning Trust
NEA	Nuclear Energy Agency
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission technical report designation
O&M	Operations and Maintenance
Palisades	Palisades Nuclear Plant
PWR	Pressurized Water Reactor
RPV	Reactor Pressure Vessel
PSDAR	Post Shutdown Decommissioning Activities Report
RRR	Real Rate of Return
RSSI	Radiation Survey and Site Investigation
RVI	Reactor Vessel Internals
SCO	Surface Contaminated Object
SFP	Spent Fuel Pool
SME	Subject Matter Expert
SNF	Spent Nuclear Fuel

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US	United States
WBS	Work Breakdown Structure
WCS	Waste Control Specialists

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**SUMMARY**

This report presents a Site-Specific Decommissioning Cost Estimate (DCE), as required by 10 CFR 50.82(a)(7), for the decommissioning of the Palisades Nuclear Plant (Palisades). This DCE provides the Holtec Decommissioning International (HDI) site-specific DCE for decommissioning following license transfers and sale of the entity that owns Palisades from Entergy to Holtec. This DCE is included as an attachment to the Palisades Post-Shutdown Decommissioning Activities Report (PSDAR) that describes HDI's decommissioning plan.

On December 23, 2020 ENOI, on behalf of itself and Entergy Nuclear Palisades (to be renamed Holtec Palisades, LLC after the transaction closing), Holtec International (Holtec) and HDI submitted a License Transfer Application (LTA) to the U.S. Nuclear Regulatory Commission (NRC) requesting approval for the transfer of the Palisades Renewed Facility Operating License No. DPR-20 for the Palisades and the general license for the Palisades Independent Spent Fuel Storage Installation (ISFSI) and Facility Operating License No. DPR-6 for Big Rock Point and the general license for the Big Rock Point ISFSI to Holtec Palisades and HDI (Reference 2). Following the transfer of the licenses and the sale closure, Holtec Palisades will be the licensed owner and HDI will be the licensed operator. HDI will contract with Comprehensive Decommissioning International, LLC (CDI) as the Decommissioning General Contractor (DGC). Following the sale and transfer of the licenses, HDI intends to complete decommissioning well before 60 years following permanent cessation of operations as required by 10 CFR 50.82(a)(3).

CDI prepared this cost estimate and schedule for HDI using several sources, including Palisades data and historical information obtained from ENOI in addition to the input and professional judgment of experienced decommissioning, demolition and waste management specialty subcontractors and subject matter experts (SMEs). This estimate is based on regulatory requirements, site conditions, basis of estimate assumptions, low-level radioactive waste disposal standards, high-level radioactive waste management options, and site restoration requirements. The methods utilized to estimate decommissioning costs were based on experienced SME assessments regarding the nature of the work, degree of scope definition and the availability of quantifiable cost and pricing data. In addition, HDI used real time experience and executed contracts from Holtec-owned nuclear decommissioning sites to help prepare this DCE. The decommissioning costs presented in this report are reported in 2020 dollars. Escalation of future decommissioning costs over the remaining decommissioning project life cycle are excluded.

HDI's detailed decommissioning project schedule is used as the foundation for developing the decommissioning cost estimate model and the risk model. The schedule baseline is a detailed Critical Path Method (CPM) schedule developed with input from key decommissioning subcontractors and SMEs. The schedule and cost estimate are based on the International Structure for Decommissioning Costing (ISDC) for Nuclear Installations (Reference 10) Work Breakdown Structure (WBS) and corresponding WBS dictionary.

This DCE demonstrates that adequate funding is available in the Nuclear Decommissioning Trust (NDT) fund to complete license termination. In addition to the license termination costs, site restoration and spent nuclear fuel management costs are included in this estimate; however,

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per regulatory requirements, the non-radiological estimates are segregated and listed separately. The HDI request for NRC approval of an exemption from the requirements of 10 CFR 50.82(a)(8)(i)(A) to use NDT funds for spent fuel management and site restoration activities is being submitted by HDI separately (Reference 11).

HDI's costs to decommission the site, safeguard the spent fuel until it can be transferred to the Department of Energy (DOE) and restore the impacted area of the site are estimated to be \$644 million in 2020 dollars. The summary of the costs estimated for License Termination, Spent Fuel Management and Site Restoration activities are presented in the summary table below.

**Palisades Decommissioning Cost Summary (thousands of 2020 dollars)**

Cost Category	License Termination	Spent Fuel	Site Restoration	Total
Decontamination	7,697			7,697
Removal	109,357		21,433	130,790
Packaging	34,984		4,043	39,028
Transportation	31,674		2,736	34,411
Disposal	34,609		2,682	37,291
Off-site Waste Processing	5,880			5,880
Program Management	145,736	32,602	3,373	181,712
Corporate A&G	-	-	-	-
Spent Fuel (Direct Expenditures)		123,230		123,230
Insurance and Regulatory Fees	23,809	5,309	194	29,312
Energy	7,679			7,679
Characterization and Licensing Surveys	7,926			7,926
Property Taxes	8,589	4,981	217	13,787
Miscellaneous Equipment / Site Services	25,273			25,273
Spent Fuel Pool Isolation	-	-	-	-
<b>Grand Total<sup>1</sup></b>	<b>443,215</b>	<b>166,122</b>	<b>34,679</b>	<b>644,015</b>

<sup>1</sup> Columns may not add due to rounding.

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## **1 INTRODUCTION**

This report presents a Site-Specific DCE, as required by 10 CFR 50.82(a)(7), for the decommissioning of Palisades. This DCE provides the HDI site-specific DCE for decommissioning following license transfers and sale of the entity that owns Palisades from Entergy to Holtec. This DCE is included as an attachment to the Palisades PSDAR that describes HDI's decommissioning plan.

By letter dated October 19, 2017, Entergy Nuclear Operations, Inc. (ENOI) submitted to the NRC a Notification of Permanent Cessation of Power Operations (Reference 1) for Palisades notifying the NRC of its intent to permanently cease power operations no later than May 31, 2022.

On December 23, 2020 ENOI, on behalf of itself and Entergy Nuclear Palisades (to be renamed Holtec Palisades, LLC after the transaction closing), Holtec and HDI submitted a LTA to the NRC requesting approval for the transfer of the Palisades Renewed Facility Operating License No. DPR 20 for Palisades and the general license for the Palisades ISFSI and Facility Operating License No. DPR-6 for Big Rock Point and the general license for the Big Rock Point ISFSI to Holtec Palisades and HDI (Reference 2).

The initiation of decommissioning activities will occur following the sale closure and license transfers. The sale closure and license transfers are targeted to be complete prior to July 1, 2022, following cessation of plant operations and permanent reactor defueling. In addition, HDI is submitting a request for NRC approval of an exemption to use NDT funds for spent fuel management and site restoration activities.

Following the sale closure and transfer of the facility licenses, HDI will initiate decommissioning activities and expects to be completed well before 60 years following permanent cessation of operations as required by 10 CFR 50.82(a)(3). HDI has a project goal to complete all decommissioning activities and terminate the Palisades operating license within approximately 20 years of license transfer.

### **1.1 Objectives**

The goal for the project is the decommissioning of Palisades following shutdown and permanent reactor defueling leading ultimately to the termination of the NRC licenses. Decommissioning objectives are:

- a. Decommissioning of Palisades and site restoration of all areas.
- b. DOE acceptance of Spent Nuclear Fuel (SNF) from the Palisades ISFSI.
- c. NRC termination of the Palisades licenses and final site release when decommissioning is complete.
- d. Final site restoration of the site.

The objective of this DCE is to provide a description of the planned decommissioning activities and an estimate of the cost, along with the detailed schedule of associated activities required to complete the decommissioning of the plant and obtain NRC approval



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of license termination. The estimate and schedule are based on the assumptions delineated in this document.

## **1.2 Site Description**

Palisades is a single unit pressurized water reactor with a licensed thermal power of 2565.4 MWt. Palisades is located along the eastern shore of Lake Michigan in Covert Township, approximately four and one-half miles south of South Haven, Michigan, and consists of the pressurized water reactor, other associated plant equipment, and related site facilities. Palisades is also the site of the generally licensed Palisades ISFSIs. Palisades is currently owned by Entergy Nuclear Palisades (ENP) and operated by ENOI.

## **1.3 Regulatory Guidance**

Current regulations governing decommissioning, waste management, and spent fuel management; and the funding of those elements, include the following:

- Decommissioning is defined in 10 CFR 50.2 as the safe removal of a facility or site from service and the reduction of residual radioactivity to levels that permit release of the site and termination of the license.
- Pursuant to 10 CFR 50.51(b), each license for a facility that has permanently ceased operations continues in effect beyond the expiration date to authorize ownership and possession of the production or utilization facility, until the Commission notifies the licensee in writing that the license is terminated.
- Prior to, or within two years following permanent cessation of operations, the licensee is required by 10 CFR 50.82(a)(4)(i) to submit a PSDAR to the NRC. The PSDAR must contain a site-specific DCE, including the projected cost of managing irradiated fuel.
- Pursuant to 10 CFR 50.82(a)(7) the licensee is required to notify the NRC before performing any decommissioning activity inconsistent with, or making any significant changes from, those action and schedules described in the PSDAR.
- Pursuant to 10 CFR 50.82(a)(8)(iii), within 2 years following permanent cessation of operations, if not already submitted, the licensee shall submit a site-specific DCE.
- Pursuant to 10 CFR 50.82(a)(8)(iv), during the period of dormancy planned for 2025 through 2035, HDI will use the annual NDT fund status update required in 10 CFR 50.75(f)(1) and 10 CFR 50.82(a)(8) to provide a means for adjusting decommissioning and spent fuel management cost estimates and associated funding levels over the dormancy period.
- In accordance with 10 CFR 72.30, licensees must have a proposed decommissioning plan for the ISFSI site and facilities that includes a cost estimate for the plan. The plan should contain sufficient information on the proposed practices and procedures for the decontamination of the ISFSI and for the disposal of residual radioactive materials after all spent fuel, high-level radioactive waste, and reactor related GTCC waste have been removed.

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- Use of the decommissioning funds is limited by 10 CFR 50.82(a)(8)(i) to legitimate decommissioning expenses that neither reduces the value of the trust fund below that necessary to place and maintain the reactor in a safe storage condition if unforeseen conditions or expenses arise, nor inhibits the ability of the licensee to complete funding of any shortfalls in the trust needed to ensure the availability of funds to ultimately release the site and terminate the license.
- As provided in 10 CFR 50.82(a)(8)(ii), a licensee may withdraw funds from the decommissioning trust up to a cumulative total of 3 percent of the generic amount calculated under 10 CFR 50.75 for decommissioning planning purposes at any time. After submittal of the certifications of permanent shutdown and fuel removal required under 10 CFR 50.82(a)(1) and commencing 90 days after the NRC has received the PSDAR, the licensee may use an additional 20 percent of the decommissioning funds prescribed in 10 CFR 50.75(c) for decommissioning purposes. The licensee is prohibited from using the remaining 77 percent of the generic decommissioning funds until a site-specific DCE is submitted to the NRC.
- Regulatory Guide 1.202, Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Plants, (Reference 3) provides the standard format and content to facilitate preparation and NRC review of required cost estimates.

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## **2 DECOMMISSIONING APPROACH**

### **2.1 Decommissioning Approach**

Palisades decommissioning activities will proceed following sale and license transfers to HDI. Decommissioning is expected to be completed well before 60 years following permanent cessation of operations as required by 10 CFR 50.82(a)(3).

The Palisades PSDAR describes HDI's planned decommissioning processes and impacts. This DCE provides an estimate of the costs to decommission the Palisades facility. A planned schedule of decommissioning activities is shown in Figure 5-1.

The decommissioning approach reflected in this cost estimate is organized into activities based on the ISDC Work Breakdown Structure (WBS) and corresponding WBS dictionary. The ISDC WBS is a delivery-based, hierarchical structure organized at the highest level of a decommissioning project into eleven groups of similar activities or principal work groups:

- 01 – Pre-decommissioning actions
- 02 – Facility shutdown activities
- 03 – Additional activities for safe enclosure and entombment
- 04 – Dismantling activities within the radiologically controlled area
- 05 – Waste processing, storage, and disposal
- 06 – Site infrastructure and operation
- 07 – Conventional dismantling, demolition, and site restoration
- 08 – Project management, engineering, and support
- 09 – Research and development
- 10 – Fuel and nuclear material
- 11 – Miscellaneous expenditures

Of the eleven principal work groups identified in the ISDC Level 1 WBS, activities 03 and 09 are not used for the Palisades project. Activity 03-Additional activities for safe enclosure and entombment is not applicable to the decommissioning approach used by HDI for the Palisades decommissioning. There are no experimental activities associated with the project, therefore Activity 09-Research and development is not used.

NRC guidance in Regulatory Guide 1.202, Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Plants, (Reference 3) provides the recommended method of summarizing total decommissioning costs by period. The four periods are: Pre-Decommissioning Planning and Preparation, Plant Deactivation, Safe Storage Operations, and Dismantlement. NUREG-1713, Standard Review Plan for Decommissioning Cost Estimates for Nuclear Reactors (Reference 4), and NUREG/CR-5884, Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station, (Reference 5) divides decommissioning activities into similar periods.

