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Final Environmental Assessment
for the Approval of the License Termination Plan for
Zion Nuclear Power Station, Units 1 and 2 in
Lake County, Illinois

ZionSolutions, LLC.

Docket Nos. 50-295 & 50-304

License Nos. DPR-39 & DPR-48

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CONTENTS

| | | |
|-------|---|----|
| 1.0 | INTRODUCTION | 1 |
| 1.1 | Proposed Action | 3 |
| 1.2 | Purpose of and Need for the Proposed Action..... | 3 |
| 1.3 | Alternative to the Proposed Action | 4 |
| 1.4 | Scope of the Environmental Analysis..... | 4 |
| 2.0 | DECOMMISSIONING and License termination | 6 |
| 2.1 | Brief History of ZNPS Licenses | 6 |
| 2.2 | Decommissioning Activities | 9 |
| 3.0 | AFFECTED ENVIRONMENT | 13 |
| 3.1 | Site Description and Land Use..... | 13 |
| 3.1.1 | Existing Radiological Conditions | 15 |
| 3.2 | Water Resources..... | 16 |
| 3.2.1 | Surface Water..... | 16 |
| 3.2.2 | Ground Water | 16 |
| 3.3 | Meteorology and Air Quality | 17 |
| 3.4 | Ecological Resources..... | 18 |
| 3.4.1 | Terrestrial Resources | 18 |
| 3.4.2 | Aquatic Resources | 18 |
| 3.5 | Protected Species and Habitats | 19 |
| 3.5.1 | Federally Listed Species and Habitats | 19 |
| 3.5.2 | State-listed Species..... | 24 |
| 3.5.3 | Migratory Birds | 24 |
| 3.5.4 | Bald Eagle (<i>Haliaeetus leucocephalus</i>)..... | 26 |
| 3.5.5 | Essential Fish Habitat..... | 26 |
| 3.6 | Public and Occupational Health | 26 |
| 3.6.1 | Occupational Dose | 27 |
| 3.6.2 | Public Dose | 27 |
| 3.7 | Socioeconomics | 28 |
| 3.8 | Environmental Justice | 29 |
| 3.8.1 | Minority Populations in the Vicinity of the ZNPS | 29 |
| 3.8.2 | Low-income Populations in the Vicinity of the ZNPS..... | 29 |
| 3.9 | Historic and Cultural Resources..... | 29 |

| | | |
|--------|---|-----|
| 3.10 | Aesthetics | 30 |
| 3.11 | Noise | 31 |
| 3.12 | Transportation and Traffic | 31 |
| 3.12.1 | Radiological Impacts | 31 |
| 3.12.2 | Nonradiological Impacts | 32 |
| 3.13 | Waste Management | 32 |
| 3.13.1 | Radioactive Waste..... | 32 |
| 3.13.2 | Nonradioactive Waste | 34 |
| 4.0 | ENVIRONMENTAL IMPACTS..... | 35 |
| 4.1 | Greenhouse Gases and Climate Change | 36 |
| 4.2 | Protected Species and Habitat Impacts | 37 |
| 4.2.1 | General Impacts | 38 |
| 4.2.2 | Birds and Bats | 39 |
| 4.2.3 | Other Fauna | 40 |
| 4.2.4 | Plants..... | 40 |
| 4.2.5 | Species and Habitats under the National Marine Fisheries Service's Jurisdiction..... | 40 |
| 4.2.6 | Cumulative Effects..... | 40 |
| 4.2.7 | State-listed Species and Migratory Birds..... | 41 |
| 4.3 | Public and Occupational Health Impacts..... | 41 |
| 4.3.1. | Rubblization..... | 42 |
| 4.4 | Environmental Justice | 42 |
| 4.5 | Waste-Management Impacts | 43 |
| 4.5.1 | Radioactive Waste..... | 43 |
| 4.5.2 | Nonradioactive Waste | 44 |
| 5.0 | Cumulative IMPACTS ANALYSIS | 45 |
| 6.0 | AGENCIES CONSULTED AND COMMENTS RECEIVED | 48 |
| 6.1 | Illinois State Review | 48 |
| 6.2 | National Historic Preservation Act Section 106 Consultation | 48 |
| 6.3 | Endangered Species Act Section 7 Consultation | 48 |
| 7.0 | CONCLUSION..... | 50 |
| 8.0 | LIST OF PREPARERS..... | 51 |
| 9.0 | REFERENCES | 52 |
| | Appendix A: Draft EA Comment Resolution..... | A-1 |

ABBREVIATIONS AND ACRONYMS

| | |
|-------------------|---|
| ac | acres |
| ACOE | U.S. Army Corps of Engineers |
| ACS | American Community Survey |
| ADAMS | Agencywide Documents Access and Management System |
| AEC | Atomic Energy Commission |
| ALARA | as low as is reasonably achievable |
| ARGPPR | Annual Radiological Groundwater Protection Program Report |
| APE | Area of Potential Effect |
| BMP | best management practice |
| CFR | <i>Code of Federal Regulations</i> |
| Co ₂ e | carbon dioxide equivalents |
| ComEd | Commonwealth Edison Company |
| DCGL | derived concentration guideline level |
| EA | Environmental Assessment |
| EFH | essential fish habitat |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act of 1973, as amended |
| Exelon | Exelon Nuclear Generation, LLC |
| FLAP | Fatal Light Awareness Program |
| FONSI | Finding of No Significant Impact |
| FR | <i>Federal Register</i> |
| ft | feet |
| FWS | U.S. Fish and Wildlife Service |
| GCRP | U.S. Global Change Research Program |
| GEIS | Generic Environmental Impact Statement (Decommissioning) |
| GHG | greenhouse gas |
| GTCC | Greater-Than-Class-C (waste) |
| ha | hectare |
| IDNR | Illinois Department of Natural Resources |
| IEPA | Illinois Environmental Protection Agency |
| IHPA | Illinois State Historic Preservation Agency |
| ISFSI | Independent Spent Fuel Storage Installation |
| LLW | low-level radioactive waste |
| LTP | License Termination Plan |
| MBTA | Migratory Bird Treaty Act of 1918, as amended |
| mi | miles |
| MOU | Memorandum of Understanding |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act of 2006, as amended |
| msl | mean sea level |

| | |
|-------|--|
| NEPA | National Environmental Policy Act of 1969, as amended |
| NHPA | National Historic Preservation Act of 1966, as amended |
| NMFS | National Marine Fisheries Service |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | National Park Service |
| NRC | U.S. Nuclear Regulatory Commission |
| NRHP | National Register of Historic Places |
| PCB | polychlorinated biphenyl |
| PSDAR | Post-Shutdown Decommissioning Activities Report |
| PWR | Pressurized-Water Reactor |
| RAIs | Requests for Additional Information |
| REMP | Radiological Environmental Monitoring Program |
| SER | Safety Evaluation Report |
| Sv | Sievert |
| TEDE | Total Effective Dose Equivalent |
| WCS | Waste Control Specialists |
| WHC | Wildlife Habitat Council |
| ZNPS | Zion Nuclear Power Station Units 1 and 2 |
| ZS | ZionSolutions, LLC |

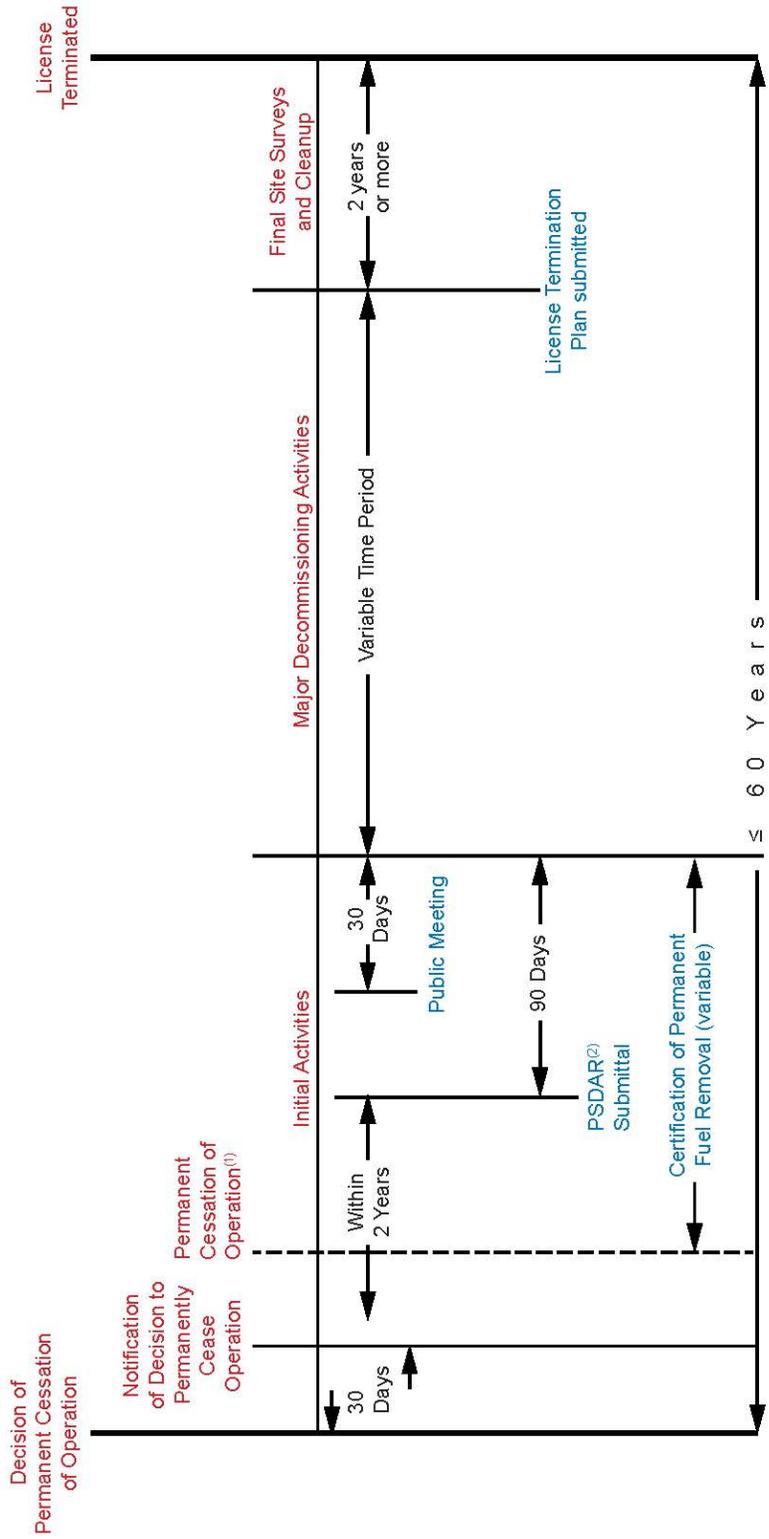
1.0 INTRODUCTION

In December 2014, ZionSolutions, LLC (ZS, the licensee) submitted a license amendment request to the U.S. Nuclear Regulatory Commission (NRC) to amend its operating licenses for Zion Nuclear Power Station, Units 1 and 2 (ZNPS) (ZS 2014). The request, if granted, would add a license condition reflecting the NRC's approval of the License Termination Plan (LTP), which was submitted as part of the request and submitted again in response to NRC's request for additional information (RAIs) in July 2017 (ZS 2017a). The licensee updated its LTP in February 2018 (ZS 2018a). ZS is also requesting that the NRC amend the licenses to include a provision to allow ZS to make certain changes to the NRC-approved LTP without prior NRC approval (ZS 2014). ZNPS, a commercial nuclear power plant in Lake County, Illinois, is licensed by the NRC but has been permanently shut down since 1998.

Submission of the LTP is one of the final steps in the NRC's nuclear power reactor decommissioning process, which involves the safe removal of a facility from service and the reduction of residual radioactivity to a level that permits NRC license termination. Figure 1 provides a general timeline for the overall decommissioning process. Title 10 of the *Code of Federal Regulations* (CFR) 50.82 provides regulations for terminating power reactor operating licenses. 10 CFR 50.82(a)(9) specifies what must be included in a licensee's LTP when submitted to the NRC for review and approval. The LTP describes the process the licensee will use to meet the requirements for terminating the operating licenses and to release the site for unrestricted use.

The NRC will terminate the licenses if it determines that the site meets the performance-based criteria for unrestricted site release, in accordance with 10 CFR 20.1402, and that the facility has been dismantled in accordance with the approved LTP. The portion of the site associated with the independent spent fuel storage installation (ISFSI) will remain under the NRC's regulatory jurisdiction. Although the terminology "license termination" is used throughout this EA, the ZNPS 10 CFR Part 50 operating licenses will continue in effect for the ZNPS ISFSI only. The ZNPS licenses will be considered terminated in all other aspects and will only apply to the site occupied by the ZNPS ISFSI.

The NRC staff has prepared this Environmental Assessment (EA) to evaluate and document the potential environmental impacts resulting from the NRC's approval of ZS's license amendment request and the subsequent implementation of the LTP. The NRC staff is also performing a detailed safety analysis of ZS's license amendment request. The results of the safety analysis will be documented in a separate Safety Evaluation Report (SER). The NRC decision whether to approve the license amendment request will be based on the results of the NRC staff's reviews documented in this EA and the SER.



(1) The cessation of operations may occur before, concurrent with, or following the certification to permanently cease operations.
 (2) The PSDAR may be submitted before permanent cessation of operations.

Decommissioning Timeline

(Adapted from NUREG-0586 Figure 1-1)

■ = Licensee Decommissioning Activities
 ■ = Regulatory Activities

Figure 1. General Timeline of the Decommissioning Process

1.1 Proposed Action

The proposed action is review and approval of the ZNPS LTP. In its license amendment request, ZS requested amendment of the ZNPS licenses to add license conditions (1) reflecting the NRC staff's approval of the LTP and (2) providing criteria for when NRC approval is needed for LTP changes. If the NRC approves the LTP, the approval will be issued in the form of an amendment to the ZNPS licenses to add the requested license conditions.

1.2 Purpose of and Need for the Proposed Action

The purpose of and need for the proposed action is to allow for the completion of decommissioning of the ZNPS site by ZS, the termination of the ZNPS operating licenses by the NRC, and the subsequent release of the ZNPS site for unrestricted use. NRC regulation 10 CFR 50.82 sets forth the process for the licensee to decommission its nuclear power plant, including the submission of the LTP. The NRC will approve the LTP, provided that the LTP meets the criteria in 10 CFR 50.82(a)(10).

The NRC staff's review and approval of the LTP is the regulatory mechanism by which the NRC ensures that final decommissioning activities are appropriately completed. As part of the LTP review process, the NRC staff determines whether the procedures and activities planned for completing decommissioning (e.g., adequacy of radiation release criteria and adequacy of the design of the final radiation survey) appear sufficient as described in the LTP.

ZS intends to meet the radiological criteria for unrestricted use. The NRC's performance-based radiological criteria for unrestricted release of a licensed site, as specified by 10 CFR 20.1402, is:

A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE⁽¹⁾ to an average member of the critical group that does not exceed 25 [millirem] mrem (0.25 [milliSievert] mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

ZS has proposed derived concentration guideline levels (DCGLs) to meet the 10 CFR 20.1402 criteria. NRC staff must determine whether additional planning, investigation, or other activities by ZS are necessary to support the NRC's decision on approving the LTP. Once decommissioning has been completed, the NRC licenses have been terminated, and the site

(1) Total Effective Dose Equivalent (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). *Dose equivalent* means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and Sievert (Sv). (10 CFR 20.1003.)

has been released for unrestricted use, the licensee can make the ZNPS site available for another use.

1.3 Alternative to the Proposed Action

As an alternative to the proposed action, the NRC staff considered the “no-action alternative.” Under the no-action alternative, the NRC would not approve the LTP or the license amendment request because regulatory requirements have not been met. Consequently, the ZNPS licenses would not be terminated, decommissioning and other onsite maintenance and operations activities involving the storage of spent nuclear fuel would continue, and the ZNPS site would not be released for unrestricted use. NRC regulation 10 CFR 50.82(a)(10) states that the Commission shall approve an LTP, by license amendment, if the LTP demonstrates that the remainder of the decommissioning activities will be performed in accordance with the NRC’s regulations, will not be inimical to the common defense and security or to the health and safety of the public, and will not have a significant effect on the quality of the environment.

If the NRC was unable to approve the LTP because the regulatory requirements were not met, then the licensee would have to take the necessary actions to ensure the regulations are met. Under the no-action alternative, the NRC would be unable to approve the LTP. ZS would need to take additional action to prepare an LTP that meets the requirements in 10 CFR 50.82(a)(10); the updated LTP would then need to be submitted to NRC for approval prior to license termination.

1.4 Scope of the Environmental Analysis

To fulfill its obligations under the National Environmental Policy Act (NEPA), the NRC must evaluate the radiological and nonradiological environmental impacts associated with approval of the LTP and subsequent termination of the licenses. These evaluations involve an assessment of the impacts of remaining decommissioning and site restoration activities documented in the LTP and license termination activities (e.g., final site survey).

