ZION STATION RESTORATION PROJECT
LICENSE TERMINATION PLAN
CHAPTER 8, REVISION 1
SUPPLEMENT TO THE ENVIRONMENTAL REPORT

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LIST OF ACRONYMS AND ABBREVIATIONS

ACS	American Community Survey
AEC	Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
AMSL	Above Mean Sea Level
BMP	Best Management Practices
ComEd	Commonwealth Edison
CCDD	Clean Construction Demolition Debris
DOE	Department of Energy
DOT	Department of Transportation
DSAR	Defueled Safety Analysis Report
EPA	Environmental Protection Agency
ES	Environmental Statement
FSAR	Final Safety Analysis Report
GEIS	Generic Environmental Impact Statement
GTCC	Greater-Than- Class- C
HASP	Health and Safety Plan
HSA	Historical Site Assessment
ICMP	Illinois Coastal Management Program
IDNR	Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IRSF	Interim Radioactive Storage Facility
ISFSI	Independent Spent Fuel Storage Installation
LTP	License Termination Plan
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NSSD	North Shore Sanitary District
ODCM	Off-site Dose Calculation Manual
OSHA	Occupational Health and Safety Administration
PCB	Polychlorinated Biphenyls
PDSAR	Post Shutdown Decommissioning Activity Report
PWR	Pressurized Water Reactors
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Environmental Monitoring Program
RGPP	Radiological Groundwater Protection Program
SMC	Storm Water Management Commission

SWPPP	Storm Water Pollution Prevention Plan
TEDE	Total Effective Dose Equivalent
VCC	Vertical Concrete Cask
WCS	Waste Control Specialist
WDO	Watershed Development Ordinance
WWTF	Waste Water Treatment Facility
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

8. SUPPLEMENT TO THE ENVIRONMENTAL REPORT

8.1. Introduction

In accordance with the requirements of 10 CFR 50.82 (a)(9)(ii)(A) and the guidance of Regulatory Guide 1.179, *"Standard Format and Contents for License Termination Plans for Nuclear Power Reactors"* (Reference 8-1), this chapter provides a supplement to the environmental report describing any new information or significant environmental change associated with the site-specific decommissioning and site closure activities performed at the Zion Nuclear Power Station (ZNPS) site.

8.1.1. Purpose

This chapter supplements the Commonwealth Edison Company, "*Environmental Report - Zion Nuclear Power Station*" as supplemented (Reference 8-2), describing any new information or significant environmental changes associated with the site-specific decommissioning and license termination activities presented in this License Termination Plan (LTP). The supplement includes a detailed description of the remaining decommissioning and site closure activities, the interaction between those activities and the environment, and the likely environmental impact of those activities. The supplement discusses whether the activities and their impacts are bounded by the impacts predicted by the United States Atomic Energy Commission (AEC) "*Final Environmental Statement related to operation of Zion Nuclear Power Station Units 1 and 2*", - December 1972 (AEC Environmental Statement) (Reference 8-3) issued in December 1972; NUREG-0586, Supplement 1, Volume 1 *"Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities"* (Reference 8-4); and the Zion Nuclear Power Station, "*Post Shutdown Decommissioning Activity Report*" (PSDAR) (Reference 8-5). This chapter discusses decommissioning activities, with a focus on those activities to be performed from time of submittal of this LTP until the license transfer back to Exelon.

8.1.2. Background

ZNPS is comprised of two 1,100-Mwe Pressurized Water Reactors (PWR), Units 1 and Unit 2, with supporting facilities, which was owned and operated by Commonwealth Edison Company (now Exelon) from 1973 to 1998.

The station was granted a construction permit by the AEC in December 1968 for both Units. Commercial operation was achieved in 1973 for Unit 1 and 1974 for Unit 2. Due to a variety of factors, including economic analysis associated with proposed steam generator replacements, Commonwealth Edison made the decision to shut down ZNPS. Permanent cessation of operations at ZNPS occurred on February 13, 1998. Certification of Permanent Defueled Status for both Units was achieved in March 09, 1998.

In accordance with the requirements of 10 CFR 50.82, Commonwealth Edison Company (now Exelon) submitted the initial revision of the PSDAR to the Nuclear Regulatory Commission (NRC) on February 14, 2000. The reactors at ZNPS remained in a SAFSTOR condition until September of 2010. At this point, the license for the facility was transferred from Exelon (the licensee at that time) to Zion*Solutions* LLC. This was accomplished to allow Zion*Solutions* to begin the process of the physical decommissioning of the ZNPS. Integral to the license transfer,

the PSDAR was amended on March 18, 2008 to address the acceleration of decommissioning activities, changes to the decommissioning schedule and cost milestones. The amended PSDAR established the DECON method as the current decommissioning approach and described the accelerated decommissioning schedule with a lower revised cost estimate to reflect current knowledge and waste disposal options.