To facilitate a comparison of projected Palisades decommissioning costs to the reference PWR, decommissioning activities are organized into periods like those described in NRC guidance, with differences described below.

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Periods 1 through 4 are generally consistent with the decommissioning periods in Regulatory Guide 1.202; however, a Program Management cost category (Period 6) is added to capture generic labor and project support costs that are applicable to periods 1 through 4 but not readily distributable into individual periods. Since acceptance of spent nuclear fuel by DOE is not assumed to be completed until 2040, a fifth period is included in the Palisades cost estimate and is identified as Ongoing ISFSI Operations. This fifth period captures the costs associated with storing spent fuel and GTCC waste until DOE acceptance, as well as the costs for decommissioning the ISFSI. Dormancy period costs from 2025 to 2035 are captured in both Periods 5 and 6.

Period 1 – Pre-Decommissioning Planning and Preparation

In the time leading up to and following the sale and license transfers, preparations for performance of decommissioning will include the following activities:

1. Final decommissioning planning
2. Procurement of services, materials, and supplies
3. Licensing and permitting actions necessary to reflect the defueled and permanently shut-down plant configuration
4. Stakeholder interaction
5. Facility characterization so that radiological, regulated, and hazardous wastes are identified, categorized, and quantified to support decommissioning and waste management planning
6. Waste management planning, including determination of transportation and disposal container requirements and disposal pathways
7. Performance of safety, security, and environmental studies

Period 2 - Plant Deactivation

During the time between plant shutdown and sale and license transfers, ENOI will defuel the reactor in preparation for decommissioning. Following license transfers, HDI will operate and maintain the Spent Fuel Pool (SFP) and supporting systems required for cooling of the SNF and perform the following activities:

1. Isolation of power equipment
2. Drainage and drying of systems
3. Removal of system fluids, operational waste, and redundant material
4. Radiological inventory characterization to support detailed planning

Due to the decommissioning strategy utilized by HDI, reactor vessel and internals segmentation and removal activities are included in Period 4.

Period 3 - Safe Storage Operations

The activities in this period only include preparations for and conduct of fuel movement to an on-site dry fuel storage facility. This period concludes once all the spent nuclear fuel has

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been removed from the SFP and placed into long term storage at the ISFSI. Activities include the following:

1. Construction of additional dry fuel storage capacity
2. Transfer of spent nuclear fuel to dry storage canisters
3. Movement and placement of fuel into long term storage at the ISFSI
4. Operation of the ISFSI until all fuel is placed in the ISFSI

Period 4 - Dismantlement

The following dismantlement activities will be performed during this period according to the project decommissioning schedule. These activities include detailed work planning, procurement, mobilization and execution of the dismantlement and disposal work and support activities, including measures to maintain occupational dose As Low As Reasonably Achievable (ALARA).

1. Asbestos Containing Material (ACM), Hazardous, and Universal Waste removal
2. Dismantling of main process systems, structures, and components
3. Dismantling of reactor internals, core components and reactor vessel
4. Dismantling of other primary loop components
5. Dismantling of other systems and components
6. Reactor Vessel Internals (RVI) and Reactor Pressure Vessel (RPV) segmentation, tooling design, fabrication, and testing.
7. Procurement of equipment, tools, and services
8. Procurement of waste containers
9. Demolition of buildings and structures within the radiologically controlled area
10. Maintenance, surveillance, and operational support for waste management
11. Low level waste management
12. Management of exempt waste and materials
13. Management of waste and materials generated outside the radiologically controlled area
14. Final status survey
15. Earthworks and land works
16. Landscaping and site finishing

Period 5 – Ongoing ISFSI Operations

Ongoing ISFSI Operations activities are associated with storing spent fuel and GTCC waste until DOE acceptance, as well as the costs for decommissioning the ISFSI. Activities for Period 5 include:

1. Operational activities from the time that all spent fuel is in storage at the ISFSI until all spent fuel and GTCC waste is removed from the ISFSI
2. Decommissioning of the ISFSI
3. Dormancy costs

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Period 6 – Program Management

Program Management costs include infrastructure and operation, management and fees that are generic in nature and applicable across decommissioning Periods 1 through 4. These costs include the following:

1. Site infrastructure and operation costs, including security, maintenance, site upkeep, operation of support systems and environmental monitoring
2. Project management, engineering and support including the core management group, scheduling and cost control, quality assurance, health and safety, records management, general administration and accounting, warehousing, engineering, regulatory and support services
3. Regulatory fees, taxes, and insurance
4. Dormancy costs

Due to the generic nature of Program Management costs and the fact that work activities associated with Periods 1 through 4 are performed concurrently, it is not feasible to allocate these costs to discrete Periods.

WBS Principal Activities Mapping.

The nine Level 1 WBS principal activities used for the Palisades project are mapped in Table 2-1 to the decommissioning periods described above in accordance with the following conventions:

- Period 1, Pre-Decommissioning Planning and Preparation maps directly to principal work group 01-Pre-decommissioning actions.
- Period 2, Plant Deactivation, maps directly to principal work group 02-Facility Shutdown Activities.
- Period 3, Safe Storage Operations maps to principal work group 10-Fuel and Nuclear Material for those activities required to complete the movement of all spent nuclear fuel into dry storage, as indicated by the 2025 end date.
- Period 4, Dismantlement, maps to principal work groups 04-Dismantling Activities Within the Radiologically Controlled Area, 05-Waste Processing, Storage and Disposal and 07-Conventional Dismantling Demolition and Site Restoration.
- Period 5, Ongoing ISFSI Operations, maps to principal work group 10- Fuel and Nuclear Materials like Period 2, but activities in this period begin once all spent nuclear fuel is placed in dry storage and end when the ISFSI is decommissioned in 2041.
- Period 6, Program Management is applicable to activities performed across Periods 1 through 4 and is mapped to principal work groups 06-Site Infrastructure and Operation; 08- Project Management, Engineering and Support and 11-Miscellaneous Expenditures.

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**Table 2-1 Decommissioning Periods and WBS Elements**

Period	Period Title	WBS Elements	Start and Finish
1	Pre-Decommissioning Planning and Preparation	01.02.01 Pre-decommissioning actions	06/21/2022 - 05/03/2023
2	Plant Deactivation	01.02.02 Facility Shutdown Activities	06/21/2022 - 09/02/2023
3	Safe Storage Operations	01.02.10 Fuel and Nuclear Material (until fuel on pad)	01/03/2023 - 11/03/2025 <sup>1</sup>
4	Dismantlement	01.02.04 Dismantling Activities Within the Radiological Controlled Area	06/21/2022 - 12/30/2041
		01.02.05 Waste Processing, Storage and Disposal	06/21/2022 - 03/31/2041
		01.02.07 Conventional Dismantling, Demolition, and Site Restoration (LTP portion only)	06/21/2022 - 11/20/2041
5	Ongoing ISFSI Operations	01.02.10 Fuel and Nuclear Material (after fuel on pad)	11/03/2025 - 12/30/2041
6	Program Management	01.02.06 Site Infrastructure and Operation	06/21/2022 - 12/30/2041
		01.02.08 Project Management, Engineering and Support	06/21/2021 - 12/30/2041
		01.02.11 Miscellaneous Expenditures	06/21/2022 - 12/31/2041

<sup>1</sup> Fuel on pad date is 7/2/25, however, additional Period 3 costs include demobilization continue through 11/3/25.

### **3 DECOMMISSIONING COST ESTIMATE**

The DCE for decommissioning Palisades presented in this section demonstrates that adequate funding is available in the NDT fund to complete license termination. In addition to the License Termination costs, Site Restoration and Spent Fuel Management costs are included in this estimate; however, per regulatory requirements, the non-radiological licensing termination estimates are segregated and listed separately. In addition, this section provides a cash flow analysis demonstrating the adequacy of decommissioning funding.

The decommissioning costs presented in this report are reported in 2020 dollars. Escalation of future decommissioning costs over the remaining decommissioning project life cycle are excluded.

The cost estimate summary is presented, followed by a discussion of the site-specific matters that were taken into consideration while developing this DCE. Site-specific matters include items that are applicable to decommissioning Pressurized Water Reactors (PWRs). Section 4.0 discusses the estimating methodology, basis of estimate and assumptions that were used in preparing this cost estimate; as well as the methods of handling the risk and uncertainty that are inherent in the project, which carry over to the estimate.

#### **3.1 Cost Estimate Summary**

This DCE conforms with the guidance provided in NRC Regulatory Guide 1.202. The estimate was developed and organized using the ISDC Work Breakdown Structure (WBS) and corresponding WBS dictionary. The ISDC WBS is a delivery-based, hierarchical structure and is identified as the international standard cost structure for nuclear facility decommissioning projects, addressing the entirety of work within the planned scope of a typical nuclear facility decommissioning project (i.e., license termination, site restoration, and spent nuclear fuel management). The ISDC WBS is organized at the highest level of a decommissioning project into eleven principal work groups of which nine are applicable to the Palisades project. As described in subsection 2.3 of this DCE, Activity 03-Additional activities for safe enclosure and entombment and Activity 09-Research and development are not used.

To organize the WBS information in a format consistent with regulatory guidance, Table 3-1 presents decommissioning costs by the five Periods and Program Management category described in Section 2.3.

Table 3-2 provides a detailed view of the Program Management costs on an annualized basis. Program Management costs include expenses that are common to decommissioning Periods 1 through 4, and include site infrastructure and operation, project management, engineering, regulatory, support services, scheduling and cost control, quality assurance, general administration, materials management, insurance, taxes, and fees. Due to the generic nature of Program Management costs and the fact that work activities associated with Periods 1 through 4 are performed concurrently, it is not feasible to allocate these costs to discrete Periods.



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The decommissioning project cost estimate summary by cost category is shown in Table 3-3.

The estimate captures costs associated with License Termination, in addition to costs associated with Spent Fuel Management and Site Restoration. License Termination costs are those costs associated with the collective work required to plan, mobilize, and execute the removal of the radioactive contamination from the site, consistent with the definition of decommissioning per 10 CFR 50.2. Site Restoration costs are those costs associated with conventional dismantling, demolition, and removal from the site of structures and systems after confirmation that radioactive contaminants have been removed. Spent Fuel Management are the costs to safely manage spent fuel from sale closure and license transfers until successful transfer to the DOE. The costs of Spent Fuel Management and Site Restoration are not considered part of the 10 CFR 50.2 definition of decommissioning and are listed separately per regulatory requirements.

### **3.2 Site-Specific Matters Considered in DCE**

Based on the guidance in Regulatory Guide 1.202, the following site-specific matters are discussed. These items not only influence the methods used to decommission the plant, but many have significant cost impacts as well.

- Management after License Transfer, Labor Requirements and Costs

Following approval of license transfers and closing on the sale, the management team will be comprised of HDI and CDI personnel as well as certain site incumbent personnel who accept offers of employment and are transferred to HDI or CDI upon closure of the sale. These personnel will be incorporated into the decommissioning organization according to their expertise and previous positions held while the plant was operating. HDI will ensure that positions filled by incumbent employees that are vacated due to attrition are backfilled with qualified personnel, subject to a determination of need to fill the position. The need for these staff positions required by the Palisades license will reduce over time as fuel cools, fuel is moved to the ISFSI, and the facility licenses are amended. The attrition strategy includes filling vacant positions with other qualified employees, hiring from the community of retired Palisades employees, assigning qualified personnel from the HDI and CDI parent companies, and seeking qualified personnel from industry staff augmentation firms. In all cases, the individuals will be qualified to the Site's programs and procedures, as applicable.

Table 3-4 presents the labor costs and the annualized labor requirements, and Table 3-5 presents labor costs and the labor requirements by decommissioning period. Neither Table 3-4 or Table 3-5 includes resources that will be mobilized by subcontractors that will be responsible for providing appropriate levels of project management, supervisory, engineering and labor resources necessary to accomplish decommissioning activities. Subcontractor labor resources and associated labor costs will be included in the subcontracts. For the decommissioning cost estimate documented herein, HDI has included subcontract cost estimates including labor costs using previous

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decommissioning experience, discussions with potential subcontractors, and SME opinion.

At license transfer, daily onsite staffing, excluding subcontractor resources, is estimated to be between 210 and 260 personnel and is expected to decrease as the spent fuel cools, as the fuel is moved from the pool to the ISFSI and as requirements for security and emergency planning are reduced. The subcontractor onsite staffing will be defined during contract development, bidding, and selection. The maximum site population, inclusive of subcontractor resources, will vary throughout the life of the project, with increased and decreased staffing required as decommissioning activities ramp up or down. The maximum site population including subcontractors is not expected to exceed 450 personnel. Onsite HDI and CDI staffing changes (excluding subcontractor resources) are expected to occur at the following milestones:

- Emergency planning zone reduced following the spent fuel cooling period
- All spent fuel has been moved from the SFP to the ISFSI
- Major demolition initiation

- **Characterization**

Site wide characterization will be performed with systems and components in place, maximizing the use of non-destructive assay techniques and direct reading survey instrumentation readings correlated with analytical data gathered via direct smears and sampling. Site wide characterization activities will follow the Radiation Survey and Site Investigation (RSSI) described in NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)” (Reference 7). The decommissioning approach minimizes decontamination activities, resulting in maintaining occupational doses ALARA and reducing decommissioning costs.