The NRC previously evaluated the potential environmental impacts of nuclear reactor decommissioning in NUREG–0586, Supplement 1, “Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities” (GEIS) (NRC 2002). The GEIS is used by NRC staff to evaluate environmental impacts that would occur during the decommissioning of nuclear power reactors. The GEIS is considered “generic” in that it evaluates environmental impacts from decommissioning activities common to nuclear power reactor facilities. The GEIS addresses decommissioning of nuclear power reactors licensed by the NRC, including pressurized-water reactors (PWRs), boiling-water reactors, and multiple reactor stations. The generic analysis was based, in part, on experience with reactors that had already undergone or were undergoing decommissioning, which included ZNPS. Thus, the GEIS is applicable to the decommissioning of the ZNPS.

The scope of the GEIS is based on decommissioning from the time that a licensee certifies that it has permanently ceased power operations until the license is terminated. NRC staff concluded in the GEIS that the environmental impacts of decommissioning, including the license

termination activities, can be determined generically for all nuclear power plants and will have SMALL impacts⁽²⁾ in all but six environmental resource areas. The GEIS concluded that two of these six resource areas (i.e., threatened and endangered species and environmental justice) must always be evaluated on a site-specific basis in site-specific EAs, such as this EA for the ZNPS project. Depending on the site-specific circumstances, the following four additional resource areas are considered to be conditionally site-specific: offsite land use, historic and cultural resources, terrestrial ecology beyond the operation area, and aquatic ecology beyond the operational area (NRC 2002).

In the GEIS, the NRC addressed the nonradiological impacts of rubbleization (i.e., onsite disposal of slightly contaminated material) but determined that the long-term radiological aspects of rubbleization would require a site-specific analysis and would need to be addressed at the time the LTP is submitted (NRC 2002). Because ZS intends to use crushed concrete as onsite backfill, the long-term radiological aspects of rubbleization are addressed in this EA.

Although the disposal of radioactive waste is outside the scope of the GEIS, the volume of land required for radioactive waste was considered in the GEIS evaluation of irreversible and irretrievable resources. The amount of radioactive waste estimated by ZS to be generated from ZNPS decommissioning is much greater than the estimates considered in the GEIS. Therefore, this EA will address the land needed for the disposal of low-level radioactive waste (LLW). Further, the GEIS did not address the affected environment, cumulative impacts, climate change and greenhouse gases, or nonradioactive waste management. Therefore, this EA will also describe the affected environment at ZNPS, consider cumulative impacts, and evaluate the impacts of nonradioactive waste management.

The cost of decommissioning was considered but not evaluated in the GEIS. The analysis of the cost of decommissioning is not considered in this EA because licensees must submit decommissioning funding plans annually. Upon receipt of a decommissioning funding plan, the NRC reviews the estimates to determine if the licensee has demonstrated compliance with 10 CFR 50.82(a)(8)(v)-(vii), thus providing assurance that the licensee is maintaining the sufficient funds for decommissioning. The financial assurance review, which is a required part of the LTP approval, is not related to human health or the environment and will not be discussed in this EA.

(2) NRC staff use a standard of significance in the GEIS, described as either SMALL, MODERATE, or LARGE. "SMALL" impacts are defined as environmental impacts that are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource (NRC 2002).

2.0 DECOMMISSIONING AND LICENSE TERMINATION

This section provides a brief history of ZNPS, describes typical demolition and decommissioning activities, and provides an overview of the facility's decommissioning process to date. The ZNPS site is in Lake County, Illinois, along the western shore of Lake Michigan (see Figure 2). ZNPS had two PWRs with supporting infrastructure and buildings. The two reactors have not operated since 1997 and are currently undergoing decommissioning.

2.1 Brief History of ZNPS Licenses

In December 1968, Commonwealth Edison Company (ComEd) received a construction permit for ZNPS from the Atomic Energy Commission (AEC), the NRC's predecessor agency. Pursuant to 10 CFR Part 50, the AEC issued operating licenses DPR-39 (Unit 1) and DPR-48 (Unit 2) in 1973, and by 1974 both units were operating. As part of the NRC's licensing review for operations, the NRC prepared a Final Environmental Statement⁽³⁾ (AEC 1972).

ComEd ceased operation of both units by 1997. By 1998, all fuel assemblies had been removed from the two reactors and placed in a spent fuel pool (ComEd 1998). The reactors were placed in a SAFSTOR condition⁽⁴⁾ (ZS 2014).

Pursuant to 10 CFR 50.82(a)(4)(i), ComEd submitted its initial Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC in 2000 (ComEd 2000). NRC staff reviewed the PSDAR and determined that it contained the required information, including "that the environmental impacts associated with the anticipated decommissioning activities at ZNPS are bounded by appropriate, previously issued environmental impact statements as required by 10 CFR 50.82(a)(4)(i)." (NRC 2001).

(3) The "Environmental Statement" is the equivalent of an "Environmental Impact Statement", as this form of document is presently known.

(4) As defined in the GEIS Glossary, SAFSTOR is "A method of decommissioning in which the nuclear facility is placed and maintained in a safe stable condition for a number of years until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel has been removed from the reactor vessel and radioactive liquids have been drained from systems and components and then processed. Radioactive decay occurs during SAFSTOR period, thus reducing the quantity of contaminated and radioactive material that must be disposed of during decontamination and dismantlement."



Figure 2. Location of ZNPS (ZS 2017a)

In 2000, ComEd transferred the ZNPS operating licenses to Exelon Nuclear Generation, LLC (Exelon). Exelon amended the PSDAR in 2008 to reflect significant schedule changes (Exelon 2008). In 2010, Exelon transferred the operating licenses to ZS. ZS then amended the PSDAR in 2010 to reflect additional schedule changes (ZS 2010a). ZS removed ZNPS from SAFSTOR and began decommissioning (DECON)⁽⁵⁾ in October 2010 (ZS 2017a).

ZS submitted the LTP to the NRC in December 2014 and Revision 1 in July 2017 in response to an NRC request for additional information (ZS 2014, 2017a). The licensee submitted an updated LTP in February 2018 (ZS 2018a). The initial LTP submittal included a request for the NRC to amend the ZNPS operating licenses to include the LTP and to include a provision to allow ZS to make certain changes to the NRC-approved LTP without prior NRC approval. The NRC held a public meeting in Zion, Illinois on April 28, 2015, related to the LTP (NRC 2015a).

In August 2015, ZS requested a partial site release of 87 hectares (ha) (214 acres (ac)) of non-impacted and mostly undisturbed land from the 10 CFR Part 50 licenses and, thus, the NRC's jurisdiction (ZS 2015a, 2016a). Figure 3 shows the ZNPS property boundary at the time ZS submitted its LTP. Figure 4 indicates the non-impacted and impacted areas. The NRC approved the partial site release on March 31, 2016 (NRC 2016a). As part of its review, the NRC did not identify any environmental concerns associated with the release of the 87 ha (214 ac) property and determined that the

*The ZNPS footprint has been reduced to include only the areas identified as **radiologically impacted**—a term defined in 10 CFR 50.2 “Definitions”—to indicate the potential for residual radioactivity in excess of natural background radiation levels by the routine operation and maintenance of the facility. **Non-impacted areas** are defined as those areas with no reasonable potential for residual radioactivity in excess of natural background or fallout levels.*

environmental impacts associated with the proposed release of the property are bounded by previously issued environmental impact statements such that no NEPA review was necessary. The ZNPS footprint is now 47 ha (117 ac) and includes the radiologically restricted area, the west training area, the Lake Michigan shoreline along the radiologically restricted area, and the southeast corner of the exclusion area (see Figure 5).

ZS divided the ZNPS decommissioning effort into several different periods:

- SAFSTOR
- Preparation for decontamination and dismantlement
- Creation of ISFSI and transfer of spent fuel and Greater-Than-Class-C (GTCC) waste
- Decommissioning (DECON)

(5) DECON, as defined in the GEIS Glossary, is “An option for decommissioning in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.

- Restoration of the site, except for ISFSI
- Removal of the spent fuel and GTCC waste from the site, and
- Restoration of the remaining portion of the site (Exelon 2008).

ZS is currently completing the remaining decommissioning and dismantling activities and restoring the site (except for that portion of the site occupied by the ISFSI) to meet the radiological criteria for unrestricted use set forth in 10 CFR 20.1402. The NRC will not terminate the ZNPS licenses until ZS demonstrates in its final radiation survey that the site meets the 10 CFR 20.1402 criteria and that the facility has been dismantled in accordance with the approved LTP. ZS anticipates completing decommissioning by the end of 2018. Following the completion of decommissioning activities and termination of the NRC operating licenses (except for the ISFSI), Exelon will make a determination regarding future use of the property (ZS 2017a). In the PSDAR, Exelon estimated that the ISFSI would operate until 2025 unless the spent fuel and GTCC waste stored in the ISFSI was transferred before that date to an off-site storage site or disposal facility. Full restoration of the site is estimated to require three years after the removal of the last of the waste from the ISFSI (Exelon 2008).

2.2 Decommissioning Activities

During SAFSTOR, ZNPS was placed in a safe, stable condition. The fuel was removed from the reactor vessel, and the radioactive liquids were drained from systems and components. During DECON, equipment, structures, and components are decontaminated, dismantled, demolished, and removed from the site. Chapter 3 of the LTP identifies the completed activities as well as the remaining site dismantlement activities. ZS has continued dismantling and decommissioning activities as the NRC reviews the LTP.

Completed decommissioning activities include lead and asbestos abatement; installation of a heavy lift system in the containment buildings; removal and shipment of reactor components (e.g., pumps, valves, piping, and the reactor head); and demolition of the radioactive waste storage building, training center, warehouse, and fire training complex. In addition, the crib house structure has been demolished and dismantled (ZS 2017a).

Remaining activities, as indicated in the 2017 LTP, include demolition of the turbine building, auxiliary building, containment buildings, fuel handling buildings, waste-water treatment facility, service buildings, meteorological tower, and other auxiliary buildings (warehouse, laundry, waste handling). The valve house and forebay for the intake/outtake system will be demolished while the circulating water intake piping and discharge tunnels located at the bottom of Lake Michigan will be abandoned in place. If surveys indicate residual radioactivity above the unrestricted release criteria, then surface and subsurface soils will be excavated and disposed of (ZS 2017a).

Decommissioning activities at the site are subject to other non-NRC Federal regulations and permits, such as for hazardous waste generation and disposition, handling and removal of asbestos and lead, and removal of underground storage tanks.

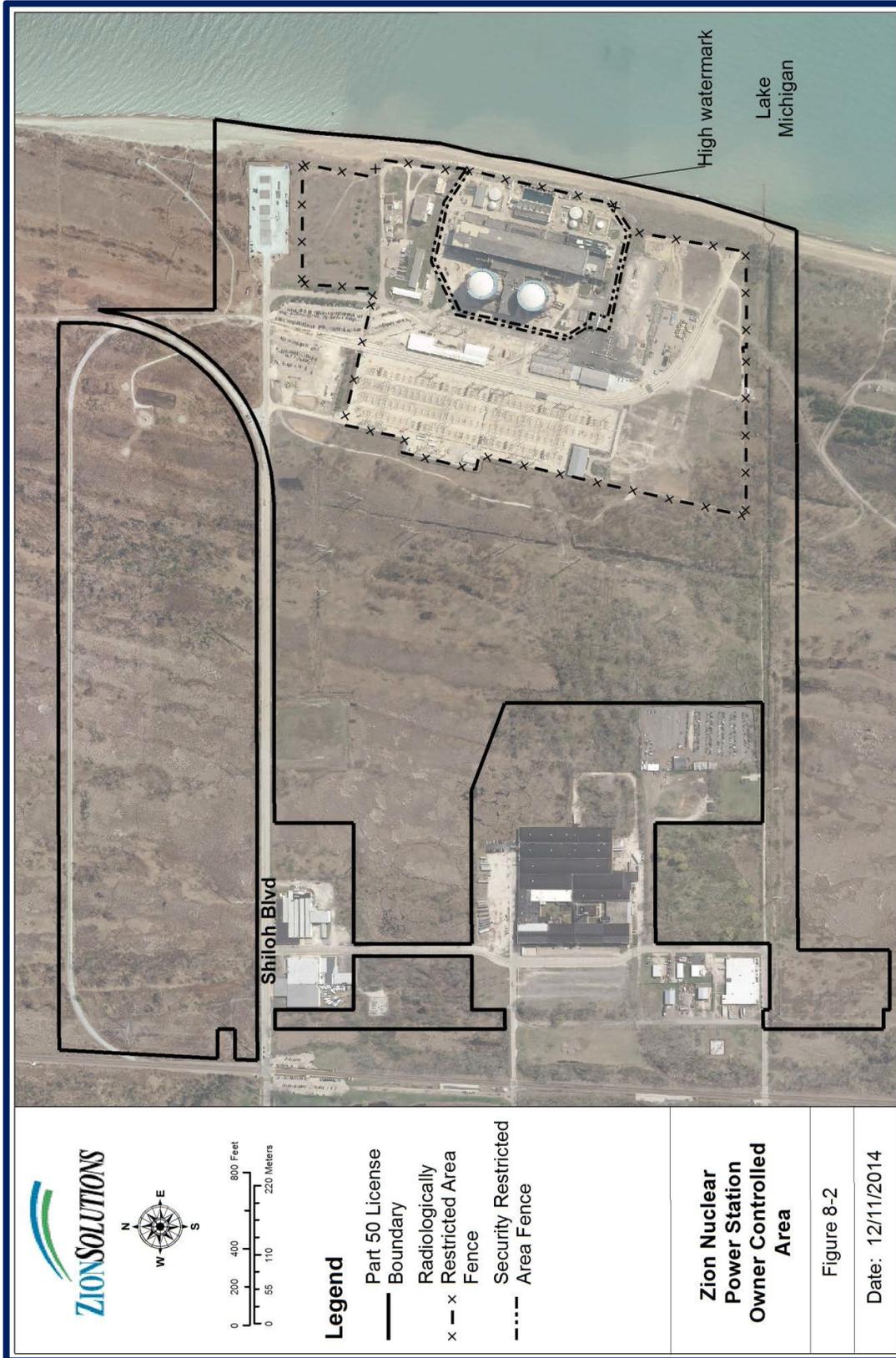
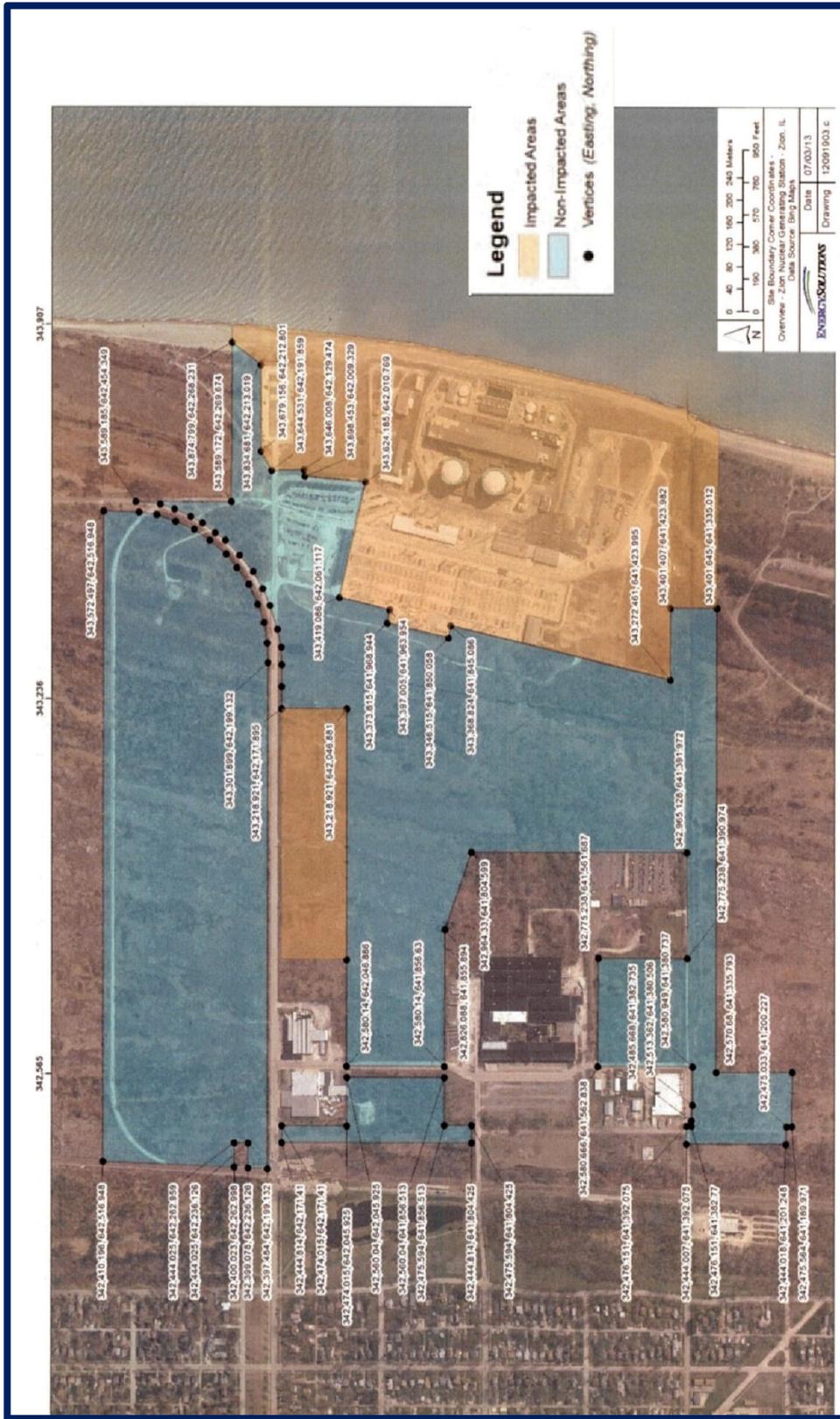


Figure 3. ZNPS Property Boundary at Time of LTP Submittal (ZS 2017a)



Note: The blue shaded areas (non-impacted areas), were released from the Part 50 license when the NRC approved the partial site release in March 2016. The orange shaded areas (impacted areas) are still included in the Part 50 operating licenses.