The environmental impacts of decommissioning operations at ZNPS were previously assessed in both revision of the PSDAR. The assessments included the evaluation of impacts against those noted in the AEC Environment Statement and NUREG-0586. The reference facility in NUREG-0586 is a 1,175-MWe PWR owned by Portland General Electric and designed by Westinghouse. As the Zion PWRs are similar in size and also designed by Westinghouse, the two ZNPS units fall within the envelope of the generic environmental assessment.

The amended PSDAR concluded that the decommissioning of the ZNPS would be accomplished with no significant adverse environmental impacts and that the environmental impacts associated with the site-specific decommissioning activities for ZNPS would be bounded by previously issued environmental impact statements.

8.2. Site Location and Description

ZNPS is located in northeastern Illinois on the west shore of Lake Michigan, about 40 miles north of Chicago, Illinois and about 42 miles south of Milwaukee, Wisconsin. The site is located in the eastern portion of the City of Zion in Lake County, Illinois, about 3.2 miles south of the Illinois-Wisconsin State line. See Figure 8-1 for a map showing the site location, including nearby prominent features such as highways, rivers and lakes. The map coordinates for ZNPS are longitude 87 degrees, 48.1 minutes West and latitude 42 degrees, 26.8 minutes North.

The site comprises approximately 331 acres which is owned and controlled by Zion*Solutions*, LLC under a lease agreement with Exelon Generation, Inc. integral to the *"Zion Nuclear Power Station, Units 1 and 2 Asset Sale Agreement"* (Reference 8-6). The site is accessed by Shiloh Boulevard which enters the site on the north side. The site is bordered on the west by an industrial area located immediately east of the Chicago and Northwestern railway. The site is bordered on the north by the City of Zion Hosah Park, and further north as well as south by the Illinois State Beach Park along the Lake Michigan shoreline. Figure 8-2 is an aerial view of the local area showing the site boundaries. Figure 8-3 presents a topographic map of the site with contour intervals; the site grade is at 591 feet Above Mean Sea Level (AMSL).

8.2.1. Site Description After Unrestricted Release

This section provides a summary of the final condition of the site at the conclusion of decommissioning and site closure activities. The "End State" is defined as the configuration of the remaining below ground buildings, structures, piping and open land areas at the time of license termination.

Section 8.5 of Exhibit C, Lease Agreement, titled "Removal of Improvements; Site Restoration" integral to the Asset Sale Agreement requires the demolition and removal of all on-site buildings, structures, and components to a depth of at least three feet below grade (designated as an elevation of 588 foot AMSL. All systems, components, piping, buildings and structures above 588 foot elevation will be removed during decommissioning and disposed of as waste. The

demolition debris will be segregated for recycling, reuse, or disposal. The decommissioning approach also calls for the beneficial reuse of concrete from building demolition as clean fill. Only concrete that meets the definition of Clean Construction and Demolition Debris (CCDD) and, where radiological surveys demonstrate that the concrete is free of plant derived radionuclides above background will be considered for use as fill.

In both Containment basements (Unit 1 and Unit 2), all concrete will be removed from the inside of the steel liner, leaving only the remaining exposed liner below the 588 foot elevation and the structural concrete outside of the liner. In the Auxiliary and Turbine building basements, all internal walls and floors will be removed, leaving only the reinforced concrete floors and outer walls of the building structures. For the Fuel Handling Building, the only portion of the structure that will remain is the lower 12 feet of the fuel pool below the 588 foot elevation and the concrete structure of the Fuel Transfer Canals after the steel liner has been removed. There are four additional below ground structures that will remain including the lower concrete portions of the Waste Water Treatment Facility (WWTF), Main Steam Tunnels, Circulating Water Inlet Piping and Circulating Water Discharge Tunnels.

An evaluation was performed regarding the disposition of the Intake/Discharge structures. The alternative to leave in place was determined to be the least disruptive to the environment and was recommended. The impact of leaving the intake and discharge piping in place is discussed in an AMEC, Inc. report titled *"Final Environmental Analysis of Alternatives Regarding Intake/Discharge Structure Disposition at the Former Zion Nuclear Generating Station, Zion, Illinois"* (Reference 8-7).