- **Segmentation of the RPV and Internals**

CDI will subcontract reactor and fuel system dismantling services. The subcontract will include project management, supervision, engineering, labor, tooling (including the design, fabrication, and testing of segmentation tooling) for the RPV, RVI, irradiated hardware, SFP, and cavity pool liner removals in addition to removal and disassembly of the refueling machine and bridge. GTCC waste generated during segmentation activities will be placed into dry storage canisters, transferred from the reactor building, and stored at the ISFSI until acceptance by the DOE.

Depending on the condition of the Palisades reactor vessel, there may be an opportunity to remove, ship and dispose of the vessel intact. However, for the purposes of this estimate, the Palisades reactor vessel is assumed to be size-reduced and shipped for disposal in a segmented configuration. The RVI will be size reduced using specially designed tooling and mechanical techniques. The tooling will be developed during the dismantlement period and will be mobilized to the site and tested prior to use.

Segmentation of the reactor internals will be completed systematically from the top to

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the bottom of the reactor. Highly activated portions of the internals will be segmented into pieces that are sized to fit within the dry storage casks used for GTCC waste.

The RPV will be separated from the surrounding structure and segmented in stages. The reactor support structures will be removed when they are no longer required to maintain needed structural support. RPV segments will be loaded into waste shipment casks using the reactor building crane and the loaded casks will be moved across the reactor building, lowered through the access hatch, and readied for transport to the disposal site.

- **Fuel Pool and Spent Fuel Racks**

The fuel pool will be inspected with underwater cameras and surveyed with radiation monitors to identify any radioactive material or debris remaining after removal of the spent fuel. Remote handling or vacuum lines will remove fuel contamination found during the inspection.

The fuel racks will be removed from the pool, segmented, and sized reduced for disposal as Low-Level Radioactive Waste (LLRW). Pool liners will be segmented after they have been drained and decontaminated to protect workers. Any GTCC waste generated during these activities will be placed in a dry storage cask, transferred from the area, and stored at the ISFSI. CDI intends to subcontract the Fuel Pool and Spent Fuel Rack removal scope.

- **Turbine and Condenser Segmentation**

Turbine and condenser components will be segmented by a specialty subcontractor. The turbines and condensers are not expected to be radiologically contaminated. The subcontractor will remove large parts of the turbine (such as the low-pressure portion) intact and send the components offsite for disposal as intact packages suitably wrapped. The generator can be removed whole for later recycling or re-use.

- **Large Contaminated Components**

CDI will subcontract the removal of large, contaminated components and piping from power block structures. The HDI decommissioning strategy utilizes free or conditional release for a majority of the plant demolition materials. Although the primary CDI decommissioning strategy is focused on bulk removal of contaminated waste materials, experience at Oyster Creek and Pilgrim has identified effective and efficient decontamination and offsite processing techniques. The use of these techniques is reflected in the cost estimate provided in this DCE. The subcontractor will provide management, labor, tools, heavy lift services and segmentation of components, and equipment to complete the removal of large components at the Palisades site. Support services include radiation protection, security, engineering support. Evaluation of the suitability of the component(s) to be sealed and utilized as the shipping package will be part of the subcontractor planning. Otherwise, the containers or packaging will be provided by CDI.

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- **Building and Structure Removal**

Building demolition will be subcontracted with scope including equipment, personnel, permits, and surveys to perform the following activities:

1. Hazardous waste (asbestos and lead paint) removal from buildings and components
2. Demolition of site buildings to 3 feet below grade and backfill with suitable fill material
3. Demolition of above ground tanks
4. Removal of parking lot surfaces
5. Final grading, and
6. Site restoration

- **Review of Decommissioning Records**

Based on a review of Palisades decommissioning records required by 10 CFR 50.75(g), including subsurface monitoring reports, groundwater contamination reports, and annual NRC effluent reports, HDI has concluded that events occurring during operation involving the spread of contamination in and around the facility, equipment, or site are well documented and the fate and transport of contaminants are generally understood. The decommissioning cost estimate includes a conservative estimate of contaminated soil that will be removed, packaged, shipped, and disposed as low level or exempt waste.

- **Final Radiological Surveys**

After completing site decommissioning activities, the final status surveys will be performed to demonstrate that the site can be released for unrestricted use and removed from the license. The survey planning approach and site release criteria are defined by the MARSSIM protocol and is in general 25 mrem/year from all pathways. Adherence to the NRC-approved License Termination Plan (LTP) and MARSSIM guidance will ensure that the surveys are conducted so that applicable regulatory criteria are satisfied.

- **Spent Fuel Management**

DOE's repository program assumes that spent fuel will be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste" (Reference 6), indicating plans to implement a program over the next 10 years that begins operations of a pilot interim storage facility by 2021 with an initial focus of accepting used nuclear fuel from shutdown reactor sites with a larger interim storage facility to be available by 2025. Although the DOE proposed it would start fuel acceptance in 2025, no progress has been made in the repository program since DOE's 2013 strategy was issued except for the completion of the Yucca Mountain safety evaluation report. Because of this continued

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delay, this DCE assumes a start date for DOE fuel acceptance of 2030 and completing in 2040. For planning purposes only, the fuel removal schedule assumed in this estimate is based upon DOE acceptance of fuel according to the “Oldest Fuel First” priority ranking. It is expected that Holtec Palisades will seek the most expeditious means of removing fuel from the site, based on shutdown reactor priority and other contract provisions.

This DCE identifies the details, schedules, and costs of spent fuel management activities, along with license termination and site restoration activities and costs. Spent fuel management activities will be funded from the NDT following receipt of an exemption from current NRC restrictions on use of the fund.

- ISFSI License Amendments (all fuel on pad milestone)

Once all spent fuel is removed from the SFP and stored at the ISFSI, the Palisades security, Technical Specifications and emergency planning requirements will be revised to reflect plant conditions.

- ISFSI Decommissioning

In accordance with 10 CFR §72.30, licensees must have a proposed decommissioning plan for the ISFSI site and facilities that includes a cost estimate for the plan. The plan should contain sufficient information on the proposed practices and procedures for the decontamination of the ISFSI and for the disposal of residual radioactive materials after all spent fuel, high-level radioactive waste, and reactor related GTCC waste have been removed.

The design and capacity of the Palisades ISFSI is based upon the Holtec HI-STORM FW dry cask storage system. The system consists of a Multi-Purpose Canister (MPC) with a nominal capacity of 37 fuel assemblies and a steel-lined concrete storage overpack. The current spent fuel management plan for the Palisades spent fuel would result in 20 spent fuel storage casks being placed in dry storage at the site. The 49 casks that are currently stored on the existing ISFSI pads will be consolidated to the East ISFSI facility. The 69 casks projected to be in dry storage after shutdown excludes any additional casks that may be used for GTCC storage.

The decommissioning estimate is based on the configuration of the consolidated ISFSI expected after all spent fuel and GTCC material has been removed from the site. The configuration of the ISFSI is based on the station operating until mid-2022 and the DOE’s spent fuel acceptance assumptions, as previously described.

The canister overpack assemblies are not expected to have any interior or exterior radioactive surface contamination. Any neutron activation of the steel and concrete is expected to be extremely small. The decommissioning estimate assumes that some of the inner steel liners and the concrete overpacks will contain low levels of neutron-induced residual radioactivity that would necessitate remediation at the time of decommissioning. As an allowance, 6 of the 69 overpacks are assumed to be affected,

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i.e., contain residual radioactivity. The allowance quantity is based upon the number of casks required for the final core off-load (i.e., 204 offloaded assemblies, 37 assemblies per cask) which results in 6 overpacks. The waste generated from the demolition of the overpack assemblies is assumed to meet criteria for free release and therefore the packaging, transportation and disposal costs are conservatively allocated to Site Restoration expense.

The storage overpacks used for the GTCC canisters (estimated quantity of two) are not expected to have any interior contamination or residual activation and can be reused or disposed of by conventional means after a radiological release survey.

No contamination or activation of the ISFSI pads is assumed. As such, only verification surveys are included for the pad in the decommissioning estimate. The estimate is limited to costs necessary to terminate the ISFSI's NRC license and meet the §20.1402 criteria for unrestricted use

The estimated cost to decommission the ISFSI and release the facility for unrestricted use is provided in Appendix A. The ISFSI decommissioning cost estimate Contingency Allowance has been added at an overall rate of 25%. This is consistent with the contingency evaluation criteria referenced by the NRC in NUREG-1757 (Reference 8). Costs are reported in 2020 dollars.

In accordance with the specific requirements of 10 CFR §72.30 for the ISFSI work scope, the cost estimate for decommissioning the ISFSI reflects: 1) the cost of CDI performing the decommissioning activities; 2) a Contingency Allowance of 25%; and 3) the cost of meeting the criteria for unrestricted use.

- **Waste Management**

CDI developed waste volume estimates for Palisades based on plant design and industry data. The estimates were modified to reflect the decommissioning approach and were used to perform a disposition analysis to determine the type, size, and quantity of waste containers required. Disposal facilities were selected, pricing was confirmed, and various methods of transportation to the disposal facility were evaluated. Transportation logistics were evaluated to ensure that the overall shipping strategy would be efficient and balanced with respect to container utilization, transport cycles and support for shipping during peaks in demolition periods.

Greater-Than-Class C (GTCC) Waste

GTCC waste will be managed and stored onsite until the DOE accepts the waste for final disposition, or until an appropriately licensed facility becomes available. The GTCC waste will be present in the SFP and generated during reactor internal segmentation. The segmentation plan will use characterization information and an activation analysis to minimize the quantity of GTCC waste, and the packaging plan will reflect the segmentation plan. It is anticipated that no more than 2 GTCC canisters will be required for the storage of GTCC waste from Palisades decommissioning activities.

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Low-Level Radioactive Waste

A major component of the decommissioning work scope for Palisades is the packaging, transportation and disposal of contaminated/activated equipment, piping, concrete, and soil. Most of the waste volume will meet Class A, including large volumes of low activity wastes. For transportation, the majority of LLRW will be shipped as Low Specific Activity, or Surface Contaminated Object (SCO) definitions, and higher activity items will be segmented and loaded to avoid complex transportation modes (e.g., cask transport.) as much as possible. Some components will be capped and shipped with minimal sectioning but will require special conveyance equipment for at least a portion of the haul route. This is most likely for the RPV, large components, and some bulk debris items. Most of the radioactive debris will be shipped in metal shield boxes or standard combination intermodal containers. For the purposes of this DCE, Class A waste volumes conservatively assumed no reduction due to dormancy period.

HDI has entered into a fleet wide waste contract with Waste Control Specialist (WCS), in Texas, for disposal of all radioactive waste. Additional services for treatment, encapsulation, mixed waste stabilization and further disposal will be procured as needed.

For Class B and C waste, HDI intends to file an import application with the Texas Low Level Radioactive Waste Disposal Compact Commission to gain approval to dispose of out-of-compact waste at the WCS site in Andrews, Texas. As stated above, Holtec currently holds a contract with WCS that permits disposal of radioactive waste from any decommissioning project in the United States (US).

One or more disposal facilities licensed in accordance with 10 CFR 20.2002 can be evaluated as an opportunity for management of low activity waste since it is estimated that approximately 25% of the heterogeneous bulk debris will be compatible with these facilities. In addition to lower disposition costs, the transportation route is shorter than the route to 10 CFR 61 licensed facilities, offering reduced shipping costs and better cycling efficiency for reusable bulk containers.

Mixed Wastes

Mixed Low-Level Waste generation will be minimized through appropriate characterization and demolition techniques and will be managed in accordance with applicable Federal and State regulations. Onsite treatment will not be pursued rather, treatment needs will be procured from vendors such as Perma-Fix, Waste Control Specialists, and EnergySolutions.

Waste Transportation

The transportation approach for hazardous, Class A, Low Specific Activity (LSA), or SCO classes of waste will use a combination of truck, rail and potentially barge to support bulk quantity removal of waste. Since there is no active rail line at the site, a truck will be used to deliver the waste to a transload facility. Transportation of waste by barge from Palisades to a nearby facility with rail access is an opportunity warranting

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further investigation due to the potential for a reduction in waste transportation vehicle road traffic and costs. However, transportation by barge is not used as a basis for costs in this estimate.

The transportation of all other classes of waste (Class B and C, GTCC, hazardous, and mixed), as well as the transportation of the spent fuel to the DOE repository, when it becomes available, will be by truck, as this mode of transportation minimizes transit time and is consistent with cask use requirements.

Table 3-6 presents Palisades waste volume and weight estimates by Class. The HDI estimated costs do not include off-site processing since this option would only be utilized if items require decontamination to meet transportation criteria or if the item has significant residual value and can be salvaged or reused.