Figure 4. Impacted and Non-Impacted Areas (ZS 2017a)

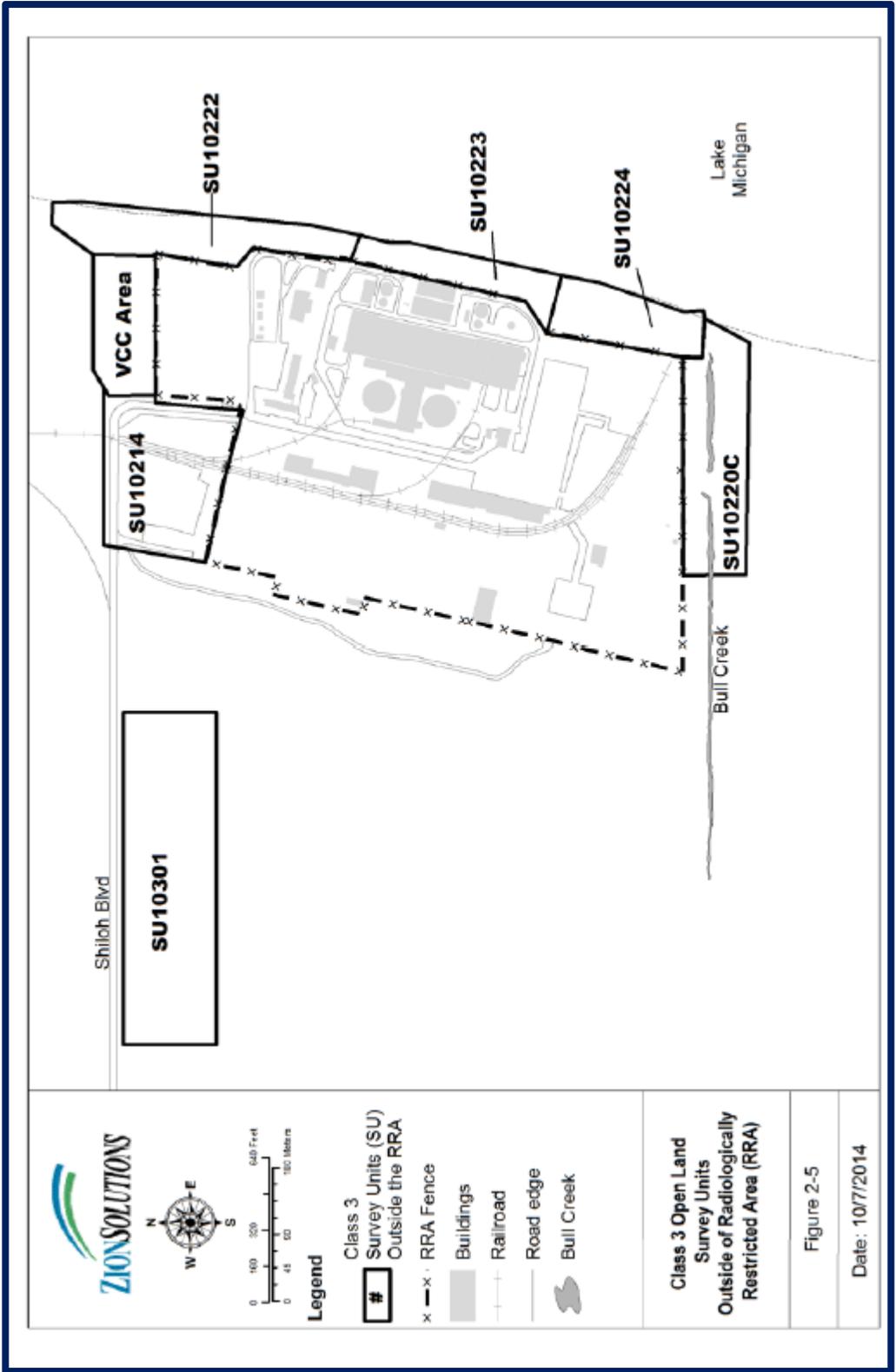


Figure 5. ZNPS Property Boundary After Partial Site Boundary (ZS 2017a)

3.0 AFFECTED ENVIRONMENT

This section describes current environmental conditions at the ZNPS site to provide a framework, or baseline, for the evaluation of the potential environmental impacts discussed in Section 4.0.

3.1 Site Description and Land Use

The ZNPS site is located on the western shore of Lake Michigan in northeast Lake County, Illinois. The site is 64 kilometers (km) (40 miles (mi)) north of Chicago, Illinois; 67 km (42 mi) south of Milwaukee, Wisconsin (See Figure 2); 1.6 km (1 mi) east of Zion, Illinois; and 12.8 km (8 mi) south of Kenosha, Wisconsin. After the partial site release in March 2016, the ZNPS footprint is 47 ha (117 ac).

The ZNPS footprint evaluated in this EA (see Figure 5) includes the following:

- the radiologically restricted area,
- the Lake Michigan shoreline along the radiologically restricted area (SU10222, SU10223, SU10224),
- the west training area (SU10301),
- the construction parking lot (SU10214),
- the vertical concrete cask construction area, and
- the southeast corner of exclusion area (SU10220C).

The radiologically restricted area is zoned as industrial and will remain an industrial-zoned property throughout decommissioning and future use. The public cannot access the radiologically restricted area. The two nuclear reactors were located within the security restricted area (See Figure 3), which was completely within the radiologically restricted area.

The following facilities and infrastructure will remain in place after decommissioning and license termination:

- the ISFSI,
- roadways and rail lines,
- the forebay,
- intake and discharge structures and piping,
- the electric switchyard (including the microwave tower),
- the sanitary sewage lift station,
- parking areas, and
- the spent fuel pool and other structures below 588 feet (ft) mean sea level (msl) (ZS 2017a).

All spent nuclear fuel from ZNPS is stored in an ISFSI, which will be maintained under amended 10 CFR Part 50 licenses and the associated 10 CFR Part 72 general license. The ZNPS

10 CFR Part 50 operating licenses will continue in effect for the ZNPS ISFSI only, the license will be considered terminated in all other aspects and will only apply to the site occupied by the ZNPS ISFSI. The generally-licensed ISFSI is a 2-ha (5-ac) concrete pad (see Figure 6), located to the south and west of the radiologically restricted area. There are 61 dry storage canisters containing 1,850 spent fuel assemblies at the ISFSI (ZS 2017a). In addition, the ISFSI holds four containers of GTCC waste. The ISFSI will remain in operation during and after decommissioning and until the fuel is removed to an off-site storage facility or a permanent geological repository. Utility services (e.g., water, sanitary, and electrical services) will remain in operation to support the ISFSI.



Figure 6. ZNPS ISFSI (Source: ANS 2015)

Soil, approximately 35,000 cubic yards (yd^3) (26,759 cubic meters (m^3)), is currently being stored onsite for use as backfill material. Up to an additional 99,000 yd^3 (75,690 m^3) will be brought onsite and stored for use as backfill. Stockpiled material is stored at the south end of the former parking lot, located within the radiologically restricted area. For site restoration, areas that require backfill will be contoured to blend in with adjoining property. Up to nine inches (0.22 meter (m)) of top soil will be placed in some areas that will be also be seeded to improve stabilization (ZS 2017a).

The rail line was built during the initial construction of ZNPS. The rail line was modified and refurbished to support decommissioning. Loading of containers will occur onsite. Vehicle parking, equipment laydown, and storage and staging will continue as during operations. Onsite

roads were refurbished and a heavy haul road was constructed to support the transfer of casks to the ISFSI (ZS 2017a).

The ZNPS site is bordered to the north by Hosah Park and the Illinois Beach State Park (State Park). The North Dunes Nature Preserve is located 1 mi (1.6 km) north of the ZNPS site. The State Park also borders the site to the south. On the western border of the ZNPS site, there is generally undeveloped land with a few industrial and commercial facilities along Deborah Avenue (ZS 2017a). Edina Park and Zion, Illinois sit due west of the ZNPS site, and Lake Michigan forms the site's eastern border. Lake Michigan is used by recreational boaters and for commercial barge and ship traffic.

The area around the ZNPS site has changed since the facility was constructed. During ZNPS construction, the State Park was located south of the site, along the lake shoreline. Today, the State Park includes the area directly north and south of the ZNPS site and is part of a State-owned coastal area managed by the Illinois Department of Natural Resources (IDNR). This coastal management area extends approximately 3 mi (4.8 km) north and south of ZNPS and has been incorporated into the Illinois Coastal Management Program. The coastal management area has been identified as a "unique public resource requiring special attention for preservation, protection and restoration of areas impacted by shoreline erosion, invasive species and damage caused by previous industrial activities." (ZS 2017a.) Further, the ZNPS site and the surrounding land on all sides have been identified as "environmentally sensitive" (ZS 2017a).

3.1.1 Existing Radiological Conditions

A preoperational radiological environmental monitoring program (REMP) was conducted at the ZNPS site to establish a baseline for monitoring the fluctuations of radioactivity in the environment before ZNPS began operating. The operational REMP measures radiation and radioactive materials released from ZNPS. During operation of ZNPS, the REMP monitored exposure pathways including the direct radiation pathway, airborne exposure pathway, water exposure pathway, aquatic exposure pathway, and the ingestion exposure pathway. The REMP has been modified as the offsite radiological impacts from ZNPS have been reduced. The modified REMP will continue until license termination. The results of the REMP are included in an annual *Radioactive Environmental Operating Report* (e.g., ZS 2018b). In addition, the *Annual Radiological Groundwater Protection Program Report* (ARGPPR) provides the annual results of ground water and surface water sampling (e.g., ZS 2018c).

Exelon, the then licensee, prepared a Historical Site Assessment in 2006, which provided information about the site related to contaminants that may require remediation. The Historical Site Assessment informed subsequent site characterization efforts (Exelon 2006). Monitoring results indicate that surface waters on or near the facility and groundwater beyond the site have not been affected by ZNPS operations (ZS 2017b). There is a radiological groundwater protection program that includes quarterly sampling and analysis of onsite groundwater monitoring wells and one lake sample for tritium. The results are reported annually to the NRC. The 2016 annual report stated that tritium was not detected in any of the samples analyzed (ZS 2017b).

ZS developed a sampling program to characterize non-radiological contamination. Surface and subsurface soil sampling and groundwater sampling were performed for volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, metals, and dioxins. Further, ZS has begun an asbestos abatement project and is conducting lead and polychlorinated biphenyls tests on structures scheduled to be demolished and performing remediation as needed (ZS 2017a).

3.2 Water Resources

3.2.1 Surface Water

ZNPS is located on the western shore of Lake Michigan. There are several small creeks within 3 mi (4.8 km) of the ZNPS site: Bull Creek and wetlands (1 mi (1.6 km) south); Dead River (3 mi south); and Kellogg Creek (~1 mi (1.6 km) north). There are mapped wetlands and a mapped 100-year regulatory floodplain located within the ZNPS site associated with Lake Michigan (ZS 2016c).

Municipal and domestic water supplies are obtained from Lake Michigan. The nearest potable water intake to ZNPS is 1 mi (1.6 km) north with the intake 3,000 ft (0.9 km) from the shoreline (ZS 2017a). Lake Michigan is also used for commercial fishing charters and recreational boating, with a boat launch on the shoreline 2.5 mi (4 km) north of ZNPS.

Lake Michigan was once used for secondary cooling during operation of ZNPS; however, following shutdown and fuel removal, that large volume of water is no longer being withdrawn from and discharged to the Lake. The cooling water system was used for spent fuel pool cooling, fire suppression, and heating and cooling of administrative buildings, with the volume of Lake Michigan water being significantly less than the amount used during operations (ZS 2017a). However, once the spent fuel was transferred to the ISFSI and the spent fuel pool was removed, the cooling water system was also removed (ZS 2018a).

A National Pollutant Discharge Elimination System (NPDES) permit is in place for nonradiological discharges from ZNPS to Lake Michigan, issued by the Illinois Environmental Protection Agency (IEPA), and expires in 2018 (IEPA 2013). ZS has implemented its Stormwater Pollution Prevention Plan for demolition activities. Further, ZS stated that it will implement best management practices to mitigate impacts to Lake Michigan and nearby creeks (ZS 2017a).

As part of its REMP, ZS collects samples from four water works facilities that get water from Lake Michigan. The 2017 results showed no tritium and analysis for specific radionuclides (e.g., Co-60) indicated concentrations are below EPA drinking water standards (ZS 2018b). The 2017 REMP results are consistent with REMP results through 2006.

3.2.2 Ground Water

The water table in the vicinity of ZNPS is less than 20 ft (6 m) from the surface with flows to the east and southeast towards Lake Michigan (ZS 2014). The groundwater and Lake Michigan are hydraulically connected due to high permeability in the upper sand unit, allowing for generally

unrestricted ground-water flow. ZNPS structures, foundations, and a retaining wall alter the natural flow of groundwater, causing a more complex localized flow, with ultimate discharge to Lake Michigan. The underlying regional bedrock aquifer is separated from the shallow groundwater zone by 30 to 50 ft (9 to 15 m) of glacial silt and clay, limiting vertical interaction (ZS 2017a).

Potable water was used during operation and withdrawn from an onsite well; potable water will continue to be used to support decommissioning but will be less than the volume used during operations (ZS 2017a).

As part of the terms and conditions of its operating licenses and in accordance with NRC regulations, ZS must meet its Offsite Dose Calculation Manual limits and report results of its REMP and ARGPPR to the NRC. Groundwater is sampled from 11 onsite wells as part of the groundwater protection program (ZS 2017a). In 2006, Exelon began an evaluation of ground water and surface water at ZNPS and vicinity. Once ZS became the licensee in 2010, it became responsible for the ARGPPR. After two phases of the groundwater protection program, ZS determined that there were no known active releases into the ground water at ZNPS. Results in the 2017 REMP and ARGPPR, consistent with results going back to 2006, indicate that tritium and other radionuclides are well below the EPA's drinking water standards (ZS 2018b, 2018c).

3.3 Meteorology and Air Quality

Lake County has been a nonattainment area, per 40 CFR Part 81, for 8-hour ozone since 2012 and a maintenance area for particulate matter (2.5 microns) (EPA 2017). A 1,000-gallon aboveground gasoline storage tank is registered as a minor emissions source under the IEPA Registration Of Smaller Sources Program. The diesel generators and auxiliary boiler are no longer present. ZS will operate machinery and equipment per manufacturer specifications, which will help prevent additional emissions. As needed, water will be sprayed to suppress dust to mitigate fugitive dust emissions.

Decommissioning activities include vehicle traffic, demolition of structures, and dismantlement and decontamination of systems, occurring over a period from 2010 until decommissioning is complete. Equipment, worker vehicles, and truck shipments emit criteria pollutants and greenhouse gases (GHGs). Structure demolition and dismantlement cause fugitive dust emissions. Emissions from decommissioning are localized and temporary.

Recent improvements regarding emissions and the science of climate change have enabled the U.S. Global Change Research Program (GCRP) to estimate regional climate change in the United States (GCRP 2014). The GCRP predicts increasing heat waves, heavy downpours, and flooding in the Midwest due to climate change (GCRP 2014). In the Midwestern United States, the projected change in temperature by mid-century—which encompasses the timeframe for decommissioning activities—is a regional annual average temperature increase of between 4° and 5°F. While the GCRP has not incrementally forecasted the change in precipitation by decade to align with the licensing action, rainfall in spring and winter is projected to increase by 10 to 20 percent during this century (GCRP 2014). Increases in both frequency

and intensity of extreme precipitation are projected across the Midwestern United States (GCRP 2014).

3.4 Ecological Resources

3.4.1 Terrestrial Resources

The ZNPS site provides a variety of terrestrial habitats, including sandy beaches, dunes, wetlands, prairies, and forests (WHC 2006). The Great Lakes dunes are a unique habitat that provide microhabitats within a small area. The varied physical and biological characteristics among the microhabitats make these dunes the most diverse ecosystem within the Great Lakes. On the ZNPS site, existing dunes have been degraded over time due to human activities and wind erosion. In addition, many areas on the ZNPS site that were previously wetland, grassland, and forests have been cleared or heavily modified for plant construction and remain as open areas or industrial facilities and roads. Birds and wildlife near ZNPS are likely tolerant of human activity given the decades of use as an industrial facility. Common species include eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*Sciurus niger*), eastern chipmunk (*Tamias striatus*), blue jay (*Cyanocitta cristata*), and wild turkey (*Meleagris gallopavo*). Two exotic/invasive species that occur on or near ZNPS include the common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) (WHC 2006).