Remaining below grade structures such as basement foundations will be filled with clean concrete debris, soil, sand or other suitable media. The end-state will also include a range of buried, embedded piping and penetrations. All buried piping that is abandoned in place will be capped and/or filled with grout. The restored areas on the site will be back-filled, graded and returned to natural contours. Several structures will remain at license transfer as requested by Exelon. These structures are as follows;

- North Access Control Security Gate
- Owner Controlled Fence Line
- Commonwealth Edison Electrical Switchyard (note: the Switchyard will remain in active use after decommissioning in support of the existing Commonwealth Edison offsite electrical transmission and distribution system) including the microwave tower
- Sanitary sewage system Lift Station (note: the Lift Station is required to remain to support the Independent Spent Fuel Storage Installation [ISFSI] Monitoring Building).
- Paved roadways and rail lines, including the lines and rail spur constructed in 2011, allowing for rail service at the site via connection to the nearby Union Pacific railway

After all demolition and remediation activities are compete, Zion*Solutions* will use the final survey process described in Chapter 5 of this LTP to demonstrate that the ZNPS and surrounding open land areas, with the exception of the ISFSI facility, comply with radiological criteria for unrestricted use specified in 10 CFR 20.1402. As part of the decommissioning process, all reactor fuel and greater than Class C waste will be loaded into casks and transferred to the ISFSI.

It is expected that the fuel will remain on-site in dry storage within the ISFSI until it is transferred to the Department of Energy (DOE). The ISFSI, which occupies approximately 5 acres, has been constructed in the southwest corner of the ZNPS site, immediately south of the Switchyard.

Following the conclusion of radiological remediation activities and prior to initiating final survey, isolation and control measures will be implemented. The control measures will be implemented to ensure the final radiological condition is not compromised by the potential for re-contamination as result of access by personnel or equipment. Open land areas, access roads and boundaries will be posted with signs restricting access. Isolation and control measures will be implemented through approved plant procedures and will remain in force throughout final survey activities and until there is no risk of recontamination from decommissioning or the survey area has been released from the license.

Several services, such as the City of Zion water and sanitary sewer services and Commonwealth Edison electrical service will remain in operation to support the ISFSI monitoring and security operations. There are no potable wells on site. Water service will be provide through the City of Zion municipal water supply which draws water from Lake Michigan via a water intake about one mile north of the site.

8.3. Remaining Dismantlement and Decommissioning Activities

Key dismantlement and decommissioning activities that have been completed include: activities associated with the removal of system piping and components; the segmentation and packaging of the internals from both Unit 1 and Unit 2 reactors; the on-going transfer of spent nuclear fuel from the Fuel Handling Building to the ISFSI and the demolition and disposal of several ancillary structures, including the Interim Radioactive Storage Facility (IRSF) and the storage tank farms located east of the Turbine Building.

Chapter 3 of this LTP provides details on the dismantlement, demolition and remediation activities currently performed and remaining activities to be executed to achieve the End State condition.

8.4. Impacts to the Post-Shutdown Decommissioning Activities Report (PSDAR)

The PSDAR, amended in March 2008, described the planned decommissioning operations at the site and concluded that the potential environmental impacts associated with decommissioning the site have already been postulated in, and will be bounded by the previously issued environmental impact statements, specifically:

- Final Environmental Statement,
- NUREG-0586,
- NUREG-1496 *"Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities"* (Reference 8-8), dated July 1997.

Chapter 3 of this LTP identified the dismantlement and decontamination activities that are scheduled to be completed prior to unrestricted release of the site (excluding the ISFSI footprint)

and the transfer of the license back to Exelon. These identified activities are not significantly different than what was proposed in the PSDAR. Although additional details regarding major decommissioning activities will be defined during ongoing decommissioning planning efforts, no significant impacts beyond those identified in the PSDAR have been identified. Subsequent sections in this chapter provide additional evaluation and information regarding the environmental effects of decommissioning.

8.5. Zion Station Environment Description

8.5.1. Geography and Demography

8.5.1.1. Site Location and Description

The site location and description were previously discussed in Section 8.2. In addition, the site occupies portions of Sections 22, 23, 26, and 27 in Township 46 North, Range 23 East. The site is located on a narrow strip of lake deposits which borders the Lake Michigan shoreline. A series of low, parallel beach ridges, oriented north-south, separated by marshy depressions, cross the site. The topography at the site ranges from approximately 580 feet to 605 feet AMSL and represents recessional beach lines deposited along the Lake Michigan shoreline subsequent to the most recent period of glaciations. The beach ridges are composed primarily of sand.