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**Table 3-1 Decommissioning Activities and Costs by Period**

Period:	Period 1	Period 2	Period 3	Period 4	Period 5		
Activities	Pre- Decommissioning Planning and Preparation	Plant Deactivation	Safe Storage Operations	Dismantlement	Ongoing ISFSI Operations	Program Management Costs	Total
<b>License Termination</b>	7,667,829	239,263	0	227,683,667	9,028,804	198,595,330	443,214,893
<b>Pre-decommissioning actions</b>	7,667,829	0	0	0	0	0	7,667,829
<b>Facility characterization.</b>	4,833,360	0	0	0	0	0	4,833,360
Detailed facility characterization.	4,833,360	0	0	0	0	0	4,833,360
<b>Authorization.</b>	1,100,234	0	0	0	0	0	1,100,234
License applications and license approvals.	1,100,234	0	0	0	0	0	1,100,234
<b>Preparing management group and contracting.</b>	1,734,235	0	0	0	0	0	1,734,235
Management team activities.	1,734,235	0	0	0	0	0	1,734,235
<b>Facility shutdown activities</b>	0	239,263	0	0	0	0	239,263
<b>Plant shutdown and inspection.</b>	0	239,263	0	0	0	0	239,263
Cooling down of spent fuel.	0	239,263	0	0	0	0	239,263
<b>Dismantling activities within the controlled area</b>	0	0	0	67,719,732	0	0	67,719,732
<b>Procurement of equipment for decontamination and dismantling.</b>	0	0	0	7,408,800	0	0	7,408,800
Procurement of special tools for dismantling the reactor systems.	0	0	0	7,408,800	0	0	7,408,800
<b>Removal of materials requiring specific procedures.</b>	0	0	0	8,895,803	0	0	8,895,803
Removal of asbestos.	0	0	0	8,895,803	0	0	8,895,803
<b>Dismantling of main process systems, structures, and components.</b>	0	0	0	48,794,023	0	0	48,794,023
Dismantling of reactor internals.	0	0	0	27,871,200	0	0	27,871,200
Dismantling of reactor vessel and core components.	0	0	0	2,653,893	0	0	2,653,893
Dismantling of other primary loop components.	0	0	0	18,268,930	0	0	18,268,930
<b>Dismantling of other systems and components.</b>	0	0	0	2,621,106	0	0	2,621,106
Dismantling of remaining components.	0	0	0	2,621,106	0	0	2,621,106
<b>Waste processing, storage, and disposal</b>	0	0	0	113,856,775	0	0	113,856,775
<b>Waste management system.</b>	0	0	0	4,533,470	0	0	4,533,470
Maintenance, surveillance, and operational support for waste management system.	0	0	0	4,533,470	0	0	4,533,470
<b>Management of decommissioning intermediate-level waste.</b>	0	0	0	2,352,000	0	0	2,352,000
Containers.	0	0	0	2,352,000	0	0	2,352,000
<b>Management of decommissioning low-level waste.</b>	0	0	0	32,840,134	0	0	32,840,134
Processing.	0	0	0	5,880,000	0	0	5,880,000
Transport.	0	0	0	2,442,223	0	0	2,442,223
Disposal.	0	0	0	21,856,036	0	0	21,856,036
Containers.	0	0	0	2,661,876	0	0	2,661,876
<b>Management of decommissioning exempt waste and materials.</b>	0	0	0	71,955,571	0	0	71,955,571
Treatment and packaging.	0	0	0	29,970,447	0	0	29,970,447
Transport of hazardous waste.	0	0	0	29,232,038	0	0	29,232,038
Disposal of hazardous waste at dedicated waste dumps.	0	0	0	12,753,085	0	0	12,753,085
<b>Management of decommissioning waste and materials generated outside controlled areas.</b>	0	0	0	2,175,600	0	0	2,175,600

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Period:	Period 1	Period 2	Period 3	Period 4	Period 5	Program Management Costs	Total
Activities	Pre- Decommissioning Planning and Preparation	Plant Deactivation	Safe Storage Operations	Dismantlement	Ongoing ISFSI Operations	Program Management Costs	Total
Treatment and packaging of hazardous waste.	0	0	0	2,175,600	0	0	2,175,600
<b>Site infrastructure and operation</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>80,829,065</b>	<b>80,829,065</b>
<b>Site security and surveillance.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>41,373,001</b>	<b>41,373,001</b>
Procurement of general security equipment.	0	0	0	0	0	4,009,537	4,009,537
Deployment of guards/security forces.	0	0	0	0	0	37,363,464	37,363,464
<b>Site operation and maintenance.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,913,271</b>	<b>10,913,271</b>
Inspection and maintenance of buildings and systems.	0	0	0	0	0	10,215,466	10,215,466
Site upkeep activities.	0	0	0	0	0	697,805	697,805
<b>Operation of support systems.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17,266,523</b>	<b>17,266,523</b>
Electricity supply systems.	0	0	0	0	0	10,944,750	10,944,750
Ventilation systems.	0	0	0	0	0	1,088,096	1,088,096
Other systems.	0	0	0	0	0	5,233,677	5,233,677
<b>Radiation and environmental safety monitoring.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11,276,270</b>	<b>11,276,270</b>
Procurement and maintenance of equipment for radiation protection and environmental monitoring.	0	0	0	0	0	1,769,581	1,769,581
Radiation protection and monitoring.	0	0	0	0	0	9,506,689	9,506,689
<b>Conventional dismantling, demolition, and site restoration</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>46,107,160</b>	<b>0</b>	<b>0</b>	<b>46,107,160</b>
<b>Demolition of buildings and structures.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>45,189,760</b>	<b>0</b>	<b>0</b>	<b>45,189,760</b>
Demolition of buildings and structures from the formerly controlled area.	0	0	0	45,189,760	0	0	45,189,760
<b>Final radioactivity survey of site.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>917,400</b>	<b>0</b>	<b>0</b>	<b>917,400</b>
Final survey.	0	0	0	917,400	0	0	917,400
<b>Project management, engineering, and support</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>70,080,373</b>	<b>70,080,373</b>
<b>Project management.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>32,168,363</b>	<b>32,168,363</b>
Core management group.	0	0	0	0	0	20,553,737	20,553,737
Project implementation planning, detailed ongoing planning.	0	0	0	0	0	986,405	986,405
Scheduling and cost control.	0	0	0	0	0	1,317,453	1,317,453
Safety and environmental analysis, ongoing studies.	0	0	0	0	0	7,453,479	7,453,479
Quality assurance and quality surveillance.	0	0	0	0	0	1,006,363	1,006,363
General administration and accounting.	0	0	0	0	0	146,797	146,797
Public relations and stakeholder's involvement.	0	0	0	0	0	704,129	704,129
<b>Support services.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>29,018,248</b>	<b>29,018,248</b>
Engineering support.	0	0	0	0	0	3,219,778	3,219,778
Information system and computer support.	0	0	0	0	0	116,686	116,686
Waste management support.	0	0	0	0	0	1,490,121	1,490,121
Decommissioning support including chemistry, decontamination.	0	0	0	0	0	363,533	363,533
Personnel management and training.	0	0	0	0	0	6,147,533	6,147,533
Documentation and records control.	0	0	0	0	0	140,023	140,023
Procurement, warehousing, and materials handling.	0	0	0	0	0	3,184,255	3,184,255
Housing, office equipment, support services.	0	0	0	0	0	14,356,319	14,356,319
<b>Health and safety.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,717,762</b>	<b>7,717,762</b>

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Period:	Period 1	Period 2	Period 3	Period 4	Period 5		
Activities	Pre- Decommissioning Planning and Preparation	Plant Deactivation	Safe Storage Operations	Dismantlement	Ongoing ISFSI Operations	Program Management Costs	Total
Health physics.	0	0	0	0	0	3,489,066	3,489,066
Industrial safety.	0	0	0	0	0	4,228,695	4,228,695
<b>Support services by contractors (if needed).</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,176,000</b>	<b>1,176,000</b>
Information system and computer support.	0	0	0	0	0	1,176,000	1,176,000
<b>Fuel and nuclear material</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9,028,804</b>	<b>0</b>	<b>9,028,804</b>
<b>Dedicated ISFSI for fuel and/or nuclear material.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8,709,029</b>	<b>0</b>	<b>8,709,029</b>
Operation of ISFSI.	0	0	0	0	4,884,207	0	4,884,207
Transfer of fuel and/or nuclear material away from the ISFSI.	0	0	0	0	3,824,822	0	3,824,822
<b>Decommissioning of ISFSI.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>319,775</b>	<b>0</b>	<b>319,775</b>
Decommissioning of ISFSI.	0	0	0	0	319,775	0	319,775
<b>Miscellaneous expenditures</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>47,685,892</b>	<b>47,685,892</b>
<b>Owner costs.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31,053,894</b>	<b>31,053,894</b>
Implementation of transition plans.	0	0	0	0	0	20,171,889	20,171,889
Payments (fees) to authorities.	0	0	0	0	0	10,882,004	10,882,004
<b>Taxes.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3,705,206</b>	<b>3,705,206</b>
Local, community, federal taxes.	0	0	0	0	0	3,705,206	3,705,206
<b>Insurances.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12,926,793</b>	<b>12,926,793</b>
Nuclear related insurances.	0	0	0	0	0	12,926,793	12,926,793
<b>Spent Fuel</b>	<b>0</b>	<b>0</b>	<b>31,932,270</b>	<b>35,605,743</b>	<b>58,835,893</b>	<b>39,747,793</b>	<b>166,121,699</b>
<b>Waste processing, storage, and disposal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35,605,743</b>	<b>0</b>	<b>0</b>	<b>35,605,743</b>
<b>Management of decommissioning high-level waste.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35,605,743</b>	<b>0</b>	<b>0</b>	<b>35,605,743</b>
Containers.	0	0	0	35,605,743	0	0	35,605,743
<b>Site infrastructure and operation</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>588,000</b>	<b>588,000</b>
<b>Site security and surveillance.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>588,000</b>	<b>588,000</b>
Procurement of general security equipment.	0	0	0	0	0	588,000	588,000
<b>Project management, engineering, and support</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>28,690,345</b>	<b>28,690,345</b>
<b>Project management.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>19,064,107</b>	<b>19,064,107</b>
Core management group.	0	0	0	0	0	11,341,292	11,341,292
Project implementation planning, detailed ongoing planning.	0	0	0	0	0	581,065	581,065
Scheduling and cost control.	0	0	0	0	0	602,798	602,798
Safety and environmental analysis, ongoing studies.	0	0	0	0	0	4,993,178	4,993,178
Quality assurance and quality surveillance.	0	0	0	0	0	963,588	963,588
General administration and accounting.	0	0	0	0	0	54,372	54,372
Public relations and stakeholder's involvement.	0	0	0	0	0	527,814	527,814
<b>Support services.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,962,182</b>	<b>7,962,182</b>
Engineering support.	0	0	0	0	0	1,363,179	1,363,179
Information system and computer support.	0	0	0	0	0	43,219	43,219
Waste management support.	0	0	0	0	0	191,379	191,379
Decommissioning support including chemistry, decontamination.	0	0	0	0	0	328,266	328,266
Personnel management and training.	0	0	0	0	0	4,058,543	4,058,543
Documentation and records control.	0	0	0	0	0	51,863	51,863