The ZNPS site is located along the Mississippi Flyway, which is the migration corridor for 40 percent of North America's waterfowl and shorebirds (USGS 2015). The Mississippi Flyway is also an important migration corridor for raptors and neotropical songbirds. The Flyway provides high-quality habitats for breeding, nesting, foraging, and wintering. See Section 0 for a list of migratory birds likely to occur on or within the vicinity of the ZNPS site.

The State Park, adjacent to the ZNPS site, protects high-quality habitats (e.g., foredunes and sand dunes) that support diverse vegetation and wildlife communities, including potential habitats for rare and endangered species. The State Park is also an important area for migratory birds.

3.4.2 Aquatic Resources

The ZNPS site is located along the western shore of Lake Michigan, which is the third largest of the Great Lakes, with a surface area of 57,757 square kilometers (22,300 square miles). The two primary freshwater habitats on the ZNPS site include onsite streams and the adjacent Lake Michigan. Onsite streams provide an important refuge for many vertebrate and invertebrate species. The shallow water prevents larger predators from entering the streams while rocks, vegetation, and other structural complexities along the stream banks provide physical refuges from biological stressors.

Lake Michigan consists of a diverse freshwater lake ecosystem comprised of plankton, fish, and invertebrates. Plankton, a primary food source for many fish and other animals, consists of bacteria, protozoans, certain algae, tiny crustaceans (e.g., copepods), and many other

organisms. Ichthyoplankton (i.e., fish eggs and larvae) may be found in areas where fish spawn, such as shallow areas with sand-gravel bottoms.

The fish and macroinvertebrate community within Lake Michigan has undergone large-scale changes due to the presence of numerous invasive species. Two of the most common invasive species include the sea lamprey (*Petromyzon marinus*), which invaded Lake Michigan in 1936, and the zebra mussel (*Dreissena polymorpha*). The sea lamprey is an aggressive predator that had been attributed to the collapse of lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), and lake herring (*Coregonus artedii*) populations (GLFC 2000). Zebra mussels have outcompeted many native mussels by attaching to the native mussel, thus preventing the native mussel from moving, feeding, or surviving. In addition, zebra mussels have decreased the availability of food sources for native fish and shellfish by their prolific filter feeding that results in the removal of particulates and phytoplankton (State of Michigan 2017).

Given the large populations within the Lake Michigan watershed, the lake experiences the impacts from residential and industrial development, agricultural production, and other human-caused stressors. For example, runoff from residential and agricultural areas resulted in nutrient loading in the 1950s, which led to high levels of eutrophication and major algal blooms, oxygen depletion, and subsequent die-offs of fish and other biota. In the past few decades, the discharge of raw sewage and other pollutants, such as mercury polychlorinated biphenyls, into Lake Michigan has led to unsafe levels of bacteria and pollutants that resulted in several beach closings (IEMA 2018).

3.5 Protected Species and Habitats

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) jointly administer the Endangered Species Act of 1973 (ESA). The FWS manages the protection of, and recovery effort for, listed terrestrial and freshwater species, and NMFS manages the protection of and recovery effort for listed marine and anadromous species. The Illinois Endangered Species Protection Act of 1972 authorizes the Illinois Endangered Species Protection Board to designate endangered and threatened species. This section discusses these species and species protected under the Migratory Bird Treaty Act of 1918 (MBTA).

3.5.1 Federally Listed Species and Habitats

Action Area

The implementing regulations for section 7(a)(2) of the ESA define “action area” as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area effectively bounds the analysis of ESA-protected species and habitats because only species that occur within the action area may be affected by the Federal action.

For the purposes of the ESA analysis in this EA, the NRC staff considers the action area to include the 134-hectare (ha) (331-ac) ZNPS site, the surrounding area where runoff drains and activities would be audible to wildlife, and the portion of Lake Michigan that runs along the site

boundary. The NRC staff expects all direct and indirect effects of the proposed action to be contained within these areas.

The NRC staff recognizes that while the action area is stationary, Federally listed species can move in and out of the action area. For instance, a flowering plant known to occur near, but outside, of the action area could appear within the action area over time if its seeds are carried into the action area by wind, water, or animals. Thus, in its analysis, the NRC staff considers not only those species known to occur directly within the action area, but those species that may passively or actively move into the action area. The NRC staff then considers whether the life history of each species makes the species likely to move into the action area where it could be affected by the license termination activities.

Overview of Protected Species and Habitats

Figure 7 describes the Federally listed species and habitats that have the potential to exist within the action area. The NRC staff compiled this table from the FWS's online database (FWS 2016a), correspondence from FWS (2016b and 2018), and the ecological studies conducted on and near the ZNPS site (WHC 2006; AMEC 2013; ZS 2016d). The NRC staff did not identify any candidate species within the action area (FWS 2016a). As discussed in detail below, the action area provides potential habitats for seven Federally listed species and designated critical habitat for the piping plover, although no Federally listed species have been documented onsite (WHC 2006; AMEC 2013; ZS 2016c, 2014).

Lake Michigan does not contain marine or anadromous fish species. Therefore, no Federally listed species or habitats under NMFS's jurisdiction occur within the action area.

Federally Listed Species

Rufa Red Knot (Calidris canutus rufa)

The FWS published a final rule to list the rufa red knot (*Calidris canutus rufa*) as threatened throughout its range on December 11, 2014 (79 FR 73706). The rufa red knot is a migratory shorebird, 9 in. (0.2 m) in length with a 20-in. (0.5 m) wingspan. Some of these birds fly more than 9,000 mi (14,484 km) every spring from south to north and then repeat the trip in the fall (FWS 2013). Their habitat during the migratory window of May through September includes coastal shorelines and large wetland complexes (FWS 2016a). Rufa red knots may stopover along the coast of the Great Lakes during migrations and eat bivalves, gastropods, amphipods, and occasionally polychaetes (Niles et al. 2008). Rufa red knots have the potential to occur on the ZNPS site, such as along the Lake Michigan shoreline, for resting or foraging during migratory stops (WHC 2006). The occurrence of this species within the action area would be occasional or rare based on the lack of direct observations, the lack of preferred habitat (e.g., beaches with large concentrations of preferred prey), and the amount of ongoing human activity along or near the shoreline.

Figure 7. Federally and State-listed Threatened and Endangered Species and Habitat with the Potential to Occur at the ZNPS Site or within the Vicinity

| Common Name | Scientific Name | Federal Status | State Status | Habitat On Site Or Within Vicinity |
|------------------------------|---------------------------------|----------------|--------------|---|
| Redveined Prairie Leafhopper | <i>Aflexia rubranura</i> | | T | Potential habitat within vicinity (IDNR 2016b). |
| Pale False Foxglove | <i>Agalinis skinneriana</i> | | T | Potential habitat within vicinity (IDNR 2016b). |
| Marram grass | <i>Ammophila breviligulata</i> | | E | Suitable habitat on site (AMEC 2013). |
| Bearberry | <i>Arctostaphylos uva-ursi</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| American bittern | <i>Botaurus lentiginosus</i> | | E | Potential habitat on site (WHC 2006). |
| Rufa Red Knot | <i>Calidris canutus rufa</i> | T | | Potential habitat on site (WHC 2006). |
| Sea rocket | <i>Cakile edentula</i> | | E | Suitable habitat on site (AMEC 2013). |
| Little Green Sedge | <i>Carex viridula</i> | | T | Potential habitat within vicinity (IDNR 2016b). |
| Downy Yellow Painted Cup | <i>Castilleja sessiliflora</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Seaside Spurge | <i>Chamaesyce polygonifolia</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Piping plover | <i>Charadrius melodus</i> | E | E | Piping plover observed less than 6 miles south of ZNPS site. Suitable habitat on site (AMEC 2013). Designated critical habitat occurs along the Lake Michigan shoreline (FWS 2018). |
| Black tern | <i>Childonias niger</i> | | E | Potential habitat on site (AMEC 2013). |
| Dune (Pitcher's) thistle | <i>Cirsium pitcheri</i> | T | T | Potential habitat onsite (WHC 2006; AMEC 2013). |
| Few-flowered spikerush | <i>Eleocharis pauciflora</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Blanding's turtle | <i>Emydoidea blandingii</i> | | E | Suitable habitat on site; Three turtles observed from 2011-2012 (AMEC 2013). |
| Peregrine falcon | <i>Falco peregrinus</i> | | T | Observed onsite (WHC 2006; AMEC 2013). |
| Kalm's St. John's Wort | <i>Hypericum kalmianum</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Least bittern | <i>Ixobrychus exilis</i> | | T | Potential habitat on site (WHC 2006). |

| Common Name | Scientific Name | Federal Status | State Status | Habitat On Site Or Within Vicinity |
|--------------------------------|--|----------------|--------------|---|
| Richardson's Rush | <i>Juncus alpinoarticulatus</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Trailing juniper | <i>Juniperus horizontalis</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Karner blue butterfly | <i>Lycaeides melissa samuelis</i> | E | E | Potential habitat onsite (WHC 2006). |
| Northern long-eared bat | <i>Myotis septentrionalis</i> | T | | Potential habitat onsite (WHC 2006; FWS 2015b). |
| Black-crowned night heron | <i>Nycticorax</i> | | E | Potential habitat onsite (WHC 2006). |
| Osprey | <i>Pandion haliaetus</i> | | E | Potential habitat onsite (WHC 2006). |
| Tuberclad Orchid | <i>Platanthera flava var. herbiola</i> | | T | Potential habitat within vicinity (IDNR 2016b). |
| Eastern prairie fringed orchid | <i>Platanthera leucophaea</i> | T | E | Potential habitat onsite (WHC 2006). |
| Dune willow | <i>Salix syrticola</i> | | E | Potential habitat within vicinity (IDNR 2016b). |
| Eastern Massasauga rattlesnake | <i>Sistrurus catenatus</i> | P (T) | E | Potential habitat onsite (WHC 2006). |
| Forsters tern | <i>Sterna forsteri</i> | | E | Potential habitat onsite (WHC 2006). |
| Common tern | <i>Sterna hirundo</i> | | E | Potential habitat onsite (WHC 2006; IDNR 2015). |
| False Asphodel | <i>Tofieldia glutinosa</i> | | T | Potential habitat within vicinity (IDNR 2016b). |
| Common Bog Arrow Grass | <i>Triglochin maritima</i> | | T | Potential habitat within vicinity (IDNR 2016b). |

Sources: WHC 2006, AMEC 2013, FWS 2015b, FWS 2016a, IDNR 2016a and 2016b
E – Endangered, P– Proposed, T – Threatened

Piping Plover (*Charadrius melodus*)

The FWS listed the Great Lakes watershed population of piping plover (*Charadrius melodus*) as endangered in 1985 (50 FR 50726). The piping plover is a small and stocky migratory bird that lives along shores. Piping plover habitat includes wide, flat, open, sandy beaches with little vegetation. Piping plovers are endangered due to habitat loss and degradation and because they are sensitive to the presence of humans, and too much disturbance causes them to abandon their nests (FWS 2001). The FWS-designated critical habitat for the piping plover runs along approximately 6 mi of shoreline from Illinois Beach State Park to Waukegan Beach in Lake County, Illinois. This area is directly south of the ZNPS site. In 2009, a piping plover nest was found, for the first time in 30 years, south of the ZNPS site; however, no nests were found on the ZNPS site (AMEC 2013). While suitable shoreline habitat and dunes occur on the site,

the occurrence of this species within the action area would be occasional or rare based on the lack of direct observations and ongoing human activity along or near the shoreline.

Pitcher's Thistle (*Cirsium pitcheri*)

The FWS listed the Pitcher's thistle (*Cirsium pitcheri*) as threatened in July 18, 1988 (53 FR 27137). This native thistle grows on the shoreline and grassland dunes of Lake Michigan. Pitcher's thistle was previously extirpated from Illinois but has been reintroduced in Lake County, south of the ZNPS site (FWS 2015a). In 2011, Pitcher's thistle was reintroduced within the foredunes in the Illinois Beach State Park, which is located immediately to the south of ZNPS. Dunes, such as those located on the ZNPS site, historically supported populations of this species; however, the plant is not known to occur on the ZNPS site (AMEC 2013; ZS 2016c).



Photo credit: FWS, Phil Delphy

Figure 8. Karner Blue Butterfly

Karner Blue Butterfly (*Lycaeides Melissa samuelis*)

The FWS listed Karner blue butterfly (*Lycaeides Melissa samuelis*) as endangered in 1992 (57 FR 59236). Its preferred habitats include open barrens, oak savannas, and prairies that contain wild lupine (*Lupinus perennis*). The wild lupine provides food for the larvae of the Karner blue butterfly and is therefore essential for survival of the species. Perennial lupine may be present in an upland forested area onsite and could be elsewhere on the ZNPS site (WHC 2006). The butterfly can also be found in old fields, road margins, and frequently disturbed area (AMEC 2013).

Northern Long-Eared Bat (*Myotis septentrionalis*)

The FWS published a final rule to list the Northern long-eared bat (*Myotis septentrionalis*) as threatened throughout its range on April 2, 2015 (80 FR 17973). The medium-sized bat roosts and forages in upland forests in the cavities and crevices of trees during the summer months. During the winter, the bats hibernate in caves and mines. The biggest threat to this species is a disease, white-nose syndrome. Potential habitat could occur on the ZNPS site given the availability of older trees that may have peeling bark (WHC 2006); however, no surveys for potential habitats or mist net surveys have occurred onsite. No Northern long-eared bats have been identified on site (AMEC 2013; WHC 2006).

Eastern Prairie Fringed Orchid (*Plantanthera leucophaea*)

The FWS listed the Eastern prairie fringed orchid (*Plantanthera leucophaea*) as threatened in 1989 (54 FR 39857). It can be found in a variety of habitats from mesic prairies to wetlands. It requires full sun for growth and flowering in a grassy habitat with little or no woody encroachment (FWS 2005). Although no Eastern prairie fringed orchids were observed on the ZNPS site during onsite surveys, suitable habitat—wet prairies and sedge meadows—occurs at ZNPS (WHC 2006).

Eastern Massasauga Snake (*Sistrurus catenatus*)

In September 2015, FWS (80 FR 58688) proposed to list the Eastern massasauga snake (*Sistrurus catenatus*) as a threatened species. Eastern massasauga snakes hibernate in the winter and are active in spring, summer, and fall. During the active period, this species generally occupies higher, drier habitats, open canopy wetlands, and adjacent upland area. The FWS lists the main threats to this species as habitat loss and fragmentation. The Eastern massasauga snake has not been observed onsite (AMEC 2013).

3.5.2 State-listed Species

State-listed species that have the potential to exist on or within the vicinity of the ZNPS site are listed in Figure 7. The NRC staff compiled this table from IDNR's description of Illinois Threatened and Endangered Species (IDNR 2016a), correspondence from IDNR (IDNR 2016b), and the ecological studies conducted on and near the ZNPS site (WHC 2006; AMEC 2013; ZS 2016c). State-listed species have been observed onsite or within the immediate vicinity of the site and are described in additional detail below.

*Blanding's Turtle (*Emydoidea blandingii*)*

Since decommissioning started in 2010, three Blanding's turtles (*Emydoidea blandingii*) have been observed in the northern portion of the site, in the wetland area near the rail spur, north of Shiloh Boulevard. One turtle was taken to the Wildlife Discovery Center. The female turtle was released to the Illinois Beach State Park, north of the site, after laying her eggs. After being nursed, the hatchlings were released by the IDNR in the northern portion of the Illinois Beach State Park (ZS 2015b).

*Peregrine Falcon (*Falco peregrinus*)*

The peregrine falcon (*Falco peregrinus*) is a State-listed threatened species of raptor. There have been observations of the peregrine falcon within the close vicinity of the site. Peregrine nesting habitat does not occur on the ZNPS site, although this species may use onsite marshlands for hunting prey (WHC 2006; AMEC 2013).

*Common Tern (*Sterna hirundo*)*

ZS has worked with the IDNR to establish an experimental nesting area on the shoreline for the Common tern (*Sterna hirundo*). No terns successfully nested in the area provided, as the nests were destroyed by predators. IDNR hopes to continue working with ZS on this program (IDNR 2015).

3.5.3 Migratory Birds

The FWS administers the MBTA, which prohibits anyone from taking native migratory birds or their eggs, feathers, or nests. Regulations under the MBTA define "take" as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to" carry out these activities (50 CFR 10.12). The MBTA definition for "take" is different than the definition in the ESA

(16 U.S.C. 1532(19)), which defines “take” as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” Unlike a “take” under the ESA regulations (50 CFR 17.3), a “take” under the MBTA does not include significant habitat alteration or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns (e.g., breeding, feeding, or sheltering).

The MBTA protects a total of 1,007 migratory bird species (75 FR 9281). FWS (2016a) indicated that 21 migratory birds of concern may occur on or near the action area (Figure 9).

Figure 9. Migratory Birds of Concern that May Occur Near ZNPS

| Scientific Name | Common Name | Occurrence in Project Area |
|-----------------------------------|-----------------------|----------------------------|
| <i>Empidonax vireescens</i> | Acadian flycatcher | Breeding |
| <i>Botaurus lentiginosus</i> | American bittern | Breeding |
| <i>Haliaeetus leucocephalus</i> | bald eagle | Year-round |
| <i>Coccyzus erythrophthalmus</i> | black-billed cuckoo | Breeding |
| <i>Vermivora pinus</i> | blue-winged warbler | Breeding |
| <i>Dendroica cerulea</i> | cerulean warbler | Breeding |
| <i>Sterna hirundo</i> | common tern | Breeding |
| <i>Spiza americana</i> | dickcissel | Breeding |
| <i>Vermivora chrysoptera</i> | golden-winged warbler | Breeding |
| <i>Ammodramus henslowii</i> | Henslow's sparrow | Breeding |
| <i>Ixobrychus exilis</i> | least bittern | Breeding |
| <i>Lanius ludovicianus</i> | loggerhead shrike | Breeding |
| <i>Colaptes auratus</i> | northern flicker | Breeding |
| <i>Falco peregrinus</i> | peregrine falcon | Breeding |
| <i>Podilymbus podiceps</i> | pied-billed grebe | Breeding |
| <i>Protonotaria citrea</i> | prothonotary warbler | Breeding |
| <i>Melanerpes erythrocephalus</i> | red-headed woodpecker | Year-round |
| <i>Euphagus carolinus</i> | rusty blackbird | Wintering |
| <i>Bartramia longicauda</i> | upland sandpiper | Breeding |
| <i>Hylocichla mustelina</i> | wood thrush | Breeding |

Source: FWS 2016a

Near the proposed site, migratory birds rely on riparian, forested, grassland, wetland, and sandy-beach habitats as important areas for foraging, resting, and avoiding predators and for breeding for some species. Based on the limited amount of continuous habitat and the amount of ongoing human activity that occurs onsite, the proposed site likely provides low-quality habitat for migratory birds.

3.5.4 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle (*Haliaeetus leucocephalus*) is protected under the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668). This Federal act prohibits anyone from taking or disturbing bald eagles or golden eagles (*Aquila chrysaetos*), including their nests or eggs, without an FWS-issued permit. Suitable habitat for the bald eagle occurs within the ZNPS site; however, no observations of this species have been documented (WHC 2006; AMEC 2013).

3.5.5 Essential Fish Habitat

Magnuson-Stevens Fishery Conservation and Management Act of 2006 (MSA) requires Federal agencies to consult with NMFS on actions that may adversely affect essential fish habitat (EFH). The NMFS has not designated any EFH under the MSA within affected waterbodies in the vicinity of the ZNPS site (NMFS 2016). Because no habitats are designated, no EFH would be affected by the proposed action.

3.6 Public and Occupational Health

The intent of decommissioning is to reduce radiological contamination at the site to meet the NRC requirements for unrestricted use. Potential human health hazards associated with ZNPS range from potential exposure to very low levels of radioactivity in soils to elevated levels of radioactivity within the remaining facility and support structures and systems (e.g., remaining lines and sumps). All facilities that the NRC licenses must adhere to its radiation protection standards (10 CFR Part 20) to protect workers and the public against potential health risks from exposure to radioactive material used, generated, and released from the licensed facility. In the GEIS, the NRC determined that the radiological impacts to public and occupational health would remain within regulatory limits.

ZS will conduct decommissioning activities under the provisions of its Radiation Protection Program, which is protective of onsite workers and visitors, and Radioactive Waste Management Program. In addition to those programs, ZS will use the Radiological Effluent Monitoring Program and Offsite Dose Calculation Manual to protect workers and the public, both of which are inspected by the NRC. In accordance with 10 CFR Part 20, ZS submits annual reports to the NRC on results of environmental sampling and monitoring activities (ZS 2017a). The REMP will continue throughout the course of decommissioning and will continue, in a modified form, while the ISFSI remains in operation. In addition, ZS has been monitoring and providing reports to the NRC on the ISFSI as required in 10 CFR 72.44(d). In accordance with 10 CFR 72.104, exposure to the nearest resident from the ISFSI shall not exceed 25 mrem/year (0.25 mSv).

ZS is proposing DCGLs as acceptable levels of residual radioactivity that can be left at ZNPS to comply with the unrestricted use criteria specified in 10 CFR 20.1402. As part of the NRC decision on whether to approve the LTP, the NRC will evaluate the adequacy of the DCGLs to provide protection for members of the public after termination of the operating licenses. In addition, the NRC is consulting with the U.S. Environmental Protection Agency (EPA) because the proposed DCGLs exceed soil concentration values established in a memorandum of understanding (MOU) between the NRC and EPA (NRC 2016c), which is separate from the unrestricted use criteria specified in 10 CFR 20.1402. In December 2016, EPA responded that in its view if ZS was unable to meet the Table 1, “Consultation Triggers for Residential and Commercial/Industrial Soil Contamination” soil values for residential use, then the NRC should consider a more restricted land use—such as industrial—along with appropriate institutional controls (EPA 2016). Once ZS completes decommissioning, if the residual activity is greater than the EPA’s standards, then the EPA can decide if it will require further action by the licensee. However, the NRC can still terminate the license if the NRC’s release criteria is met.

3.6.1 Occupational Dose

When ZNPS permanently shut down in 1998, the plant went into SAFSTOR. Active decontamination and dismantlement activities began in 2011. From 1998 through 2014, there was a collective dose of 249 rem at ZNPS with the highest year 78.7 rem in 2014 (NRC 2016d). The GEIS estimated cumulative doses for PWRs using the SAFSTOR option of 4.8 to 11 person-Sv (480 to 1,100 person-rem). The GEIS made the generic determination that the radiological impacts of decommissioning, including license termination activities, are SMALL because the expected doses will remain within regulatory limits (NRC 2002). ZS estimates that the cumulative site dose is approximately 8.41 person-Sv (841 person-rem) for dismantling activities and 9.4 person-Sv (94 person-rem) for spent fuel management activities (ZS 2017a); therefore, the GEIS’s impact determination is bounding. During the remainder of the decommissioning process, ZS will continue to use the various protection programs and ALARA goals to ensure worker protection in accordance with 10 CFR Part 20 (ZS 2017a).

3.6.2 Public Dose

ZS continues to monitor and estimate doses to the public as discussed above. Until the termination of the operating licenses, the licensee must meet the requirements of 10 CFR 50.36(a) for effluent releases after permanent cessation of operation. Licensees are also required to keep releases of radioactive materials to unrestricted areas at ALARA levels. Licensees must also comply with the EPA’s standards in 40 CFR Part 190, “Environmental radiation protection standards for nuclear power operations” (NRC 2002). During the remainder of the decommissioning process, ZS will continue to use the various protection programs and ALARA goals to ensure public protection in accordance with 10 CFR 50, Appendix I (ZS 2017a).

In the GEIS, the NRC determined that the levels of radionuclide emissions were lower for facilities undergoing decommissioning compared to operating facilities. Collective doses to public members were lower than 0.01 person-Sv (1 person-rem) per year within 80 km (50 mi)

of the facilities. The maximally exposed individual was estimated to receive a dose of less than 0.01 mSv/yr (1 mrem/yr) which is well within the regulatory limit of 10 CFR Part 20 (NRC 2002).

3.7 Socioeconomics

This section describes current socioeconomic factors that have the potential to be directly or indirectly affected by the proposed LTP at ZNPS. ZNPS and the communities that support it can be described as a dynamic socioeconomic system. The communities supply the people, goods, and services required to conduct decommissioning activities. Decommissioning activities, in turn, supply wages and benefits for people and dollar expenditures for goods and services. The measure of a community's ability to support the proposed LTP depends on its ability to respond to changing environmental, social, economic, and demographic conditions.

The peak ZNPS workforce during decommissioning was 370 workers in 2016. ZS estimates, as decommissioning progresses and the number of structures and facilities are reduced, that the workforce will be reduced to less than 50 workers by 2018 (ZS 2017a).

According to Appendix J of the GEIS, which included information on ZNPS decommissioning, changes in local population greater than 3 percent have detectable effects on communities. At the termination of the ZNPS license, the workforce would have been reduced from a peak of 370 to 40. This represents a change of less than 2 percent, when only considering the Zion, Illinois population of 24,508 (2010 U.S. Census).

Potential socioeconomic impacts during decommissioning include increased demand for short-term housing, public services, and increased traffic due to temporary fluctuations in the size of the workforce required to implement the LTP at ZNPS. Any changes in employment and tax payments caused by the proposed LTP could have a direct and indirect impact on community services and housing demand, as well as traffic volumes in the communities around the ZNPS site.

In general, there are two ways that decommissioning activities may have a social and economic impact on a community and its surrounding area: 1) through expenditures in the community by the facility workforce and direct purchases of goods and services necessary for facility operation; and 2) the effects on local government tax revenues and services (NRC 2002).

The greatest impact has already occurred to the cities and towns surrounding the ZNPS site when ZNPS shut down permanently in 1998. The ZNPS workforce diminished, along with that workforce's expenditures in the community. Similarly, tax revenues used to fund community infrastructure, services, and education were greatly reduced. Table J-4 of the GEIS noted that the impact on local public services for ZNPS was SMALL (i.e., for housing, public utilities, tourism, and recreation), MODERATE (i.e., for education, transportation, and public safety), or MODERATE to LARGE (i.e., for social services) based on inquiries to local governments (NRC 2002).

3.8 Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from activities associated with the proposed LTP at ZNPS. Such effects may include human health, biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing in the vicinity of ZNPS, and all are exposed to the same health and environmental effects generated from activities at ZNPS.

3.8.1 Minority Populations in the Vicinity of the ZNPS

According to the 2010 Census, approximately 51 percent of the total population (approximately 45,500 individuals) residing within a 4-mi radius of ZNPS identified themselves as minority (MCDC 2016). The largest minority populations were Hispanic, Latino, or Spanish origin of any race (approximately 12,000 persons or 26 percent) and Black or African-American (approximately 9,000 persons or 19.5 percent). According to the U.S. Census Bureau's 2010 Census, about 35 percent of the Lake County population identified themselves as minorities, with persons of Hispanic, Latino, or Spanish origin of any race comprising the largest minority population (approximately 20 percent) (USCB 2016). According to the U.S. Census Bureau's 2015 American Community Survey 1-Year Estimates, the minority population of Lake County, as a percentage of the total population, had increased to about 37 percent, with persons of Hispanic, Latino, or Spanish origin of any race increasing to 21 percent (USCB 2016).

3.8.2 Low-income Populations in the Vicinity of the ZNPS

According to the U.S. Census Bureau's 2010–2014 American Community Survey 5-Year Estimates, approximately 960 families and 5,500 individuals (8.7 and 12.2 percent, respectively) residing within a 4-mi (6 km) radius of the ZNPS were identified as living below the Federal poverty threshold (MCDC 2016). The 2014 Federal poverty threshold was \$24,230 for a family of four (USCB 2016).

According to the U.S. Census Bureau's 2015 American Community Survey 1-Year Estimates, the median household income for Illinois was \$59,588, while 9.8 percent of families and 13.6 percent of the state population were found to be living below the Federal poverty threshold. Lake County had a higher median household income average (\$82,113) and a lower percentage of families (7.0 percent) and persons (8.9 percent) living below the poverty level, respectively (USCB 2016).

3.9 Historic and Cultural Resources

The National Historic Preservation Act of 1966, as amended (NHPA), requires Federal agencies to consider the effects of their undertakings on historic properties, and a proposed LTP is an undertaking that could potentially affect historic properties. As stated in the NHPA, historic properties are any prehistoric or historic district, site, building, structure, or object included in, or eligible for, inclusion in the National Register of Historic Places (NRHP).

Databases that the National Park Service (NPS) maintains show 93 historic properties listed in the NRHP in Lake County, Illinois, with two historic properties and one historic district located in the City of Zion. There are no historic properties located at ZNPS. The nearest historic properties are the Shiloh House, Zion Chapter House, and the Camp Logan National Guard Rifle Range Historic District, all of which are located less than 1.5 mi (2.4 km) west and north of ZNPS.

In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties included in, or eligible for, inclusion in the NRHP in the area of potential effect. The direct area of potential effect (APE) for this proposed action is the approximate 87-ac (35-ha) radiologically restricted area and does not include the 5-ac (2-ha) ISFSI. The indirect APE is the remaining 244 ac (99 ha). The APE may extend beyond the radiologically restricted area in those instances where decommissioning activities may affect a historic property. This determination is made irrespective of land ownership or control.

Because no historic properties would be affected and no archaeological sites or evidence of cultural resources have been found on the ZNPS site, historic and cultural resources are not likely to be impacted by the proposed LTP (36 CFR 800.4(d)(1)). Approving the LTP would also have little or no visual impact. The views from the nearest NRHP sites—the Shiloh House, Zion Chapter House, and the Camp Logan National Guard Rifle Range Historic District—are obstructed by trees and residential and commercial properties. Based on these factors, as well as the consultation with the Illinois State Historic Preservation Agency (IHPA), the NRC concludes that the proposed LTP would not impact any known historic and cultural resources near ZNPS. More information on the NRC's NHPA Section 106 consultation efforts can be found in Section 6.1 of this EA.

3.10 Aesthetics

There are temporary (e.g., noise and dust) and permanent (viewsheds) aesthetic impacts as a result of decommissioning. Licensees are expected to use best management practices to control dust and noise. The removal of structures is generally considered beneficial to aesthetics (NRC 2002).

The ZNPS site is located on the western shore of Lake Michigan. After decommissioning is complete, only a few structures will remain (e.g., the ISFSI). In addition, ZS plans to restore the site to its natural grade (ZS 2017a). Removal of most structures and restoration of the natural ground would be expected to create a less obstructed view of Lake Michigan and the Illinois Beach State Park. At this time, Exelon, whom the property will revert back to once decommissioning is complete, has not made a decision on the use of the lakefront site. The Lake County Comprehensive Plan (Teska 2015) recommends the use of extensive screening or vegetation to reduce the visual impact of the ISFSI.

3.11 Noise

In the GEIS, the NRC staff made the generic conclusion that for all facilities, the potential noise impacts from decommissioning including license termination activities are SMALL. Noise will be generated primarily from demolition activities and heavy equipment. ZS uses stackers, lifts, and cranes as well as other smaller machinery (e.g., forklifts and jackhammers). Rail and truck shipments would also generate noise. The ISFSI is a passive facility and, therefore, would not generate any noise nor would most license termination activities (e.g., site radiological surveys and scans). Most work is completed during daylight hours; and ZS complies with City of Zion noise ordinances, which limit evening noise. The rail cars are moved at night when commuter trains are not running. The closest residence to ZNPS is approximately 2,000 ft (610 m) away (ZS 2017a). Based on the predicted noise levels from dismantling activities and trains, noted in the GEIS (Section 4.3.16.2), the nearest residence could potentially hear equipment and machinery at ZNPS, as well as rail traffic. However, those activities are intermittent and temporary, and residents would be accustomed already to noise from passing trains.

3.12 Transportation and Traffic

The GEIS addressed impacts to transporting equipment and materials offsite. Materials discussed in the GEIS include LLW, hazardous and nonhazardous wastes, and mixed waste. Radiological impacts include exposures to the public and workers along the transportation route. Nonradiological impacts include increased traffic, wear and tear on the roadways, and traffic accidents.

The primary route to the ZNPS site is via Interstate 94 (I-94), which runs north-south through northern Illinois and southern Wisconsin. Several state routes connect I-94 to Illinois State road (IL) 137, which passes through the City of Zion. From IL 137, the site is accessed directly via Shiloh Boulevard, a Lake County-maintained road.

The average annual daily traffic in two directions on IL 137 in the City of Zion is about 17,000 vehicles (ILDOT 2015). The majority of the transportation activity would involve hauling nonradiological wastes offsite to local or regional landfills. Trucks accessing the ZNPS site would utilize Shiloh Boulevard, which has access to I-94 via IL 137 and IL 173.

3.12.1 Radiological Impacts

The GEIS assumed most decommissioning waste would be transported by truck. However, at ZNPS, most waste is transported offsite via railroad. Class A radiological wastes have been and will be hauled via rail, utilizing the spur to Union Pacific's line running through the City of Zion. From the end of 2015 until the end of decommissioning, ZS estimates 1,059 railcars will be shipped to EnergySolutions in Clive, Utah (ZS 2017a).

The GEIS states that experience has been that the frequency of LLW shipments is less than one per day, and that this is not large enough to have a noticeable effect on traffic flow or road wear (NRC 2002). Wear and tear on roadways and increased road traffic for waste disposal should not be significant because most waste will be shipped by rail.

The GEIS concluded that the radiological impacts from transportation, based on compliance with applicable regulations, would not be detectable or destabilizing. It is expected that ZS would comply with all regulations and requirements for transport of waste and materials.

3.12.2 Nonradiological Impacts

ZS estimated that 99,000 cubic yards (75,690 m³) of soil would need to be brought onsite for backfill, which could require as many as 7,600 trucks. This would be noticeable volume of truck traffic, in addition to workers and shipments offsite of waste and other materials. The GEIS states that transportation impacts include increases in traffic density, wear and tear on roadways and railways, and transportation accidents. While this analysis was primarily based on material leaving the site, those impacts would also apply to truck traffic bringing material to the site (NRC 2002). The number of workers for decommissioning range from 370 workers in June 2016 at the peak of decommissioning to less than 50 by June 2019 (ZS 2017a). The GEIS states that, historically, the accident rate for activities at nuclear facilities has been lower than the national average for similar activities. This is attributed to the nuclear industry emphasis on training and procedures (NRC 2002).