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

Period:	Period 1	Period 2	Period 3	Period 4	Period 5	Program Management Costs	Total
Activities	Pre- Decommissioning Planning and Preparation	Plant Deactivation	Safe Storage Operations	Dismantlement	Ongoing ISFSI Operations		
Procurement, warehousing, and materials handling.	0	0	0	0	0	1,925,734	1,925,734
<b>Health and safety.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,664,056</b>	<b>1,664,056</b>
Industrial safety.	0	0	0	0	0	1,664,056	1,664,056
<b>Fuel and nuclear material</b>	<b>0</b>	<b>0</b>	<b>31,932,270</b>	<b>0</b>	<b>58,835,893</b>	<b>0</b>	<b>90,768,163</b>
<b>Removal of fuel or nuclear material from facility to be decommissioned.</b>	<b>0</b>	<b>0</b>	<b>17,397,989</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17,397,989</b>
Transfer of fuel or nuclear material to dedicated ISFSI.	0	0	17,397,989	0	0	0	17,397,989
<b>Dedicated ISFSI for fuel and/or nuclear material.</b>	<b>0</b>	<b>0</b>	<b>14,534,282</b>	<b>0</b>	<b>58,835,893</b>	<b>0</b>	<b>73,370,174</b>
Construction of ISFSI.	0	0	14,534,282	0	0	0	14,534,282
Operation of ISFSI.	0	0	0	0	19,928,414	0	19,928,414
Transfer of fuel and/or nuclear material away from the ISFSI.	0	0	0	0	38,907,478	0	38,907,478
<b>Miscellaneous expenditures</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,469,448</b>	<b>10,469,448</b>
<b>Owner costs.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3,323,835</b>	<b>3,323,835</b>
Implementation of transition plans.	0	0	0	0	0	3,323,835	3,323,835
<b>Taxes.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,837,067</b>	<b>1,837,067</b>
Local, community, federal taxes.	0	0	0	0	0	1,837,067	1,837,067
<b>Insurances.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5,308,547</b>	<b>5,308,547</b>
Nuclear related insurances.	0	0	0	0	0	5,308,547	5,308,547
<b>Site Restoration</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>21,889,852</b>	<b>9,221,180</b>	<b>3,567,558</b>	<b>34,678,590</b>
<b>Waste processing, storage, and disposal</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9,461,352</b>	<b>0</b>	<b>0</b>	<b>9,461,352</b>
<b>Management of decommissioning low-level waste.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,034,605</b>	<b>0</b>	<b>0</b>	<b>1,034,605</b>
Transport.	0	0	0	194,369	0	0	194,369
Disposal.	0	0	0	691,471	0	0	691,471
Containers.	0	0	0	148,764	0	0	148,764
<b>Management of decommissioning exempt waste and materials.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8,426,747</b>	<b>0</b>	<b>0</b>	<b>8,426,747</b>
Treatment and packaging.	0	0	0	3,894,465	0	0	3,894,465
Transport of hazardous waste.	0	0	0	2,541,916	0	0	2,541,916
Disposal of hazardous waste at dedicated waste dumps.	0	0	0	1,990,366	0	0	1,990,366
<b>Conventional dismantling, demolition, and site restoration</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12,428,500</b>	<b>0</b>	<b>0</b>	<b>12,428,500</b>
<b>Demolition of buildings and structures.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12,428,500</b>	<b>0</b>	<b>0</b>	<b>12,428,500</b>
Demolition of buildings and structures from the formerly controlled area.	0	0	0	11,252,500	0	0	11,252,500
Demolition of buildings and structures outside the controlled area.	0	0	0	1,176,000	0	0	1,176,000
<b>Project management, engineering, and support</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,952,133</b>	<b>2,952,133</b>
<b>Project management.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,816,544</b>	<b>1,816,544</b>
Core management group.	0	0	0	0	0	1,271,432	1,271,432
Project implementation planning, detailed ongoing planning.	0	0	0	0	0	38,190	38,190
Scheduling and cost control.	0	0	0	0	0	72,378	72,378
Safety and environmental analysis, ongoing studies.	0	0	0	0	0	409,124	409,124
Quality assurance and quality surveillance.	0	0	0	0	0	1,708	1,708

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

Period:	Period 1	Period 2	Period 3	Period 4	Period 5		
Activities	Pre- Decommissioning Planning and Preparation	Plant Deactivation	Safe Storage Operations	Dismantlement	Ongoing ISFSI Operations	Program Management Costs	Total
Public relations and stakeholder's involvement.	0	0	0	0	0	23,712	23,712
<b>Support services.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>824,789</b>	<b>824,789</b>
Engineering support.	0	0	0	0	0	246,178	246,178
Waste management support.	0	0	0	0	0	195,447	195,447
Personnel management and training.	0	0	0	0	0	212,976	212,976
Procurement, warehousing, and materials handling.	0	0	0	0	0	170,189	170,189
<b>Health and safety.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>310,800</b>	<b>310,800</b>
Industrial safety.	0	0	0	0	0	310,800	310,800
<b>Fuel and nuclear material</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9,221,180</b>	<b>0</b>	<b>9,221,180</b>
<b>Dedicated ISFSI for fuel and/or nuclear material.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>216,651</b>	<b>0</b>	<b>216,651</b>
Operation of ISFSI.	0	0	0	0	216,651	0	216,651
<b>Decommissioning of ISFSI.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9,004,529</b>	<b>0</b>	<b>9,004,529</b>
Decommissioning of ISFSI.	0	0	0	0	8,058,963	0	8,058,963
Management of waste.	0	0	0	0	945,566	0	945,566
<b>Miscellaneous expenditures</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>615,425</b>	<b>615,425</b>
<b>Owner costs.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>421,266</b>	<b>421,266</b>
Implementation of transition plans.	0	0	0	0	0	421,266	421,266
<b>Insurances.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>194,159</b>	<b>194,159</b>
Nuclear related insurances.	0	0	0	0	0	194,159	194,159

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

**Table 3-2 Program Management Cost Detail**

WBS_Code	Activities	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
<b>01.02.06</b>	<b>Site infrastructure and operation</b>	<b>11,160,534</b>	<b>19,726,252</b>	<b>14,198,259</b>	<b>13,113,047</b>	<b>2,032,535</b>	<b>2,110,427</b>	<b>2,110,427</b>	<b>2,110,427</b>	<b>2,048,285</b>	<b>2,048,285</b>
<b>01.02.06.01</b>	<b>Site security and surveillance.</b>	<b>5,152,323</b>	<b>9,474,900</b>	<b>8,147,759</b>	<b>7,480,470</b>	<b>997,107</b>	<b>1,074,999</b>	<b>1,074,999</b>	<b>1,074,999</b>	<b>1,110,279</b>	<b>1,110,279</b>
01.02.06.01.01	Procurement of general security equipment.	310,245	614,908	598,162	560,006	140,287	140,287	140,287	140,287	175,567	175,567
01.02.06.01.04	Deployment of guards/security forces.	4,842,078	8,859,991	7,549,597	6,920,464	856,819	934,712	934,712	934,712	934,712	934,712
<b>01.02.06.02</b>	<b>Site operation and maintenance.</b>	<b>2,550,329</b>	<b>4,163,024</b>	<b>1,953,689</b>	<b>1,792,360</b>	<b>17,741</b>	<b>17,741</b>	<b>17,741</b>	<b>17,741</b>	<b>17,741</b>	<b>17,741</b>
01.02.06.02.01	Inspection and maintenance of buildings and systems.	2,514,847	4,092,061	1,882,726	1,725,832	0	0	0	0	0	0
01.02.06.02.02	Site upkeep activities.	35,482	70,963	70,963	66,528	17,741	17,741	17,741	17,741	17,741	17,741
<b>01.02.06.03</b>	<b>Operation of support systems.</b>	<b>2,749,402</b>	<b>4,817,655</b>	<b>3,117,394</b>	<b>2,892,814</b>	<b>422,433</b>	<b>422,433</b>	<b>422,433</b>	<b>422,433</b>	<b>256,187</b>	<b>256,187</b>
01.02.06.03.01	Electricity supply systems.	1,600,672	2,843,202	1,836,263	1,703,279	240,452	240,452	240,452	240,452	256,187	256,187
01.02.06.03.02	Ventilation systems.	284,346	454,953	181,981	166,816	0	0	0	0	0	0
01.02.06.03.07	Other systems.	864,384	1,519,500	1,099,149	1,022,719	181,981	181,981	181,981	181,981	0	0
<b>01.02.06.04</b>	<b>Radiation and environmental safety monitoring.</b>	<b>708,481</b>	<b>1,270,673</b>	<b>979,417</b>	<b>947,404</b>	<b>595,254</b>	<b>595,254</b>	<b>595,254</b>	<b>595,254</b>	<b>664,078</b>	<b>664,078</b>
01.02.06.04.01	Procurement and maintenance of equipment for radiation protection and environmental monitoring.	93,428	185,580	181,748	168,303	20,406	20,406	20,406	20,406	89,230	89,230
01.02.06.04.02	Radiation protection and monitoring.	615,052	1,085,093	797,669	779,100	574,848	574,848	574,848	574,848	574,848	574,848
<b>01.02.08</b>	<b>Project management, engineering, and support</b>	<b>7,779,277</b>	<b>14,289,856</b>	<b>11,784,089</b>	<b>10,976,009</b>	<b>2,087,130</b>	<b>2,087,130</b>	<b>2,087,130</b>	<b>2,087,130</b>	<b>2,447,908</b>	<b>2,447,908</b>
<b>01.02.08.02</b>	<b>Project management.</b>	<b>4,366,419</b>	<b>8,169,510</b>	<b>7,190,963</b>	<b>6,662,083</b>	<b>844,405</b>	<b>844,405</b>	<b>844,405</b>	<b>844,405</b>	<b>1,118,359</b>	<b>1,118,359</b>
01.02.08.02.01	Core management group.	2,332,500	4,392,030	4,132,921	3,831,664	517,833	517,833	517,833	517,833	693,145	693,145
01.02.08.02.02	Project implementation planning, detailed ongoing planning.	167,956	322,476	322,476	295,603	0	0	0	0	0	0
01.02.08.02.03	Scheduling and cost control.	159,156	305,579	305,579	280,114	0	0	0	0	0	0
01.02.08.02.04	Safety and environmental analysis, ongoing studies.	1,402,105	2,603,971	2,003,255	1,850,577	171,122	171,122	171,122	171,122	269,765	269,765
01.02.08.02.05	Quality assurance and quality surveillance.	121,707	233,678	233,678	223,941	116,839	116,839	116,839	116,839	116,839	116,839
01.02.08.02.06	General administration and accounting.	82,446	118,723	0	0	0	0	0	0	0	0
01.02.08.02.07	Public relations and stakeholder's involvement.	100,549	193,054	193,054	180,184	38,611	38,611	38,611	38,611	38,611	38,611
<b>01.02.08.03</b>	<b>Support services.</b>	<b>2,451,876</b>	<b>4,406,570</b>	<b>3,273,277</b>	<b>3,100,320</b>	<b>1,197,788</b>	<b>1,197,788</b>	<b>1,197,788</b>	<b>1,197,788</b>	<b>1,284,610</b>	<b>1,284,610</b>
01.02.08.03.01	Engineering support.	534,669	923,909	615,939	564,611	0	0	0	0	0	0
01.02.08.03.02	Information system and computer support.	65,535	94,370	0	0	0	0	0	0	0	0
01.02.08.03.03	Waste management support.	0	0	0	0	0	0	0	0	0	0
01.02.08.03.04	Decommissioning support including chemistry, decontamination.	104,818	201,251	201,251	184,480	0	0	0	0	0	0
01.02.08.03.05	Personnel management and training.	416,950	651,431	204,091	237,553	605,636	605,636	605,636	605,636	666,863	666,863
01.02.08.03.06	Documentation and records control.	78,642	113,244	0	0	0	0	0	0	0	0
01.02.08.03.07	Procurement, warehousing, and materials handling.	292,119	536,219	462,270	437,236	161,863	161,863	161,863	161,863	201,302	201,302
01.02.08.03.08	Housing, office equipment, support services.	959,143	1,886,146	1,789,726	1,676,440	430,289	430,289	430,289	430,289	416,445	416,445
<b>01.02.08.04</b>	<b>Health and safety.</b>	<b>960,982</b>	<b>1,713,776</b>	<b>1,319,849</b>	<b>1,213,607</b>	<b>44,938</b>	<b>44,938</b>	<b>44,938</b>	<b>44,938</b>	<b>44,938</b>	<b>44,938</b>
01.02.08.04.01	Health physics.	388,022	745,001	745,001	682,918	0	0	0	0	0	0
01.02.08.04.02	Industrial safety.	572,960	968,775	574,848	530,689	44,938	44,938	44,938	44,938	44,938	44,938
<b>01.02.11</b>	<b>Miscellaneous expenditures</b>	<b>13,336,336</b>	<b>10,537,572</b>	<b>7,289,703</b>	<b>6,513,040</b>	<b>318,069</b>	<b>318,069</b>	<b>318,069</b>	<b>318,069</b>	<b>2,045,259</b>	<b>560,584</b>
<b>01.02.11.01</b>	<b>Owner costs.</b>	<b>3,426,897</b>	<b>6,382,525</b>	<b>4,968,719</b>	<b>4,557,769</b>	<b>37,326</b>	<b>37,326</b>	<b>37,326</b>	<b>37,326</b>	<b>279,841</b>	<b>279,841</b>
01.02.11.01.01	Implementation of transition plans.	3,426,897	6,382,525	4,968,719	4,557,769	37,326	37,326	37,326	37,326	279,841	279,841
<b>01.02.11.02</b>	<b>Taxes.</b>	<b>2,308,273</b>	<b>1,176,000</b>	<b>1,176,000</b>	<b>882,000</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
01.02.11.02.02	Local, community, federal taxes.	2,308,273	1,176,000	1,176,000	882,000	0	0	0	0	0	0
<b>01.02.11.03</b>	<b>Insurances.</b>	<b>7,601,167</b>	<b>2,979,047</b>	<b>1,144,984</b>	<b>1,073,271</b>	<b>280,743</b>	<b>280,743</b>	<b>280,743</b>	<b>280,743</b>	<b>1,765,418</b>	<b>280,743</b>
01.02.11.03.01	Nuclear related insurances.	7,601,167	2,979,047	1,144,984	1,073,271	280,743	280,743	280,743	280,743	1,765,418	280,743

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

WBS_Code	Activities	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	Total
<b>01.02.06</b>	<b>Site infrastructure and operation</b>	<b>2,048,285</b>	<b>2,048,285</b>	<b>2,048,285</b>	<b>1,921,211</b>	<b>523,390</b>	<b>523,390</b>	<b>523,390</b>	<b>506,339</b>	<b>457,375</b>	<b>158,637</b>	<b>81,417,065</b>
<b>01.02.06.01</b>	<b>Site security and surveillance.</b>	<b>1,110,279</b>	<b>1,110,279</b>	<b>1,110,279</b>	<b>1,032,387</b>	<b>175,567</b>	<b>175,567</b>	<b>175,567</b>	<b>158,859</b>	<b>158,859</b>	<b>55,241</b>	<b>41,961,001</b>
01.02.06.01.01	Procurement of general security equipment.	175,567	175,567	175,567	175,567	175,567	175,567	175,567	158,859	158,859	55,241	4,597,537
01.02.06.01.04	Deployment of guards/security forces.	934,712	934,712	934,712	856,819	0	0	0	0	0	0	37,363,464
<b>01.02.06.02</b>	<b>Site operation and maintenance.</b>	<b>17,741</b>	<b>17,741</b>	<b>17,741</b>	<b>22,176</b>	<b>70,963</b>	<b>70,963</b>	<b>70,963</b>	<b>35,482</b>	<b>23,654</b>	<b>0</b>	<b>10,913,271</b>
01.02.06.02.01	Inspection and maintenance of buildings and systems.	0	0	0	0	0	0	0	0	0	0	10,215,466
01.02.06.02.02	Site upkeep activities.	17,741	17,741	17,741	22,176	70,963	70,963	70,963	35,482	23,654	0	697,805
<b>01.02.06.03</b>	<b>Operation of support systems.</b>	<b>256,187</b>	<b>256,187</b>	<b>256,187</b>	<b>241,190</b>	<b>76,219</b>	<b>76,219</b>	<b>76,219</b>	<b>96,117</b>	<b>96,117</b>	<b>56,512</b>	<b>17,266,523</b>
01.02.06.03.01	Electricity supply systems.	256,187	256,187	256,187	241,190	76,219	76,219	76,219	96,117	96,117	56,512	10,944,750
01.02.06.03.02	Ventilation systems.	0	0	0	0	0	0	0	0	0	0	1,088,096
01.02.06.03.07	Other systems.	0	0	0	0	0	0	0	0	0	0	5,233,677
<b>01.02.06.04</b>	<b>Radiation and environmental safety monitoring.</b>	<b>664,078</b>	<b>664,078</b>	<b>664,078</b>	<b>625,458</b>	<b>200,641</b>	<b>200,641</b>	<b>200,641</b>	<b>215,882</b>	<b>178,745</b>	<b>46,884</b>	<b>11,276,270</b>
01.02.06.04.01	Procurement and maintenance of equipment for radiation protection and environmental monitoring.	89,230	89,230	89,230	89,230	89,230	89,230	89,230	104,471	104,471	46,884	1,769,581
01.02.06.04.02	Radiation protection and monitoring.	574,848	574,848	574,848	536,228	111,410	111,410	111,410	111,410	74,274	0	9,506,689
<b>01.02.08</b>	<b>Project management, engineering, and support</b>	<b>2,447,908</b>	<b>2,447,908</b>	<b>2,447,908</b>	<b>2,858,518</b>	<b>7,375,231</b>	<b>7,375,231</b>	<b>7,242,794</b>	<b>4,394,835</b>	<b>4,263,819</b>	<b>1,619,131</b>	<b>100,546,851</b>
<b>01.02.08.02</b>	<b>Project management.</b>	<b>1,118,359</b>	<b>1,118,359</b>	<b>1,118,359</b>	<b>1,337,463</b>	<b>3,747,600</b>	<b>3,747,600</b>	<b>3,747,600</b>	<b>2,170,533</b>	<b>2,073,533</b>	<b>866,296</b>	<b>53,049,014</b>
01.02.08.02.01	Core management group.	693,145	693,145	693,145	876,567	2,894,215	2,894,215	2,894,215	1,497,675	1,400,674	482,731	33,166,461
01.02.08.02.02	Project implementation planning, detailed ongoing planning.	0	0	0	13,436	161,238	161,238	161,238	0	0	0	1,605,660
01.02.08.02.03	Scheduling and cost control.	0	0	0	25,465	305,579	305,579	305,579	0	0	0	1,992,629
01.02.08.02.04	Safety and environmental analysis, ongoing studies.	269,765	269,765	269,765	276,281	347,957	347,957	347,957	634,247	634,247	373,913	12,855,781
01.02.08.02.05	Quality assurance and quality surveillance.	116,839	116,839	116,839	107,102	0	0	0	0	0	0	1,971,658
01.02.08.02.06	General administration and accounting.	0	0	0	0	0	0	0	0	0	0	201,169
01.02.08.02.07	Public relations and stakeholder's involvement.	38,611	38,611	38,611	38,611	38,611	38,611	38,611	38,611	38,611	9,653	1,255,655
<b>01.02.08.03</b>	<b>Support services.</b>	<b>1,284,610</b>	<b>1,284,610</b>	<b>1,284,610</b>	<b>1,383,386</b>	<b>2,469,919</b>	<b>2,469,919</b>	<b>2,337,481</b>	<b>2,067,917</b>	<b>2,033,902</b>	<b>596,451</b>	<b>37,805,219</b>
01.02.08.03.01	Engineering support.	0	0	0	34,219	410,626	410,626	410,626	410,626	410,626	102,657	4,829,135
01.02.08.03.02	Information system and computer support.	0	0	0	0	0	0	0	0	0	0	159,905
01.02.08.03.03	Waste management support.	0	0	0	34,306	411,669	411,669	411,669	270,060	270,060	67,515	1,876,947
01.02.08.03.04	Decommissioning support including chemistry, decontamination.	0	0	0	0	0	0	0	0	0	0	691,799
01.02.08.03.05	Personnel management and training.	666,863	666,863	666,863	675,367	768,908	768,908	768,908	102,045	68,030	0	10,419,052
01.02.08.03.06	Documentation and records control.	0	0	0	0	0	0	0	0	0	0	191,886
01.02.08.03.07	Procurement, warehousing, and materials handling.	201,302	201,302	201,302	223,049	462,270	462,270	329,833	187,089	187,089	46,772	5,280,177
01.02.08.03.08	Housing, office equipment, support services.	416,445	416,445	416,445	416,445	416,445	416,445	416,445	1,098,097	1,098,097	379,507	14,356,319
<b>01.02.08.04</b>	<b>Health and safety.</b>	<b>44,938</b>	<b>44,938</b>	<b>44,938</b>	<b>137,669</b>	<b>1,157,713</b>	<b>1,157,713</b>	<b>1,157,713</b>	<b>156,385</b>	<b>156,385</b>	<b>156,385</b>	<b>9,692,618</b>
01.02.08.04.01	Health physics.	0	0	0	25,084	301,013	301,013	301,013	0	0	0	3,489,066
01.02.08.04.02	Industrial safety.	44,938	44,938	44,938	112,585	856,699	856,699	856,699	156,385	156,385	156,385	6,203,552
<b>01.02.11</b>	<b>Miscellaneous expenditures</b>	<b>560,584</b>	<b>560,584</b>	<b>560,584</b>	<b>519,612</b>	<b>553,246</b>	<b>553,246</b>	<b>548,354</b>	<b>972,880</b>	<b>972,880</b>	<b>532,022</b>	<b>47,888,762</b>
<b>01.02.11.01</b>	<b>Owner costs.</b>	<b>279,841</b>	<b>279,841</b>	<b>279,841</b>	<b>279,841</b>	<b>279,841</b>	<b>279,841</b>	<b>279,841</b>	<b>780,196</b>	<b>780,196</b>	<b>352,814</b>	<b>23,916,991</b>
01.02.11.01.01	Implementation of transition plans.	279,841	279,841	279,841	279,841	279,841	279,841	279,841	780,196	780,196	352,814	23,916,991
<b>01.02.11.02</b>	<b>Taxes.</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5,542,273</b>
01.02.11.02.02	Local, community, federal taxes.	0	0	0	0	0	0	0	0	0	0	5,542,273
<b>01.02.11.03</b>	<b>Insurances.</b>	<b>280,743</b>	<b>280,743</b>	<b>280,743</b>	<b>239,771</b>	<b>273,405</b>	<b>273,405</b>	<b>268,513</b>	<b>192,684</b>	<b>192,684</b>	<b>179,207</b>	<b>18,429,499</b>
01.02.11.03.01	Nuclear related insurances.	280,743	280,743	280,743	239,771	273,405	273,405	268,513	192,684	192,684	179,207	18,429,499

**Palisades Nuclear Plant  
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**Table 3-3 CDI Decommissioning Cost Estimate Summary (thousands of 2020 dollars)**

Cost Category	License Termination	Spent Fuel	Site Restoration	Total
Decontamination	7,697			7,697
Removal	109,357		21,433	130,790
Packaging	34,984		4,043	39,028
Transportation	31,674		2,736	34,411
Disposal	34,609		2,682	37,291
Off-site Waste Processing	5,880			5,880
Program Management	145,736	32,602	3,373	181,712
Corporate A&G	-	-	-	-
Spent Fuel (Direct Expenditures)		123,230		123,230
Insurance and Regulatory Fees	23,809	5,309	194	29,312
Energy	7,679			7,679
Characterization and Licensing Surveys	7,926			7,926
Property Taxes	8,589	4,981	217	13,787
Miscellaneous Equipment / Site Services	25,273			25,273
Spent Fuel Pool Isolation	-	-	-	-
<b>Grand Total</b>	<b>443,215</b>	<b>166,122</b>	<b>34,679</b>	<b>644,015</b>



**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

**Table 3-4 Labor Costs and Labor Requirements by Year (thousands of 2020 dollars)**

Labor Category	Labor (FTEs) and Labor Costs																			
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Management Labor Cost	3,456	6,453	5,906	5,487	880	880	880	880	1,055	1,055	1,055	1,055	1,055	1,318	4,204	4,204	4,071	2,330	2,195	663
Management Labor FTEs	14	26	24	22	4	4	4	4	5	5	5	5	5	5	16	16	15	10	9	2
Professional Labor Cost	7,916	14,101	10,808	10,164	2,007	1,910	1,910	1,910	2,011	2,011	2,011	2,011	2,011	2,185	4,099	4,099	4,099	3,106	3,072	954
Professional Labor FTEs	62	111	88	83	17	16	16	16	17	17	17	17	17	18	27	27	27	22	22	7
Craft Labor Cost	6,185	10,581	6,702	6,268	1,502	1,502	1,502	1,502	1,502	1,502	1,502	1,502	1,502	1,512	1,629	1,629	1,629	364	243	0
Craft Labor FTEs	33	57	36	34	8	8	8	8	8	8	8	8	8	8	9	9	9	2	1	0
<b>Total Labor Cost</b>	<b>17,557</b>	<b>31,135</b>	<b>23,415</b>	<b>21,919</b>	<b>4,389</b>	<b>4,292</b>	<b>4,292</b>	<b>4,292</b>	<b>4,568</b>	<b>4,568</b>	<b>4,568</b>	<b>4,568</b>	<b>4,568</b>	<b>5,015</b>	<b>9,932</b>	<b>9,932</b>	<b>9,799</b>	<b>5,800</b>	<b>5,510</b>	<b>1,617</b>
<b>Total Labor FTEs</b>	<b>109</b>	<b>194</b>	<b>148</b>	<b>139</b>	<b>29</b>	<b>28</b>	<b>28</b>	<b>28</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>31</b>	<b>52</b>	<b>52</b>	<b>51</b>	<b>34</b>	<b>32</b>	<b>9</b>

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

**Table 3-5 Labor Costs and Labor Requirements by Period (thousands of 2020 dollars)**

	Labor (FTEs) and Labor Costs													
	Period 1		Period 2		Period 3		Period 4		Period 5		Program Management		Total	
	Labor FTE	Labor Cost	Labor FTE	Labor Cost	Labor FTE	Labor Cost	Labor FTE	Labor Cost	Labor FTE	Labor Cost	Labor FTE	Labor Cost	Labor FTE	Labor Cost
<b>PWR Decommissioning</b>														
Decommissioning Crews	0	0	1	239	0	0	69	12,826	0	0	200	37,191	270	50,257
Management / Support Staff	13	2,834	0	0	0	0	14	2,743	193	22,609	619	103,292	839	131,478
<b>Total</b>	<b>13</b>	<b>2,834</b>	<b>1</b>	<b>239</b>	<b>0</b>	<b>0</b>	<b>83</b>	<b>15,569</b>	<b>193</b>	<b>22,609</b>	<b>819</b>	<b>140,483</b>	<b>1,109</b>	<b>181,735</b>

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

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**Table 3-6 Palisades Waste Volumes**

Waste	Class	Waste Volume (cubic feet)	Weight (lbs.)
Low-Level Radioactive Waste	A	1,128,683	91,962,633
	B	605	73,450
	C	168	16,198
Greater than Class C Waste	GTCC	345	54,548
<b>Total</b>		<b>1,129,800</b>	<b>92,106,830</b>

## **4 COST ESTIMATING APPROACH**

### **4.1 Estimating Methodology**

The CDI estimating methodology is an iterative process which is compatible with the development of integrated scope, schedule, cost, risk, and contingency baselines. Summary highlights of the key steps in the estimating process include:

- Initiating the cost estimate process with a discovery period, and cataloging project specific details, due diligence, applicable industry standards, and available benchmarking data
- Capturing and organizing the work scope into the hierarchical structure of standard decommissioning activities outlined in the major decommissioning elements and sub-elements contained within the ISDC WBS along with a corresponding WBS dictionary
- Identifying the major decommissioning project milestones and developing a Decommissioning Project Milestone Summary Schedule capturing the relationship and sequencing of the milestones
- Assigning each WBS sub-element to subject matter experts to develop a basis of estimate (BOE) for each WBS sub-element capturing the project specific scope of work, technical approach, deliverables, assumptions, existing and verifiable data, judgmental factors, exclusions, and resources
- Identifying and qualitatively ranking the discrete risk events having a potential impact on the project scope, schedule, and budget; and populating the risk register
- Developing detailed schedule fragnets for each WBS sub-element, fully defining the activities, durations and logic ties and compiling these detailed schedule fragnets into a detailed activity schedule model in Oracle Primavera, P6
- Identifying quantities, resources, and cost elements to accomplish the detailed scope of work in alignment with the Oracle Primavera, P6 schedule activities
- Compiling the estimate details into the cost model and validating results
- Assigning estimate uncertainty categories to WBS sub-elements
- Developing an integrated estimate and schedule risk model to validate schedule integrity and to establish and define cost and schedule contingency reserves
- Verifying and validating the cost, schedule, and risk models, model input and model results
- Documenting the estimate development details, basis methodologies and assumptions

### **4.2 Basis of Estimate**

The decommissioning scope of work for Palisades was organized into Level 4 WBS elements, a BOE was developed for the WBS elements. These BOEs capture the essential cost estimating and schedule development data; including the site-specific scope, technical approach, key deliverables, assumptions, judgmental factors, existing and verifiable data,

**Palisades Nuclear Plant  
Site-Specific Decommissioning Cost Estimate**

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exclusions, and resources (quantities and pricing). Table 4-1 includes the WBS elements for which the BOE was developed.