3.13 Waste Management

Decommissioning generates large volumes of waste, both radioactive and nonradioactive (e.g., hazardous, municipal, and demolition), primarily from the dismantling of buildings and equipment. Decommissioning activities at the ZNPS site are subject to non-NRC Federal and State of Illinois regulations, permits, licenses, notifications, and approvals, including those for hazardous waste generation and disposition, handling and removal of asbestos, handling and removal of lead paint, and removal of underground storage tanks. Chapter 2 (Site Characterization) of the LTP provides a description of historical spills and other events at the ZNPS site that may have contaminated site structures or soils with radiological or chemical constituents. Chapter 2 of the LTP also describes numerous studies, analyses, and other efforts to characterize the site in detail to determine the extent of radiological and nonradiological contamination and estimate the quantities of wastes for disposal onsite (e.g., clean concrete) or offsite (e.g., municipal waste or LLW).

In total, ZS projects approximately 332,000 m³ (11.5 million ft³) of radioactive and nonradioactive wastes to be generated as a result of past and ongoing decommissioning activities (ZS 2018a). Radioactive and nonradioactive wastes are discussed in separate sections below.

3.13.1 Radioactive Waste

The types of LLW generated from ZNPS decommissioning include activated and contaminated structures and components (i.e., primarily concrete, metal, and asphalt), contaminated water, contaminated soils, expended resins, filters, absorbent materials, used protective clothing, and contamination control material (ZS 2017a). The disposition of spent nuclear fuel and GTCC waste is discussed in the latter portion of this section.

The GEIS estimated the volume of land required for radioactive waste disposal as an irretrievable and irreversible impact. In the GEIS (Table 4-7), it was estimated that for SAFSTOR (see footnote 3 of Section 1.1), 600 to 45,000 m³ (or 21,000 to 1.5 million ft³) of land would be needed for disposal of LLW based on previously decommissioned facilities. The initial PSDAR included an estimated LLW volume of 9,646 m³ (340,645 ft³) (ComEd 2000). However, in the last PSDAR update, ZS (2008) estimated 172,800 m³ (6.1 million ft³) of waste. In the 2018 update to the LTP, the projected LLW volume was lowered to 166,339 m³ (5.8 million ft³). This LLW volume is much more than the GEIS considered (i.e., 45,000 m³ or 1.5 million ft³).

ZS is shipping Class A LLW waste via railcar to the EnergySolutions site in Clive, Utah. In addition, ZS plans to ship soils contaminated with hazardous constituents to the Clive site. ZS does not expect these soils to be radiologically contaminated; however, the soils originate in areas impacted by decommissioning activities. ZS estimates that a total of 29 m³ (1,030 ft³) of soils contaminated with polychlorinated biphenyls and other organic compounds, mercury, and cyanide would be shipped to the Clive site. ZS estimates that another 255 m³ (9,000 ft³) of potentially contaminated soil will also be disposed of at the Clive site (ZS 2017a).

Class B and C LLW is being shipped to Andrews, Texas to the Waste Control Specialists site (ZS 2017a). Figure 10 summarizes the number and volume of radioactive solid waste shipments made since decommissioning began in 2010. Through 2016, ZS had shipped approximately 117,470 m³ (4,148,413 ft³) of LLW. Based on estimates in the LTP, ZS will ship approximately 55,000 m³ (1,942,306 ft³) of LLW to offsite disposal sites between the time it submitted its LTP and license termination.

Figure 10. Number and Volume of LLW Shipments from ZNPS between 2011 and 2016

| Mode of Transport | Year of Disposal | | | | | | TOTALS |
|-----------------------------|------------------|--------|-----------|--------|---------|---------|-----------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | |
| No. of Rail ^(a) | 0 | 33 | 22 | 19 | 32 | 183 | 289 |
| No. of Truck ^(b) | 23 | 46 | 11 | 44 | 58 | 8 | 190 |
| Volume (m ³) | 870 | 2,200 | 94,000 | 2,800 | 3,700 | 13,900 | 117,470 |
| Volume (ft ³) | 30,700 | 78,000 | 3,300,000 | 99,000 | 131,000 | 491,000 | 4,148,000 |

Sources: Radioactive Effluent Reports (ZS 2012, 2013, 2015c, 2016d, 2017b)

Volumes have been rounded.

(a) Rail shipments are sent to Clive, Utah.

(b) Truck shipments are sent to Clive, Utah or Andrews, Texas.

In January 2015, ZS completed the transfer of spent fuel from the spent fuel pool to its onsite ISFSI (NRC 2015b). In addition, GTCC waste will also be stored at the ISFSI. ZS estimates that decommissioning will generate approximately 18.1 m³ (640 ft³) of GTCC waste (ZS 2017a). The ISFSI, constructed in 2013, is a 2-ha (5-ac) concrete pad with dry casks containing spent nuclear fuel. The ISFSI is not included within the scope of the LTP, and under the LTP, the 10 CFR Part 50 operating licenses will be reduced to the ISFSI. The ZNPS ISFSI is operating and will continue to operate under the NRC's general license regulations for ISFSIs at Subpart K of 10 CFR Part 72 (10 CFR 72.212 sets forth the conditions of the general ISFSI license). The

ISFSI will remain in operation until such time as a deep geologic repository becomes available to accept spent fuel or until other spent fuel disposal arrangements become available.

3.13.2 Nonradioactive Waste

The nonradioactive waste generated primarily consists of clean concrete, asbestos-containing materials, construction debris, contaminated soils (soils contaminated with fuel oil or other petroleum products), and scrap metal. The GEIS did not address nonradioactive waste management. Figure 11 provides the projections of nonradioactive waste generated from ZNPS decommissioning. The largest contributor of nonradioactive waste is clean concrete, approximately 138,000 m³ (4,873,424 ft³). ZS intends to crush and use the bulk of the clean concrete for onsite fill (also known as rubblization). ZS received approval from the IEPA for the use of clean concrete from building demolition as backfill in the building basements (ZS 2017a). Other uncontaminated construction debris and municipal waste is being sent to a local landfill, and the uncontaminated scrap metal is being recycled.

Figure 11. Projected Nonradioactive, Nonhazardous Waste Volumes

| Waste Type | Disposal | Waste Volume (m ³) | Waste Volume (ft ³) |
|-------------------|-------------|--------------------------------|---------------------------------|
| Clean Concrete | Onsite Fill | 138,000 | 4,870,000 |
| Clean Asbestos | Landfill | 3,400 | 121,400 |
| Clean Debris | Landfill | 7,900 | 280,000 |
| Clean Scrap Metal | Recycled | 9,800 | 346,000 |
| Total | | 159,100 | 5,617,400 |

Source: ZS 2017a

While the plant was operating, ZNPS generated small quantities of hazardous waste, which was stored onsite in designated container storage areas. During operations and as needed during decommissioning, ZNPS has shipped hazardous wastes to one or more licensed facilities in Chicago and elsewhere, and the site is currently classified as a Small Quantity Generator of hazardous wastes. Since decommissioning activities began, ZNPS has removed and shipped its polychlorinated biphenyl (PCB) transformers and fluids to a PCB management facility in Alabama. The approximate total quantity of hazardous material and waste shipped since 2010, including the transformers, is 320,975 pounds (145,592 kilograms). If ZNPS identifies any hazardous waste confirmed to be radioactively contaminated, the materials would be shipped to an EnergySolutions facility licensed to handle that specific waste stream (Bruni 2016; ZS 2017a).

4.0 ENVIRONMENTAL IMPACTS

As explained in Section 0, the analysis in this EA focuses on the following resource areas: climate change, protected species and habitats, public and occupational health, environmental justice, and waste management. In addition to the potential impacts of the proposed action, cumulative impacts and mitigation and monitoring are also addressed.

The GEIS addresses decommissioning of nuclear power reactors licensed by the NRC, including ZNPS, and evaluates environmental impacts from decommissioning activities common to a number of nuclear power facilities. In the GEIS, the NRC staff concludes that the environmental impacts of decommissioning, including license termination activities, can be determined generically for all nuclear power plants and will have SMALL impacts for most resource areas. The GEIS included information gained from the ZNPS decommissioning experience up to 2002. Figure 12 summarizes the impact considerations for those resource areas at ZNPS that are generically resolved and bounded by the GEIS analysis.

Figure 12. Environmental Resource Areas Bounded by the Decommissioning GEIS

| Environmental Resource | Impact Consideration |
|--------------------------------|--|
| Land Use | The NRC staff expects no impacts associated with these issues beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. There are no activities occurring offsite. |
| Water Resources | There is a NPDES permit for discharges to Lake Michigan. Monitoring and sampling of groundwater is ongoing as part of the RGPP. The NRC staff expects no impacts associated with these resources beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. |
| Air Quality | The NRC staff expects no impacts associated with air quality beyond those discussed in the GEIS, which concluded that the impact level for this issue is SMALL. |
| Ecological Resources | The NRC staff expects no impacts associated with these resources beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. |
| Public and Occupational Health | In the GEIS, the NRC addressed the nonradiological impacts of rubbleization (i.e., onsite disposal of slightly contaminated material) but determined that the long-term radiological aspects of rubbleization would require a site-specific analysis and would need to be addressed at the time the LTP is submitted (NRC 2002). Because ZS intends to use crushed concrete as onsite backfill, the long-term radiological aspects of rubbleization are addressed in Section 4.3.1 of this EA. |
| Socioeconomics | The NRC staff expects no impacts associated with these resources beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. Many of the impacts from the facility ceasing operation and entering decommissioning have already occurred. |

| Environmental Resource | Impact Consideration |
|---------------------------------|---|
| Historic and Cultural Resources | The NRC staff expects no impacts beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL (onsite). No decommissioning activities will be occurring offsite. |
| Aesthetics | The NRC staff expects no impacts associated with visual resources beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. |
| Noise | The NRC staff expects no impacts associated with visual resources beyond those discussed in the GEIS, which concluded that the impact level for these issues is SMALL. |
| Transportation | The GEIS assumed most waste would be transported by truck; however, at ZNPS, most waste has been or will be removed by railcar, and thus transportation impacts would be less than those estimated in the GEIS. Therefore, the NRC staff expects no impacts associated with transportation beyond those discussed in the GEIS, which concluded that the impact level for this issue is SMALL. |

4.1 Greenhouse Gases and Climate Change

In CLI-09-21 (NRC 2009), the Commission provided guidance to the NRC staff on addressing GHG issues in environmental reviews. That guidance directed the NRC staff to “include consideration of carbon dioxide and other greenhouse gas emissions in its environmental reviews for major licensing actions under the National Environmental Policy Act.” This Commission decision was issued after the GEIS was finalized in 2002, and as such, these topics were not addressed in the GEIS.

As discussed in Section 0 of this EA, equipment, worker vehicles, and truck shipments associated with decommissioning activities will emit GHGs. The NRC developed a generic GHG footprint for the lifecycle of a reference 1,000-MWe light-water reactor with an 80 percent capacity factor, including decommissioning (NRC 2014). The generic GHG footprint can be scaled for the number of units and electrical capacity. The ZNPS is a two-unit site with electrical capacity of 1,100 MWe per unit. Assuming an 80 percent capacity factor, two units at 1100 MWe would produce 1,760 MWe. This is two times larger than the generic GHG footprint. For decommissioning over a 10-year period, using a scaling factor of 2.2, 41,800 MT carbon dioxide equivalents (CO₂e) are expected from decommissioning equipment, and another 17,600 MT CO₂e are expected from the decommissioning workforce (NRC 2014). This amounts to approximately 7,500 MT CO₂e annually (from 2010 through 2018), an amount that is far below the EPA’s threshold of 25,000 MT per year of CO₂e, which requires facilities to report GHG emissions to EPA annually in accordance with 40 CFR Part 98. Given that GHG emissions during decommissioning would be localized and temporary and well below the GHG reporting threshold, the NRC staff concludes that GHG impacts associated with decommissioning would not be significant.

Even though GHG emission estimates from decommissioning are far below the GHG reporting threshold, the licensee could consider measures that would reduce GHG emissions. These could include use of low-GHG-emitting vehicles and other policies to reduce GHG emissions

from vehicle use (e.g., anti-idling policies, vanpooling, or carpooling). Maintenance of on-road construction vehicles and off-road construction equipment would also minimize daily GHG emissions.

As discussed in Section 0 of this EA, climate-change impacts for the Midwest include increasing temperatures and increases in the frequency and intensity of extreme precipitation. Increases of 4 to 5°F in the annual average temperature are projected for the Midwest (GCRP 2014). In a higher temperature environment, the formation of ozone due to emissions of nitrogen oxides (NO_x) from onsite equipment may increase. However, air emissions due to decommissioning activities are localized and temporary and unlikely to contribute measurably to ozone formation. The thermal impact to Lake Michigan from ZNPS is no longer present given that operations have ceased; therefore any increase in Lake Michigan water temperatures resulting from increasing air temperatures would not be exacerbated by decommissioning activities. Increased precipitation intensity can result in increased surface runoff and reduced water quality (GCRP 2014). Surface water is impacted from stormwater runoff at the ZNPS site; however, ZS has implemented a Storm Water Pollution Prevention Plan and obtained a Watershed Development Ordinance Permit from Lake County. These permits are protective of the surface-water resource. ZS states it will implement best management practices (BMPs) to minimize impacts from soil erosion and sedimentation to the lake and nearby creeks during decommissioning activities (ZS 2017a). Examples of BMPs that ZS might use are silt fencing, filter bags within catch basins, and routine management observations (ZS 2017a). Because discharges to Lake Michigan would still be subject to applicable Federal, State, and local requirements, climatological changes are unlikely to influence the SMALL impact determination for surface water in the GEIS.

4.2 Protected Species and Habitat Impacts

Section 0 considers whether the seven Federally listed species and designated critical habitat identified in Figure 7 occur in the action area based on each species's habitat requirements, life history, and other available information. In that section, the NRC staff concludes that suitable habitat for all seven species occurs within the action area; however, no Federally listed species have been observed within the action area. The NRC staff notes that limited ecological studies for Federally listed species have occurred because existing studies (e.g., WHC 2006; AMEC 2013; ZS 2016c) were general ecological studies and did not include species-specific surveys to target Federally listed species (e.g., spring or summer mist-nesting surveys for bats and birds). Therefore, the lack of observed Federally listed species does not provide conclusive evidence that such species do not occur on the ZNPS site. For the purpose of this EA, the NRC staff assumed all seven species have the potential to occur within the action area, and designated critical habitat for the piping plover occurs within the action area. The NRC staff also concludes that no candidate species occurs in the action area.

Figure 13 describes the general impacts to all Federally listed species, followed by a discussion of impact determinations for each species.

Figure 13. Effect Determinations for Federally Listed Species and Habitat

| Species | Common Name | Federal Status | Effect Determination |
|--|--------------------------------|----------------|---|
| Designated Critical Habitat | | | |
| <i>Charadrius melodus</i> | piping plover | | no adverse modification |
| Birds | | | |
| <i>Calidris canutus rufa</i> | rufa red knot | T | may affect, but is not likely to adversely affect |
| <i>Charadrius melodus</i> | piping plover | E | may affect, but is not likely to adversely affect |
| Mammals | | | |
| <i>Myotis septentrionalis</i> | northern long-eared bat | T | may affect, but is not likely to adversely affect |
| Reptile | | | |
| <i>Sistrurus catenatus</i> | eastern massasauga snake | PT | no effect |
| Insects | | | |
| <i>Lycaeides melissa samuelis</i> | Karner blue butterfly | E | no effect |
| Plants | | | |
| <i>Platanthera leucophaea</i> | Eastern prairie fringed orchid | T | no effect |
| <i>Cirsium pitcher</i> | Pitcher's thistle | T | no effect |
| Sources: FWS 2016a | | | |
| Key: E = endangered, P = proposed, and T = threatened. | | | |

4.2.1 General Impacts

Ongoing decommissioning activities include the demolition or dismantlement of buildings and other structures. License termination activities include radiological surveys, soil sampling, and soil removal. The majority of these activities would occur within previously disturbed areas that have been used for industrial purposes for the past several decades. Based on this history, it would be unlikely that any Federally listed species occur within these areas. Radiological surveys, soil sampling, and soil removal could occur within a small tract of wetlands and a small tract of forest that could provide habitat for some Federally listed species. Given the small size of these patches of habitat and because they are adjacent to industrial facilities, these areas provide low-quality habitat for plants, birds, and wildlife. In addition, any effects from radiological surveys, soil sampling, and soil removal would be discountable because the activities would be limited to a few times per year and ground disturbance would be limited to small, discrete areas.

Noise from demolition or other decommissioning activities could disturb and temporarily displace birds and wildlife. In response to such disturbances, birds and wildlife could move out of the immediate area and find adequate, similar habitat within the vicinity. Once decommissioning activities are complete, birds and wildlife could return to the area. Some of the disturbed areas could eventually be re-seeded and re-contoured, which may provide higher

quality habitat than the currently existing industrial buildings. These activities would be a beneficial effect.

Bird and bat collisions with demolition equipment and the existing facilities could result in increased mortality caused by the presence of tall structures and artificial night lighting. Migratory songbirds would be most likely to collide with artificially lighted structures or cranes because of their propensity to migrate at night, their low flight altitudes, and their tendency to be trapped and disoriented by artificial light (Ogden 1996; NRC 2013). ZS has not conducted any bird or bat collision surveys; however it is not aware of any bird or bat collisions (ZS 2017a). The NRC reviewed bird collisions with plant structures at nuclear power plants and determined that collision rates were negligible sources of bird mortality with plants that have cooling towers 100 ft (30 m) in height (NRC 2013). Given that the existing buildings at the ZNPS site are lower than 100 ft (30 m), bird and bat collisions would likely be discountable. Additional details regarding the Federally listed birds and bats within the action area are provided in the next section.

4.2.2 Birds and Bats

The rufa red knot, piping plover, and northern long-eared bat could experience injury or direct mortality from collisions within facility structures or decommissioning equipment. Based on the available information on bird mortality, the NRC staff finds that it is possible, although unlikely, that the rufa red knot, piping plover, or northern long-eared bat individuals could experience injury or mortality resulting from collisions.⁶ The NRC staff believes that the likelihood of a collision is extremely unlikely because the red knot, piping plover, and northern long-eared bat are relatively rare within the action area, would only occur in the action area for a short period of time each year, and are not likely to inhabit the inland, non-forested developed portions of the site that contain collision hazards.

Other decommissioning activities that ZS might undertake (e.g., radiological surveys or demolition activities) would be confined to previously disturbed areas of the ZNPS site. Noise levels and human activity may cause some temporary disturbances to these species. However, most of the activities remain similar to the current ongoing decommissioning activities and would not cause any additional disturbances that would cause these species to avoid or abandon shoreline habitat within the action area. If individuals did avoid these areas, they could return once the decommissioning activities are completed. Therefore, the NRC staff determined that decommissioning activities would result in insignificant or discountable effects to the rufa red knot, piping plover, and northern long-eared bat.

Given that the rufa red knot, piping plover, and northern long-eared bat are rare within the action area, collisions with facilities or decommissioning equipment would be unlikely, and any impacts from other decommissioning activities would result in insignificant or discountable effects, the NRC staff concludes that the proposed action may affect, but is not likely to adversely affect, the rufa red knot, piping plover, and northern long-eared bat. Based on the above information, the

(7) If a Federally listed species were to collide with the facility or decommissioning equipment, such a collision could result in a “take,” as defined by the ESA, and ESA consultation would occur.

NRC staff concludes that the proposed action would not adversely modify designated critical habitat for the piping plover.

4.2.3 Other Fauna

The eastern massasauga snake and Karner blue butterfly are not likely to experience direct impacts from human activity associated with decommissioning activities because these species are not likely to occur along the shoreline, developed areas, or small low-land tracts of forest and wetlands, where such activities would occur. Given the distance between the proposed activities and suitable upland habitat, the NRC staff does not expect indirect impacts to these species (57 FR 59236; 80 FR 58688).

Given that the eastern massasauga snake and Karner blue butterfly are rare within the action area and these species would not experience direct or indirect effects, the NRC staff concludes that the proposed action would have no effect on the eastern massasauga snake and Karner blue butterfly.

4.2.4 Plants

The eastern prairie fringed orchid and the Pitcher's thistle could experience direct impacts from ground-disturbing activities. However, ground-disturbing activities would be largely limited to previously disturbed areas, which do not provide suitable habitat for these two species. Radiological surveys, soil surveys, and soil removal could occur within a small tract of wetlands and a small tract of forest, but these areas are not suitable habitats for these two species.

Given that no ground-disturbing activities would occur within suitable habitat for the eastern prairie fringed orchid or the Pitcher's thistle, the NRC staff determined that the proposed action would have no effect on the eastern prairie fringed orchid or the Pitcher's thistle.

4.2.5 Species and Habitats under the National Marine Fisheries Service's Jurisdiction

As discussed in Section 0, no species or habitats under the NMFS's jurisdiction occur within the action area. Thus, the NRC staff concludes that the proposed action would have no effect on Federally listed species or habitats under the NMFS's jurisdiction.

In addition, the NMFS has not designated EFH pursuant to the MSA in Lake Michigan. Thus, the NRC staff concludes that the proposed action would have no effect on EFH.

4.2.6 Cumulative Effects

The ESA regulations at 50 CFR 402.12(f)(4) direct Federal agencies to consider cumulative effects as part of the proposed action effects analysis. Under the ESA, cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR 402.02). Unlike the definition of cumulative impacts under the National Environmental Policy Act of 1969 (NEPA), cumulative effects under the ESA do not include past actions or other Federal actions requiring separate ESA section 7 consultation. When

formulating biological opinions under formal ESA section 7 consultation, the FWS and the NMFS consider cumulative effects when determining the likelihood of jeopardy or adverse modification (FWS and NMFS 1998). Therefore, consideration of cumulative effects under the ESA is necessary only if listed species will be adversely affected by the proposed action (FWS 2014).

Given that the NRC staff concluded earlier in this section that the proposed action would not adversely modify designated or proposed critical habitat and some species and that it may affect but is not likely to adversely affect other species, consideration of cumulative effects is not necessary.

4.2.7 State-listed Species and Migratory Birds

Section 3.2 describes the State-listed species and migratory birds that have the potential to occur on or near the ZNPS site. In that section, the NRC staff concludes that suitable habitat occurs for some of these species within the action area; however, only one State-listed species (i.e., the Blanding's turtle) has been observed within the action area. The NRC staff notes that limited ecological studies for State-listed species or migratory birds have occurred because existing studies (e.g., by WHC 2006; AMEC 2013; and ZS 2016c) were general ecological studies and did not include species-specific surveys to target such species (e.g., spring or summer mist-nesting surveys for birds). Therefore, some species may occur onsite even if they have not been observed.

Impacts during decommissioning activities would be similar to that described above for Federally listed species. In addition, during the decommissioning process, ZS would continue to protect Blanding's turtles by posting Blanding's turtle awareness signs and conducting inspections to ensure that Blanding's turtles are protected in accordance with the IDNR recommendations and the NPDES and the stormwater pollution prevention plan (ZS 2017a).

Given that decommissioning activities would largely be limited to previously disturbed areas, fauna within the area are likely tolerant of human activity given the decades of industrial activity that has occurred on the site, any noise disturbances would be temporary, bird and bat collisions would likely be negligible, and disturbed areas would eventually be re-seeded and re-contoured as necessary, the NRC staff concludes that the impacts to State-listed species and migratory birds would not be significant.

4.3 Public and Occupational Health Impacts

As discussed in Section 0, licensees requesting unrestricted release must comply with the performance based requirements of 10 CFR 20.1402 to ensure that the residual radioactivity left at the site once the license is terminated (and the ISFSI has been removed), would not cause the dose to an average member of the critical group to exceed 0.25 mSv/yr (25 mrem/yr). The licensee must also reduce residual radioactivity to ALARA levels (defined in 10 CFR Part 20). ZS is proposing to use DCGLs, as described in the LTP, to establish cleanup levels that meet the Subpart E criteria and demonstrate compliance with the DCGLs using a Final Site Survey. As part of its safety review, the NRC staff will evaluate the appropriateness of the postulated

exposure scenarios and the methodology used for deriving the DCGLs. The NRC staff expects that any potential radiation exposures from residual radioactivity that would be present after license termination has not been underestimated by ZS and that such exposure levels are protective of the general public.

4.3.1. Rubblization

In the GEIS, the NRC staff determined that the long-term radiological aspects of rubblization would require a site-specific analysis and would need to be addressed at the time the LTP is submitted (NRC 2002). ZS intends to rubblize or crush “clean” concrete, approximately 138,000 m³ (4,870,000 ft³), and use it as backfill for building basements. After demolition, ZS will remove above-grade buildings and structures to a minimum of 1 m (3 ft) below grade, to 179 m (588 ft) above msl, and basement areas will be backfilled with the rubblized concrete and clean fill. Clean fill will be brought on to the site to supplement the crushed clean concrete from onsite demolition (ZS 2017a).

ZS asserted that the concrete was indistinguishable from background, and a zero dose value was assessed. However, the NRC issued requests for additional information regarding ZS’s justification for its determination that the concrete was indistinguishable from background (NRC 2016e). As a result, ZS re-evaluated the concrete and determined that it would contribute some dose towards the 25 mrem (0.25 mSv) limit for unrestricted release. Because the dose from the rubblization of concrete would be below the 25 mrem (0.25 mSv) limit, even when added to dose received from other onsite sources such as residual contamination on basement surfaces, soil, and groundwater, the NRC does not expect any long-term radiological effects of using concrete as onsite backfill.

4.4 Environmental Justice

Potential impacts to minority and low-income populations would consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts) and radiological effects. Radiation doses during decommissioning are expected to remain well below regulatory limits.

Noise and dust impacts would be limited to onsite activities. Minority and low-income populations residing along site access roads could experience increased commuter vehicle traffic during shift changes. Increased demand for inexpensive rental housing during major decommissioning activities could disproportionately affect low-income populations. According to 2015 American Community Survey 1-Year Estimates, there were approximately 20,174 vacant housing units in Lake County (USCB 2016).

Based on this information and the analysis of human health and environmental impacts presented in this EA, the proposed LTP would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of ZNPS.

4.5 Waste-Management Impacts

The GEIS did not consider the impacts of nonradioactive waste generation, handling, and disposal. Disposal of radioactive waste is outside the scope of the GEIS (NRC 2002). Based on the information provided in the LTP and responses to request for additional information, the NRC has evaluated the impacts of the generation, handling, and disposal of nonradioactive waste for ZNPS. Regarding LLW, the GEIS (Section 4.3.18) did consider the volume of land required for LLW disposal (NRC 2002). As described in Section 0 of this EA, the volume of LLW being generated at ZNPS is much greater than the volume of land assumed in the GEIS. Therefore, in this section, the NRC will describe the impacts from waste generation, handling, and disposal.

4.5.1 Radioactive Waste

ZS has an agreement with EnergySolutions in Clive, Utah, to take its Class A LLW, which is the majority of the waste. Class B and C LLW is shipped to Waste Control Specialists (WCS) in Andrews, Texas (ZS 2017a).

Figure 14 summarizes the estimated volumes of LLW waste going to each site, as well as each site's capacity. The ZNPS Class A waste is estimated at 172,700 m³ (6.1 million ft³), which represents approximately 4.5 percent of EnergySolutions's capacity for LLW (3.8 million m³ [135 million ft³]) (EnergySolutions 2008).

The WCS facility has a licensed disposal capacity of 65,000 m³ (2,310,000 ft³) (WCS 2016). ZS estimates generating 108 m³ (3,800 ft³) of Class B or C waste, which is less than 0.2 percent of WCS's capacity; therefore, disposal of waste from ZNPS would not create a noticeable impact on WCS's capacity.

Figure 14. Summary of Disposal Facilities and Capacities

| Disposal Facility | Capacity | ZNPS LLW to be Disposed at Facility | Percent of Capacity Needed for ZNPS Wastes |
|---------------------------|---|---|--|
| EnergySolutions | 3.8 million m ³ 135 million ft ³ | 172,700 m ³ 6.1 million ft ³ | 4.5 |
| Waste Control Specialists | 65,000 m ³ 2.3 million ft ³ | 108 m ³ 3,800 ft ³ | <0.2 |

Sources: EnergySolutions 2008; ZS 2017a; WCS 2016; ZS 2015c
Volumes have been rounded.

The NRC staff concludes that although remaining decommissioning activities, site remediation, and final site radiological surveys are or will be generating a significant amount of LLW waste, this amount would not have a noticeable effect on the remaining disposal capacity at either facility. As more nuclear reactors reach the end of their operating life, more LLW will be generated and will have a cumulative effect on disposal capacity.

4.5.2 Nonradioactive Waste

As described in Section 3.3.2, the management and disposal of hazardous materials and wastes at ZNPS is ongoing as a result of decommissioning and is described in Chapter 2 of the ZS LTP. Any hazardous materials remaining at ZNPS or generated after the site is released from operating reactor licensing would continue to be subject to the same regulatory requirements for hazardous waste generation, handling, and disposal while the ISFSI continues to operate.

As shown in Figure 11, ZS estimated that 159,100 m³ (5,617,400 ft³) of nonradioactive waste would be generated from decommissioning, of which approximately 11,300 m³ (401,400 ft³) has been or will be disposed of in the landfill. Based on Illinois landfill projections as of January 2016, the local landfill in Zion, Illinois, has a capacity of approximately 18,286,028 m³ (645,764,994 ft³) and an estimated 10.7 years remaining until capacity is reached (IEPA 2016). The amount of ZNPS nonradioactive waste projected to be sent to the landfill by Zion represents less than 0.1 percent of the local landfill's remaining capacity. Therefore, the NRC does not expect a noticeable impact on local landfill capacity from the decommissioning of ZNPS. The NRC expects that ZS will continue to adhere to applicable local, State, and Federal requirements regarding nonradioactive waste generation, handling, and disposal.

5.0 CUMULATIVE IMPACTS ANALYSIS

The NRC staff evaluated whether cumulative environmental impacts could result from the incremental impact of the proposed action when added to past, present, or reasonably foreseeable future actions in the area. Decommissioning and demolition activities have been ongoing since 2007 and have included the dismantling and demolition of buildings, refurbishment of rail lines onsite and offsite, reinforcement of heavy haul roads, and transportation of waste offsite. In 2016, the NRC approved a partial site release, reducing the footprint of the ZNPS licensed area and of the NRC's purview (NRC 2016a). Current and reasonably foreseeable future actions in the area include: 1) continued operation of the ZNPS ISFSI, 2) implementation of the City of Zion Comprehensive Plan, 3) vessel traffic on Lake Michigan, and 4) barge transfers and construction of an access road.

The ISFSI will continue to operate after decommissioning of ZNPS is complete. However, management of the ISFSI is passive and does not have any moving parts, so there is no waste generated during normal storage operations. ISFSI operation includes minimal security and basic utility services, which are already present.

The City of Zion Comprehensive Plan (Teska 2015) provides a development concept plan for the lakefront area, which includes the ZNPS site. The plan involves enhancing the unique natural resources of the City of Zion's lakefront. The ZNPS site sits between the north and south segments of the State Park, and reconnecting those two segments is a recommendation of the City's Plan. Other recommendations include utilizing the existing switchyard for sustainable energy and using extensive screening or vegetation to minimize the visual impact of the ISFSI (Teska 2015).

Lake Michigan is an important waterbody for recreational use, commercial fishing, and the transportation of a variety of goods via barges and ships. Recreational and commercial fishing can result in direct and indirect impacts on aquatic biota by removing fish, altering food web dynamics, and disturbing benthic habitats from some fishing equipment. Boat traffic can also have a negative impact through the introduction of invasive species and by degrading water quality from boat emissions, exhaust, and accidental fuel spillages. Dredging and the use of levees to enhance navigation can also cause direct habitat loss as well as habitat degradation from increased turbidity and changes in flow conditions. Lastly, aquatic and terrestrial biota may be disturbed by noises and human activity and, therefore, avoid the area (Edsall and Charlton 1997).

ZS transferred via barge two large components (stator and rotor) for re-use in December 2016 (ZSIEMA 2018). During this transfer, ZS beached a barge along its Lake Michigan shoreline (within the area of SU10222, see Figure 7 for location of barge project). In addition, an access roadway was constructed on timber mats to the beach area. The U.S. Army Corps of Engineers (ACOE) issued ZS a Regional Permit 11 for this activity (ACOE 2016). As part of that authorization request, ZS evaluated the impacts to water resources, terrestrial resources, and aquatic resources. As part of this request, ZS determined that the impact is temporary, limited in area, and located in an area significantly disturbed by human activity (ZS 2016c). In addition,

ZS will implement and maintain the ACOE-approved soil erosion and sediment control measures to minimize impacts to water resources and aquatic habitats (ACOE 2016). Similarly, IDNR issued ZS a permit related to this activity (IDNR 2016c). IDNR's permit also requires that ZS implement best management practices to prevent water pollution and control erosion.

The NRC staff has assessed the potential incremental impacts of the proposed action to the current and reasonably foreseeable activities discussed above and has determined that there would be no significant cumulative impacts based on the minimal incremental impacts from the proposed action and minor overlapping impacts with other projects.