A site-specific detailed WBS and sequence of work was developed based on current plant commodities that will make up the decommissioning waste streams. The sequence of work was used to define the labor, material, equipment, energy resources and durations required for each activity. In the case of major components, individual work sequence activity analyses were performed based on the physical and radiological characteristics of the component, removal method, packaging requirements, modes of transportation and disposal location together with required system dependencies and logic ties.

In the case of structures, small components, and equipment such as piping, pumps and tanks, the work durations and cost were calculated based on review of previous Palisades decommissioning cost analyses, decommissioning experience, estimates from specialty subcontractors, information on the latest technology applicable to decommissioning, and engineering judgment. After the work activity durations were calculated for all distributed cost activities, a detailed schedule was developed. The DCE and schedule were prepared using information collected by HDI and CDI during the due diligence period in addition to the input and professional judgment of experienced SMEs along with experience from the decommissioning work accomplished to date at Oyster Creek and Pilgrim decommissioning sites. The schedule accounts for constraints such as spent fuel cooling periods and regulatory reviews.

The DCE and schedule took into consideration regulatory requirements, site conditions, basis of estimate assumptions, LLRW disposal standards, high-level radioactive waste management options, opportunities identified in walkdowns and site restoration requirements. Cost estimates were based on the professional judgment of experienced SMEs, considering the nature of the work, degree of scope definition, availability of quantifiable cost and pricing data, among other factors.

The estimates of costs associated with license termination in NUREG/CR-5884, "Revised Analyses of Decommissioning for the Reference Pressurized-Water Reactor Power Station," (Reference 5) were reviewed to evaluate the reasonableness of the CDI estimates. In addition, CDI compared the Palisades decommissioning cost estimates for license termination, spent fuel management and site restoration activities to costs from similar activities from other decommissioned pressurized water reactor nuclear power plants.

The estimates include provisions for storage of spent fuel and GTCC wastes at the on-site ISFSI until acceptance by the DOE. Escalation of future decommissioning costs over the remaining decommissioning project life cycle are excluded.

### **4.3 Assumptions**

Work planning, schedule development and cost estimating for the decommissioning of Palisades rely on a set of assumptions regarding the type and quality of inputs and the nature of the work.

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Site-Specific Decommissioning Cost Estimate**

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Pre-Decommissioning Planning

- ENOI has provided reasonable and accurate information in good faith regarding the history and current condition of the plant and site
- No extensive on-site decontamination efforts will be carried out to free release contaminated material. Clean materials will be subject to free release processes.
- In determining the waste management strategy and volume estimates, all contaminated material will be characterized as LLRW, or its respective waste classification
- Waste classification for transport and disposal will be supported by an initial site waste characterization effort

Facility Shutdown Activities

- All wastes and waste streams generated during decommissioning have a disposition path
- No orphan waste will be generated during decommissioning

Dismantling Activities within the Radiologically Controlled Area

- Local ventilation will be required for most tasks and building ventilation is adequate for these tasks and will not require upgrading or replacement
- The reactor building overhead crane will be available and has adequate lift capacity for casks containing RPV internals, water, and the shielding cover
- The turbine building overhead crane has adequate lift capacity for the low-pressure turbines and the generator

Waste Processing, Storage and Disposal

- Transportation of waste offsite will include truck conveyance to rail
- No radioactive waste systems or processing areas will be refurbished or refit for use during decommissioning
- Waste sampling and data verification/validation is accomplished by a subcontractor

Site Infrastructure and Operation

- Existing Palisades site security is adequate for transition and CDI decommissioning activities
- The existing Palisades Operation and Maintenance (O&M) procedures are available and adequate for all active plant systems
- SMEs are available in the existing Palisades work force and a sufficient number will transition to CDI to support decommissioning

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Site-Specific Decommissioning Cost Estimate**

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Project Management, Engineering, and Support

- The CDI project management team will mobilize to the site during the pre-decommissioning planning phase to be ready to begin decommissioning following the sale and transfer of the facility licenses

Fuel and Nuclear Material

- All Palisades plant systems required to carry out the spent fuel to ISFSI pad transfer campaign are operational

#### **4.4 Inflation**

The decommissioning cost estimates presented in this report were developed and reported in 2020 dollars. Escalation of future decommissioning costs over the remaining decommissioning project life cycle are excluded.

#### **4.5 Contingency**

Any project has inherent uncertainty in the estimated quantities, unit rates, productivity, pricing, and schedule durations. Concurrently there are also a vast number of project specific discrete risks, e.g., risk events that may also affect cost and schedule estimates. Risk management is used to establish the appropriate levels of cost and schedule contingency reserves for establishing achievable target schedules, target budgets and for making well-informed decisions during the decommissioning project life cycle.

Estimate Uncertainty

Uncertainty in estimates is generally a function of the level of maturity in the project definition. Estimate uncertainty is also a function of various factors including:

- Expected site conditions (physical and radiological)
- Decommissioning processes and tools
- New and/or non-familiar technology
- Complexity
- Labor skills and productivity
- Stakeholder/regulatory requirements
- Quality of cost estimating assumptions and data
- Experience and skill level of the estimator
- Pricing
- Estimating techniques
- Time and level of effort allowed to prepare the cost estimate and schedule

Uncertainty Allowance is added to the decommissioning project baseline schedule and cost estimate to address the estimate uncertainty within the defined decommissioning scope of work and execution strategy. Uncertainty Allowance is included in the baseline cost and schedule to cover ill-defined work scope or elements of costs and schedules expected to be

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incurred, which cannot be explicitly foreseen or estimated because of a lack of complete, accurate or detailed information that can be available at this time.

Discrete Risk Events

Discrete risks events on a project can be either threats or opportunities. Discrete risk events are considered a threat when the risk event may negatively impact the project baseline objectives, such as schedule delays and cost increases. Discrete risk events are considered an opportunity when the event may positively impact the project objectives, such as schedule and/or cost savings. Unlike uncertainty, discrete risk events may or may not occur.

Risk Allowance is funds added to the baseline schedule and estimate to account for discrete risk events (both threats and opportunities) that may or may not occur during the decommissioning project life cycle.

Contingency Allowance

Based on an evaluation of estimate uncertainty and discrete risk events , combined with experience gained through decommissioning efforts at Oyster Creek and Pilgrim, newly formed waste contracts, and contingency allowances used for other decommissioning projects, a Contingency Allowance of 12 percent was determined to reasonably bound the universe of risks that are appropriate to be taken into account at the estimate phase (considering industry practice, accepted NRC methodology, and the information that is available today) for the Palisades decommissioning project. This Contingency Allowance is incorporated into the estimate of License Termination, Spent Fuel Management and Site Restoration costs presented herein. The exception is ISFSI decommissioning costs, which include a 25% Contingency Allowance consistent with the contingency evaluation criteria referenced by the NRC in NUREG-1757 (Reference 8).

Contingency does not account for inflation or escalation of the price of goods and services over the course of the project.



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Site-Specific Decommissioning Cost Estimate**

**Table 4-1 Work Breakdown Structure**

WBS CODE	WBS Name
01.02.01.02.01	Detailed facility characterization.
01.02.01.05.01	License applications and license approvals.
01.02.01.06.01	Management team activities.
01.02.02.01.03	Cooling down of spent fuel.
01.02.04.01.03	Procurement of special tools for dismantling the reactor systems.
01.02.04.04.02	Removal of asbestos.
01.02.04.05.01	Dismantling of reactor internals.
01.02.04.05.02	Dismantling of reactor vessel and core components.
01.02.04.05.03	Dismantling of other primary loop components.
01.02.04.06.02	Dismantling of remaining components.
01.02.05.01.04	Maintenance, surveillance, and operational support for waste management system.
01.02.05.07.07	Containers.
01.02.05.08.07	Containers.
01.02.05.09.02	Processing.
01.02.05.09.05	Transport.
01.02.05.09.06	Disposal.
01.02.05.09.07	Containers.
01.02.05.12.01	Treatment and packaging.
01.02.05.12.03	Transport of hazardous waste.
01.02.05.12.04	Disposal of hazardous waste at dedicated waste dumps.
01.02.05.13.02	Treatment and packaging of hazardous waste.
01.02.06.01.01	Procurement of general security equipment.
01.02.06.01.04	Deployment of guards/security forces.
01.02.06.02.01	Inspection and maintenance of buildings and systems.
01.02.06.02.02	Site upkeep activities.
01.02.06.03.01	Electricity supply systems.
01.02.06.03.02	Ventilation systems.
01.02.06.03.07	Other systems.
01.02.06.04.01	Procurement and maintenance of equipment for radiation protection and environmental monitoring.
01.02.06.04.02	Radiation protection and monitoring.
01.02.07.03.01	Demolition of buildings and structures from the formerly controlled area.
01.02.07.03.02	Demolition of buildings and structures outside the controlled area.
01.02.07.05.01	Final survey.
01.02.08.02.01	Core management group.
01.02.08.02.02	Project implementation planning, detailed ongoing planning.
01.02.08.02.03	Scheduling and cost control.
01.02.08.02.04	Safety and environmental analysis, ongoing studies.
01.02.08.02.05	Quality assurance and quality surveillance.
01.02.08.02.06	General administration and accounting.
01.02.08.02.07	Public relations and stakeholder's involvement.
01.02.08.03.01	Engineering support.
01.02.08.03.02	Information system and computer support.
01.02.08.03.03	Waste management support.
01.02.08.03.04	Decommissioning support including chemistry, decontamination.
01.02.08.03.05	Personnel management and training.
01.02.08.03.06	Documentation and records control.
01.02.08.03.07	Procurement, warehousing, and materials handling.
01.02.08.03.08	Housing, office equipment, support services.
01.02.08.04.01	Health physics.
01.02.08.04.02	Industrial safety.
01.02.08.08.02	Information system and computer support.
01.02.10.01.02	Transfer of fuel or nuclear material to dedicated ISFSI.
01.02.10.02.01	Construction of ISFSI.
01.02.10.02.02	Operation of ISFSI.
01.02.10.02.03	Transfer of fuel and/or nuclear material away from the ISFSI.
01.02.10.03.01	Decommissioning of ISFSI.
01.02.10.03.02	Management of waste.
01.02.11.01.01	Implementation of transition plans.
01.02.11.01.03	Payments (fees) to authorities.
01.02.11.02.02	Local, community, federal taxes.
01.02.11.03.01	Nuclear related insurances.

## **5 DECOMMISSIONING SCHEDULE AND FUNDING**

### **5.1 Decommissioning Schedule**

The detailed decommissioning project schedule, developed in Oracle Primavera P6, is used as the foundation for developing the decommissioning cost estimate and risk model. The Palisades schedule baseline is a detailed CPM schedule model built with input from the key decommissioning subcontractors and subject matter experts.

The major steps in the decommissioning project schedule development methodology include the following:

1. Identify and define the major decommissioning project milestones
2. Develop a decommissioning project Master Summary Schedule (MSS) in Oracle Primavera P6, capturing the relationship and sequencing of the key project milestones
3. Prepare milestone-focused, activity-based schedule fragnets by WBS, comprised of detailed activities, durations, sequencing, and constraints in alignment with the technical solutions and MSS
4. Capture all the activity-based schedule fragnets into an integrated, logically linked master decommissioning project schedule model in Oracle Primavera P6
5. Verify and validate the integrated master decommissioning project schedule model in Oracle P6 against the MSS. Confirm the schedule integrity/reasonableness of the overall project primary/secondary critical paths as well as for each MSS milestone

Figure 5-1 provides the Master Summary Schedule, which is based on the assumptions that sale closure and license transfers are completed by July 1, 2022, following cessation of plant operations and permanent reactor defueling.

Palisades spent fuel management plan is based in general upon: 1) a 2030 start date for DOE initiating transfer of commercial spent fuel to a federal facility (not necessarily a final repository), and 2) expectations for spent fuel receipt by the DOE for the Palisades fuel beginning in 2030. All spent fuel is expected to be removed from the site by 2040.

### **5.2 Decommissioning Funds**

10 CFR 50.82(a)(6)(iii) states that, "Licensees shall not perform any decommissioning activities," as defined in 10 CFR 50.2 that, "Result in there no longer being reasonable assurance that adequate funds will be available for decommissioning." HDI does not intend to perform any decommissioning activities that would jeopardize the availability of adequate funds for the completion of decommissioning.

Table 5-1 shows the amount of decommissioning funds currently available, the accumulation of additional funds, and the expenditure of the funds.

In accordance with 10 CFR 50.82(a)(8)(v), decommissioning funding assurance will be reviewed and reported to the NRC annually until residual radioactivity has been reduced to a

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level that permits termination of the licenses. The latest site-specific DCE adjusted for inflation, in accordance with applicable regulatory requirements, will be used to demonstrate funding assurance. In addition, actual radiological and spent fuel management expenses will be included in the annual report in accordance with applicable regulatory requirements. Pursuant to 10 CFR 50.82(a)(8)(iv), during the period of dormancy planned for 2025 through 2035, HDI will use the annual NDT fund status update required in 10 CFR 50.75(f)(1) and 10 CFR 50.82(a)(8) to provide a means for adjusting decommissioning and spent fuel management cost estimates and associated funding levels over the dormancy period. If the funding assurance demonstration shows the NDT is not sufficient, then an alternate funding mechanism allowed by 10 CFR 50.75(e) and the guidance provided in Regulatory Guide 1.159 (Reference 9) will be put in place.



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**Table 5-1 Decommissioning Funding Cash Flow Analysis**

<b>Palisades Nuclear Power Station</b>								
Annual Cash Flow in Thousands of 2020 Dollars								
No DOE Reimbursement of Spent Fuel Management Costs								
Year	50.75 License Termination Cost <sup>2</sup>	50.54 (bb) Spent Fuel Management Cost <sup>2</sup>	Site Restoration Cost <sup>2</sup>	Total Cost <sup>2</sup>	Beginning of Year Trust Fund Balance <sup>1</sup>	Withdrawals	Trust Fund Earnings <sup>3</sup>	Year Ending Trust Fund Balance
2022	36,786	767	0	37,553	552,049	(37,553)	5,145	519,641
2023	44,539	26,831	0	71,370	519,641	(71,370)	8,965	457,237
2024	29,102	33,374	0	62,476	457,237	(62,476)	7,895	402,656
2025	26,559	32,597	0	59,156	402,656	(59,156)	6,870	350,371
2026	4,427	2,176	0	6,603	350,371	(6,603)	6,875	350,643
2027	4,584	1,712	0	6,296	350,643	(6,296)	6,887	351,234
2028	4,584	1,712	0	6,296	351,234	(6,296)	6,899	351,837
2029	4,584	1,712	0	6,296	351,837	(6,296)	6,911	352,451
2030	4,922	7,466 <sup>5</sup>	0	12,388	352,451	(12,388)	6,801	346,864
2031	4,391	6,513	0	10,904	346,864	(10,904)	6,719	342,680
2032	4,391	6,513	0	10,904	342,680	(10,904)	6,636	338,411
2033	4,391	6,513	0	10,904	338,411	(10,904)	6,550	334,058
2034	4,391	6,513	0	10,904	334,058	(10,904)	6,463	329,617
2035	7,041	6,193	202	13,437	329,617	(13,437)	6,324	322,504
2036	31,460	5,617	1,943	39,019	322,504	(39,019)	5,670	289,155
2037	39,920	5,301	5,412	50,633	289,155	(50,633)	4,770	243,293
2038	89,538	4,837	7,725	102,100	243,293	(102,100)	2,824	144,016
2039	56,475	4,820	7,438	68,733	144,016	(68,733)	1,506	76,789
2040	32,912	4,954	6,146	44,012	76,789	(44,012)	656	33,432
2041	8,221	0	5,812	14,032	33,432	(14,032)	388	19,788
<b>Total<sup>4</sup></b>	<b>443,215</b>	<b>166,122</b>	<b>34,679</b>	<b>644,015</b>		<b>(644,015)</b>	<b>111,754</b>	

<sup>1</sup> The 2022 Beginning of Year NDT balance reflects the expected fund value post-closure of the sale transition. The value used is based on the December 2, 2020 Trust Fund Balance and conservatively bounds deductions for estimated ENOI and HDI pre-closure costs of approximately \$13.3M.

<sup>2</sup> The 2022 costs include HDI estimated 2022 post-closure costs.

<sup>3</sup> NDT earnings reflect an assumed 2% Real Rate of Return (RRR).

<sup>4</sup> Columns may not add due to rounding

<sup>5</sup> Spent Fuel Management costs assume DOE removal begins in 2030 and completes in 2040

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## **6 CONCLUSION**

The submittal of this DCE complies with NRC requirements set forth in 10 CFR 50.82(a)(7), which require the licensee to submit a site-specific decommissioning cost estimate within two (2) years following permanent cessation of operations. CDI prepared this cost estimate and schedule on behalf of HDI using several sources, including information compiled during a due diligence period and the input and professional judgment of experienced specialty subcontractors and SMEs.

The estimate is based on regulatory requirements, site conditions, baseline assumptions, low-level radioactive waste disposal standards, high-level radioactive waste management options and site restoration requirements. The cost to decommission the site, safeguard the spent fuel until it can be transferred to the DOE and restore the affected area of the site is estimated to be \$644 million. The majority of this cost is associated with decommissioning and license termination. A significant amount of the remaining cost is associated with spent fuel management since the fuel will be removed from the SFP and remain in storage at the ISFSI until acceptance by DOE. A relatively small amount of the decommissioning cost is for the demolition of uncontaminated structures and restoration of the site. The summary of the costs estimated for License Termination, Spent Fuel Management and Site Restoration activities are presented in Table 6-1.

The largest contributors to the overall decommissioning costs are removal of contaminated components and buildings, disposal costs, and program management costs. Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. The disposal of low-level radioactive waste that is generated from dismantling activities makes up the bulk of the disposal cost category. The magnitude of the program management costs is a function of both the size of the organization needed to manage the decommissioning, as well as the duration.

In accordance with 10 CFR 50.82(a)(8)(v), decommissioning funding assurance will be reviewed and reported to the NRC annually until residual radioactivity has been reduced to a level that permits termination of the licenses. The site-specific DCE adjusted for inflation, in accordance with applicable regulatory requirements, will be used to demonstrate funding assurance. In addition, actual radiological and spent fuel management expenses will be included in the annual report in accordance with applicable regulatory requirements.

If the funding assurance demonstration shows that the NDT is not sufficient, then an alternate funding mechanism allowed by 10 CFR 50.75(e) and the guidance provided in Regulatory Guide 1.159 (Reference 9) will be put in place.

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**Table 6-1 Estimated Decommissioning Cost (thousands of 2020 dollars)**

Cost By Cost Element By WBS		License Termination	Spent Fuel	Site Restoration	Total
WBS	Activities				
<b>01.02</b>	<b>Decommissioning Unit</b>	<b>443,215</b>	<b>166,122</b>	<b>34,679</b>	<b>644,015</b>
01.02.01	Pre-decommissioning actions	7,668	0	0	7,668
01.02.01.02	Facility characterization.	4,833	0	0	4,833
01.02.01.05	Authorization.	1,100	0	0	1,100
01.02.01.06	Preparing management group and contracting.	1,734	0	0	1,734
01.02.02	Facility shutdown activities	239	0	0	239
01.02.02.01	Plant shutdown and inspection.	239	0	0	239
01.02.04	Dismantling activities within the controlled area	67,720	0	0	67,720
01.02.04.01	Procurement of equipment for decontamination and dismantling.	7,409	0	0	7,409
01.02.04.04	Removal of materials requiring specific procedures.	8,896	0	0	8,896
01.02.04.05	Dismantling of main process systems, structures, and components.	48,794	0	0	48,794
01.02.04.06	Dismantling of other systems and components.	2,621	0	0	2,621
01.02.05	Waste processing, storage, and disposal	113,857	35,606	9,461	158,924
01.02.05.01	Waste management system.	4,533	0	0	4,533
01.02.05.07	Management of decommissioning high-level waste.	0	35,606	0	35,606
01.02.05.08	Management of decommissioning intermediate-level waste.	2,352	0	0	2,352
01.02.05.09	Management of decommissioning low-level waste.	32,840	0	1,035	33,875
01.02.05.12	Management of decommissioning exempt waste and materials.	71,956	0	8,427	80,382
01.02.05.13	Management of decommissioning waste and materials generated outside controlled areas.	2,176	0	0	2,176
01.02.06	Site infrastructure and operation	80,829	588	0	81,417
01.02.06.01	Site security and surveillance.	41,373	588	0	41,961
01.02.06.02	Site operation and maintenance.	10,913	0	0	10,913
01.02.06.03	Operation of support systems.	17,267	0	0	17,267
01.02.06.04	Radiation and environmental safety monitoring.	11,276	0	0	11,276
01.02.07	Conventional dismantling, demolition, and site restoration	46,107	0	12,428	58,536
01.02.07.03	Demolition of buildings and structures.	45,190	0	12,428	57,618
01.02.07.05	Final radioactivity survey of site.	917	0	0	917
01.02.08	Project management, engineering, and support	70,080	28,690	2,952	101,723
01.02.08.02	Project management.	32,168	19,064	1,817	53,049
01.02.08.03	Support services.	29,018	7,962	825	37,805
01.02.08.04	Health and safety.	7,718	1,664	311	9,693
01.02.08.08	Support services by contractors (if needed).	1,176	0	0	1,176
01.02.10	Fuel and nuclear material	9,029	90,768	9,221	109,018
01.02.10.01	Removal of fuel or nuclear material from facility to be decommissioned.	0	17,398	0	17,398
01.02.10.02	Dedicated ISFSI for fuel and/or nuclear material.	8,709	73,370	217	82,296
01.02.10.03	Decommissioning of ISFSI.	320	0	9,005	9,324
01.02.11	Miscellaneous expenditures	47,686	10,469	615	58,771
01.02.11.01	Owner costs.	31,054	3,324	421	34,799
01.02.11.02	Taxes.	3,705	1,837	0	5,542
01.02.11.03	Insurances.	12,927	5,309	194	18,429

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**REFERENCES**

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2. Letter from ENOI to US NRC, "Application for Order Consenting to Transfers of Control of Licenses and Approving Conforming License Amendments, Palisades Nuclear Plant Docket Nos. 50-255 and 72-007, and Renewed Facility Operating License No. DPR-20 and Big Rock Point Docket Nos. 50-155 and 72-043, License No. DPR-6," dated December 23, 2020
3. Regulatory Guide 1.202, Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Plants, February 2005
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5. NUREG/CR-5884, Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station, November 1995
6. "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," U.S. DOE, January 11, 2013
7. NUREG-1575, Rev. 1 "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."
8. NUREG-1757, "Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness," U.S. Nuclear Regulatory Commission's Office of Nuclear Material Safety and Safeguards, Volume 3, Revision 1, February 2012.
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10. International Structure for Decommissioning Costing (ISDC) of Nuclear Installations, ISBN 978-92-64-99173-6, Joint NEA/EC/IAEA Publication, 2012
11. Letter from HDI to US NRC, "Request for Exemptions from 10 CFR 50.82(a)(8)(i)(A) and 10 CFR 50.75(h)(1)(iv), Palisades Nuclear Plant, Docket Nos. 50-255 and 72-007," dated December 23, 2020



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**Appendix A  
ISFSI Decommissioning Cost Estimate**

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**Table A-1 ISFSI Decommissioning Cost Estimate (thousands of 2020 dollars)**

Activities	Removal Costs	Transport Costs	Disposal Costs	Other Costs	Burial Volume Class A (cf)	Labor (FTE)	License Termination	Spent Fuel	Site Restoration	Total Costs
ISFSI Demolition Non-Radiological	2,234								2,234	2,234
ISFSI Clean Waste			26						26	26
ISFSI Final Site Survey				53			53			53
ISFSI NRC Confirmatory Survey				5			5			5
ISFSI Demolition Radiological	263				26,254		263			263
ISFSI Radiological Waste	74	551	294						919	919
NRC License Termination Support										
Security Staff				325		12			325	325
Security Management				197		4			197	197
Property Tax				7					7	7
Insurance				179					179	179
NRC Regulatory Fees				734					734	734
<b>Total</b>										<b>4,941</b>