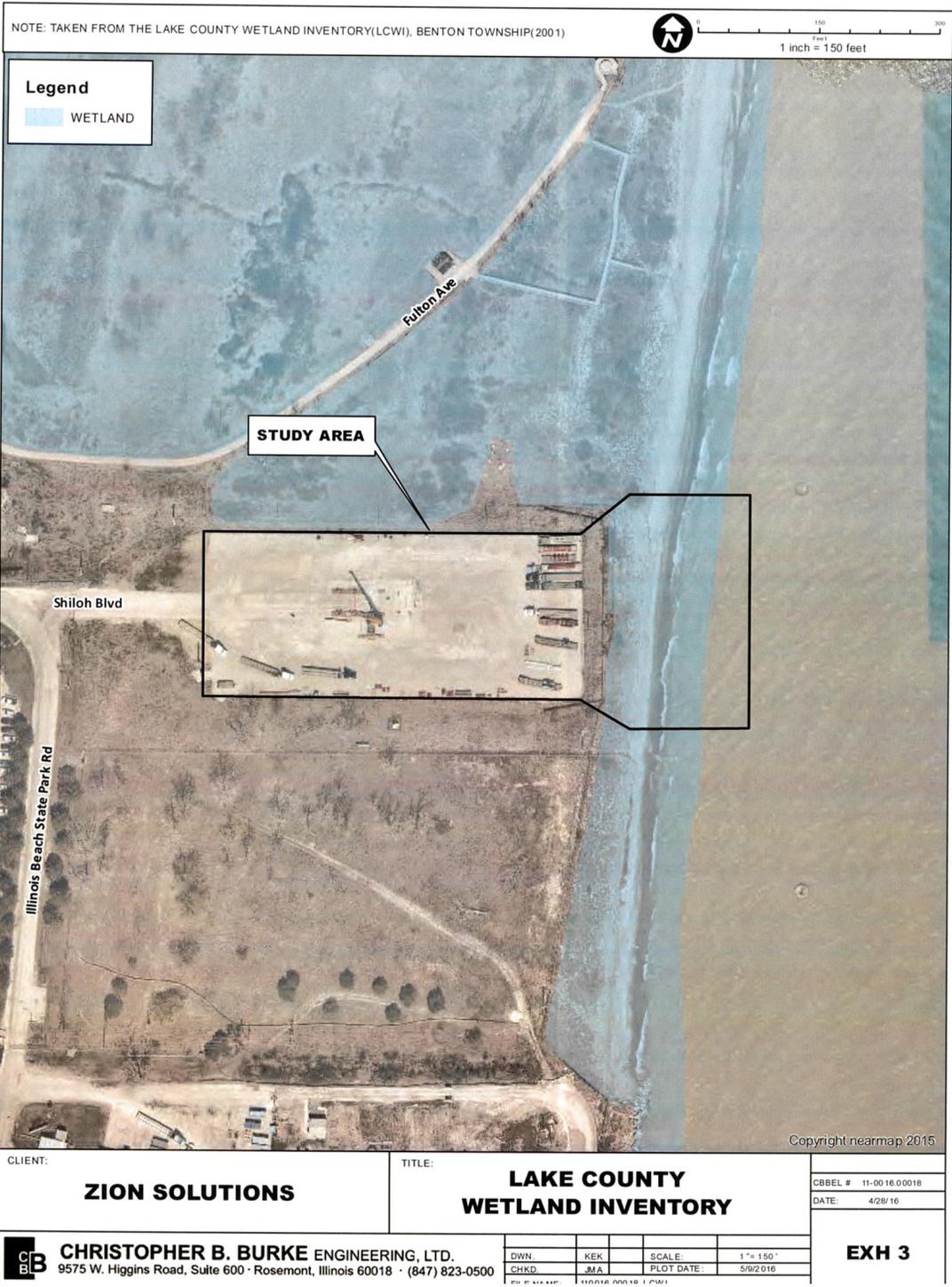


Figure 7. Barge Project Study Area (ZS 2016c)

6.0 AGENCIES CONSULTED AND COMMENTS RECEIVED

6.1 Illinois State Review

The NRC submitted the draft EA to the State Liaison Officer at the Illinois Emergency Management Agency for their 30-day review and comment on April 5, 2018 (NRC 2018a). Appendix A provides IEMA's comments (IEMA 2018) and the NRC's responses to those comments.

6.2 National Historic Preservation Act Section 106 Consultation

As previously discussed in Section 3.9 of this EA, the NRC consulted in August 2015 with the IHPA to fulfill its NHPA obligations (NRC 2015c). In its letter, the NRC provided information about the proposed action and defined both the direct APE (87 ac enclosed site) and indirect APE (area outside the enclosed site). In response, the IHPA stated that based on its review of the information the NRC provided, "no historic properties are affected," and that it had no objection to the undertaking proceeding as planned (IHPA 2015). The IHPA's response is consistent with previous IHPA responses to ZS regarding decommissioning activities and ISFSI construction at the ZNPS site (IHPA 2011, 2014).

As part of the NRC Section 106 consultation process, NRC staff also contacted Native American Tribes with ancestral ties to the project area. The NRC provided the Tribes with information about the NRC's environmental review and the IHPA's response, and requested that the Tribes provide the NRC with any information about historic and traditional cultural properties (NRC 2016b). To date, the NRC has not received any response from the Tribes contacted, which included the following:

- Ho-Chunk Nation
- Miami Tribe of Oklahoma
- Peoria Tribe of Indians of Oklahoma
- Citizen Potawatomi Nation
- Potawatomi Nation-Hannahville Indian Community
- Pokagon Band of Potawatomi Indians
- Prairie Band Potawatomi Nation
- Sac and Fox Nation of Missouri
- Sac and Fox Nation of Oklahoma

6.3 Endangered Species Act Section 7 Consultation

The NRC may fulfill its obligations to consult with the FWS under ESA section 7 in conjunction with the interagency cooperation procedures required by other statutes, including NEPA (50 CFR 402.06(a)). In such cases, the Federal agency should include the results of the ESA section 7 consultation in the NEPA document (50 CFR 402.06(b)). Accordingly, the NRC staff included the results of its biological assessment in this EA.

Upon receipt of ZS's application, the NRC staff considered whether any Federally listed or proposed species or designated or proposed critical habitats may be present in the action area (as defined at 50 CFR 402.02) for the remaining dismantlement, demolition, and site remediation activities identified and described in the LTP. The NRC staff requested a list of ESA-protected species and critical habitats within the vicinity of the facility from the FWS in accordance with the ESA section 7 regulations at 50 CFR 402.12(c). The FWS provided the list of Federally listed species in its letter dated October 11, 2016 (FWS 2016b). The NRC staff used this list as a starting point for its analysis of effects to Federally listed species and critical habitat, which appears in Sections 3.5 and 4.2 of this EA. Based on this analysis, the NRC staff concludes that the remaining dismantlement, demolition, and site remediation activities identified and described in the LTP would have no effect on critical habitat or on Pitcher's thistle (*Cirsium pitcheri*), eastern prairie fringed orchid (*Plantanthera leucophaea*), Karner blue butterfly (*Lycaeides Melissa samuelis*), and eastern massasauga snake (*Sistrurus catenatus*). In addition, the NRC staff determined that the remaining dismantlement, demolition, and site remediation activities identified and described in the LTP could have insignificant or discountable effects on rufa red knots (*Calidris canutus rufa*), piping plovers (*Charadrius melodus*), and northern long-eared bats (*Myotis septentrionalis*) and, therefore, may affect but are not likely to adversely affect these species. Because this EA constitutes the NRC staff's biological assessment, the NRC staff submitted a copy of the draft EA to the FWS for review in accordance with 50 CFR 402.12(j) (NRC 2018b). By letter dated May 31, 2018, FWS stated that it agreed with NRC's ESA determinations for the seven species listed above and that the proposed action would not adversely modify designated critical habitat for the piping plover (FWS 2018). FWS (2018) also indicated that its concurrence letter concluded section 7 ESA consultation with the NRC for this action.

7.0 CONCLUSION

The NRC has prepared this EA as part of the NRC's review of ZS's license amendment request to approve and incorporate the LTP into the operating licenses for ZNPS and to allow the licensee to make certain changes in the future to the LTP without prior NRC approval.

The Decommissioning GEIS generically addressed many of the potential environmental impacts of decommissioning. During its review of the ZNPS LTP, the NRC concluded the impacts for most resource areas—land use, water resources, air quality, ecology, socioeconomics, historic and cultural resources, aesthetics, noise, and transportation—were still bounded by the GEIS. Therefore, the NRC does not expect impacts associated with these issues beyond those discussed in the GEIS, which concluded that the impact level for these issues was SMALL.

The NRC evaluated the potential environmental impacts of the remaining decommissioning and license termination activities on climate change, public and occupational health, environmental justice, and waste management and did not identify any significant impacts. For protected species, the NRC determined that there may be the potential to affect but not likely to adversely affect some of the threatened and endangered species.

On the basis of this EA, the NRC has concluded that there are no significant environmental impacts and a Finding of No Significant Impact (FONSI) is appropriate. The FONSI will be published in the *Federal Register* after the EA is finalized.

8.0 LIST OF PREPARERS

This EA was prepared by the Environmental Review Branch in the Division of Fuel Cycle Safety, Safeguards, and Environmental Reviews in the Office of Nuclear Material Safety and Safeguards with support from the staff of the Office of Nuclear Reactor Regulation.

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9.0 REFERENCES

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[10 CFR Part 50](#). *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.”

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[36 CFR Part 800](#). *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.”

[40 CFR Part 81](#). *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.”

[40 CFR Part 98](#). *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 98, “Mandatory Greenhouse Gas Reporting.”

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APPENDIX A: DRAFT EA COMMENT RESOLUTION

The NRC submitted the draft EA to the State Liaison Officer at the Illinois Emergency Management Agency (IEMA) for their 30-day review and comment on April 5, 2018 (NRC 2018a). On May 3, 2018, IEMA submitted their comments to the NRC. IEMA's comments and the NRC's response are provided below.

COMMENT IEMA-1:

On Page 2, the footnote specifies that the ZNPS 10 CFR Part 50 operating licenses will continue in effect for the ZNPS Independent Spent Fuel Storage Installation. IEMA recommends that this fact should be highlighted in the introduction and within the EA, since only a portion of the site will actually be released for unrestricted use. The license will not be terminated until the spent fuel is removed from the site at a date that has not been determined due to federal restrictions for the disposal of spent nuclear fuel. This could be clarified within the report.

RESPONSE:

The NRC moved the discussion of the Part 50 licenses remaining in effect for the Independent Spent Fuel Storage Installation (ISFSI) from the footnote into the discussion within Sections 1.0 and 3.1.

COMMENT IEMA-2:

In Section 3.12.2, Nonradiological Impacts, IEMA recommends that the discussion should consider the infrastructure impacts of nonradiological waste being transported to landfills and scrap recyclers by truck. IEMA assumes all scrap metal and replacement fill will be transported by truck.

RESPONSE:

The impacts of transportation, including to infrastructure such as roads from the shipment of material offsite, was generically addressed in the Decommissioning Generic Environmental Impact Statement (GEIS). Reference to the analysis of impacts from the shipment of waste by truck in the Decommissioning GEIS was added to Section 3.12.2.

COMMENT IEMA-3:

In Section 5.0, Cumulative Impacts Analysis, there is a discussion of the impacts of beaching a barge on the Lake Michigan shoreline to transfer two large components for reuse. Since this action was completed in December 2016, IEMA recommends the EA be reworded to account for it.

RESPONSE:

The NRC updated Section 5.0 to reflect that the barge beaching activity was completed in December 2016.

COMMENT IEMA-4:

On Pages 8, 13, and 19, IEMA notes that the conversion from acres to hectares is incorrect in several instances. This is most likely a rounding issue.

RESPONSE:

The conversions from acre to hectare were rounded. No change was made as a result of the comment.

COMMENT IEMA-5:

In Section 3.1.1, Existing Radiological Conditions, the EA states, "The results of the REMP are included in an annual report titled Zion Nuclear Power Station Units 1 and 2 Annual Radiological Environmental Operating Report Radioactive Effluent Report and Radioactive Effluent Release Report." The Agency believes the sentence references duplicate effluent reports and should be reworded as the Annual Radioactive Effluent Release Report. IEMA recommends that the Annual Radiological Groundwater Protection Program Report (ARGPPR) should also be referenced in the EA.

RESPONSE:

The NRC updated Section 3.1.1 to clarify that the report title is "Radioactive Environmental Operating Report." A reference to the Annual Radiological Groundwater Protection Program Report (ARGPPR) was also included in the section.

COMMENT IEMA-6:

In Section 3.2.1, Surface Water, the EA states, "Lake Michigan was once used for secondary cooling during operation of ZNPS; however, following shutdown and fuel removal, that large volume of water is no longer being withdrawn from and discharged to the Lake. Currently, the cooling water system is used for spent fuel pool cooling, fire suppression, and heating and cooling of administrative buildings, with the volume of Lake Michigan water being significantly less than the amount used during operations (Solutions 2017a)." IEMA notes that this paragraph does not reflect the current status of the cooling water being used at ZNPS.

RESPONSE:

The NRC revised Section 3.2.1 to state that the cooling water system is no longer in place. Once the spent fuel had been transferred to the ISFSI and the spent fuel pool was removed, the cooling water system was also removed.

COMMENT IEMA-7:

In Section 3.2.2, Ground Water, the EA states, “Gross alpha was not detected in any surface water samples. Gross beta (dissolved) was detected in four samples at one surface water location, ranging from 2.3 to 7.3 pCi/L (Solutions 2016b).” IEMA recommends that an environmental analysis should be included in this paragraph comparing detectable gross beta activity in surface water with pre-operational data, or an area of similar background.

RESPONSE:

The NRC updated Section 3.2.1 to include the results of surface water samples collected from Lake Michigan as part of the REMP program. Section 3.2.2 was revised to remove reference to the surface water samples, which are now discussed in Section 3.2.1 and to provide results of the 2017 ARGPPR and REMP groundwater sampling. Gross beta is used as a screening tool to determine if additional analysis is necessary for other radionuclide and therefore those results are not the best indicator of contamination. Therefore the two sections were updated to remove reference to gross beta concentrations and instead state that tritium and other radionuclides, if detected, are below EPA’s derived drinking water standards.

COMMENT IEMA-8:

In Section 3.4, Aquatic Resources, the EA states, “Given the large populations within the Lake Michigan watershed, the lake experiences the impacts from residential and industrial development, agricultural production, and other human-caused stressors. For example, runoff from residential and agricultural areas resulted in nutrient loading in the 1950s, which led to high levels of eutrophication and major algal blooms, oxygen depletion, and subsequent die-offs of fish and other biota.” IEMA suggests this section may not fully illustrate the total picture of industrial and residential development, agricultural production, and other human-caused stressors (e.g., raw sewage dumped into Lake Michigan, beach closings due to unsafe levels of pollution and bacteria, beaches testing positive for mercury polychlorinated biphenyls).

RESPONSE:

Section 3.4 was updated to add comments provided by IEMA on other potential stressors to Lake Michigan.

COMMENT IEMA-9:

In Section 3.6, Public and Occupational Health, the EA states, “Solutions will conduct decommissioning activities under the provisions of its Radiation Protection Program and Radioactive Waste Management Program.” IEMA suggests that the radiation protection program is likely focused on occupational dose of workers, but not the public. Please clarify whether or not the radiation protection program considers potential dose to the public.

RESPONSE:

The NRC clarified in Section 3.6 that the radiation programs are protective of onsite workers and visitors.

COMMENT IEMA-10:

In Section 3.6.1, Occupational Dose, the EA states, “During the remainder of the decommissioning process, Solutions will continue to use the various protection programs and ALARA goals to ensure public protection in accordance with 10 CFR Part 20 and 10 CFR 50, Appendix I (Solutions 2017a).” IEMA suggests the requirements cited for occupational dose (10 CFR 50, Appendix I) are related to public dose limits and not occupational dose to workers. 10 CFR 50, Appendix I sets effluent dose limits for the public as they apply to the remaining licensed site (i.e., the Independent Spent Fuel Storage Installation).

RESPONSE:

The NRC removed the reference to 10 CFR Part 50 Appendix I in Section 3.6.1 that addresses occupational dose and was added to Section 3.6.2, which addresses dose to the public.

COMMENT IEMA-11:

In Section 3.6.2, Public Dose, the EA states, “Solutions continues to monitor and estimate doses to the public as discussed above. Until the termination of the operating licenses, the licensee must meet the requirements of 10 CFR 50.36(a) for effluent releases after permanent cessation of operation. Licensees are also required to keep releases of radioactive materials to unrestricted areas at ALARA levels. Licensees must also comply with the EPA’s standards in 40 CFR Part 190, “Environmental radiation protection standards for nuclear power operations” (NRC 2002).” IEMA suggests this section should reference 10 CFR 50, Appendix I.

RESPONSE:

The NRC revised Section 3.6.2 to state that ZS will continue its program to ensure public protection in accordance with 10 CFR Part 50 Appendix I.

COMMENT IEMA-12:

In Section 4.3, Public and Occupational Health Impacts, IEMA recommends that the EA considers direct radiation exposure from the Independent Spent Fuel Storage Installation. This dose would be included as part of the total 10 CFR 20.1402 dose to the maximally exposed individual until the spent fuel can be accepted by DOE.

RESPONSE:

In Section 4.3, the NRC clarified that the dose limits of 10 CFR 20.1402, "Radiological criteria for unrestricted use" for license termination includes the dose contribution from the ISFSI. The 25 mrem/year limit applies to when the license is terminated, including the ISFSI. However, at this time, the license will not be terminated since it will remain in effect as long as the ISFSI is in operation. The NRC added a statement to Sections 3.6 that the regulation at 10 CFR 72.104 limits exposure to the nearest resident from the ISFSI to less than 25 mrem/year.