8.5.1.2. Population

The U.S. Census Bureau American Community Survey (ACS) latest 5-year report (Reference 8-9) provides the most reliable census data for the City of Zion, nearby cities, and Lake County. The estimated total population in 2012 was: 24,400 for the City of Zion; 6,752 for Winthrop Harbor, located 3 miles to the north of Zion; 88,982 for Waukegan, located 7 miles south of Zion; and 701,282 for Lake County.

8.5.1.3. Site Access, Land, and Water Use

The ZNPS property is located in the extreme eastern portion of the City of Zion in Lake County, Illinois on the west shore of Lake Michigan. Although the site encompasses approximately 331 acres, it is relatively isolated as the property is bordered to the north and south by Illinois Beach State Park, a small industrial area followed by railroad tracks to the west and Lake Michigan to the east. The center of the community of Zion is approximately 1.6 miles from the plant location on the site. There are no schools or hospitals within one mile of the site and there are no residences within 2,000 feet of any ZNPS structures (Zion *"Historical Site Assessment"* (HSA) [Reference 8-10]).

The area of Lake Michigan adjacent to ZNPS is used by recreational boaters. The nearest marina/public boat launch is located approximately 2.5 miles north of the site. There are also several fishing charter services in Winthrop Harbor that are located approximately 3 miles north of the site. Lake Michigan is also used for commercial barge and ship traffic, however this traffic does not ordinarily operate within 5 miles of the site.

8.5.2. Climate

Zion's climate is continental with cold winters, warm summers, and frequent short fluctuations in temperature, humidity, cloudiness, and wind direction. The average temperature in the summer is 72 degrees F and the average temperature in the winter is 24 degrees F. Because the eastern edge of Zion is bounded by Lake Michigan, inland lake breezes can cool the air along the lake shore by 10 to 15 degrees F in the summer and can warm the air by as much as 20 degrees F in the winter (Conestoga-Rovers and Associates, *"Hydrogeologic Investigation Report, Fleetwide Assessment, Zion Station"*, Revision 1 [Reference 8-11]).

The average annual rainfall is 32.0 inches and the average annual snowfall is 41.0 inches (Illinois Department of Commerce and Economic Opportunity, *"Zion Illinois, General Information, Climate"* [Reference 8-12]). Winter storms, with snowfalls exceeding 6 inches, occur about once every 2 years in the northeastern part of Illinois (*"Illinois State Water Survey (1971-2000)"* [Reference 8-13]).

Wind speeds in the northeastern portion of Illinois, encompassing Zion, typically average 8 to 10 mph (*"Illinois Climate Network, 1991-2000 Data Set"* [Reference 8-14]). High winds (on the order of 70 mph) can be expected once in 50 years from storms (Commonwealth Edison Company, "*Zion Station Defueled Safety Analysis Report*" [DSAR] [Reference 8-15]). The Zion area has rarely experienced tornados. On September 28, 1972, a category F4 tornado 5.8 miles away from the Zion city center injured 20 people and caused between $500,000 and $5,000,000 in damages. On April 21, 1967, a category F4 tornado 20.9 miles away from the city center killed one person and injured 100 people and caused between $500,000 and $5,000,000 in damages (*"City of Zion Illinois Data"* [Reference 8-16]).

8.5.3. Geology and Seismology

The near-surface geology of northeastern Illinois is comprised of unconsolidated glacial deposits which range from 90 to 150 feet in thickness. The surface deposits overlay a series of sedimentary rock layers deposited in the Paleozoic Era. The thickness of the Paleozoic sedimentary rocks in northeastern Illinois is approximately 4,000 feet. These sedimentary bedrock layers dip gently toward the east at an incline of approximately 10 feet per mile and overlay on the Precambrian basement rock (Commonwealth Edison Company *"Zion Nuclear Power Station Final Safety Analysis Report"* (FSAR) [Reference 8-17]).

At ZNPS, in the vicinity of the major buildings, the surface deposits are comprised of three layers, or units, of irregular thickness. In descending order, the following overburden stratigraphic units have been identified and characterized during the various site investigations, Zion*Solutions* TSD 14-003, Conestoga Rovers & Associates (CRA) Report, "*Zion Hydrogeologic Investigation Report*" (Reference 8-18):

- Upper sand unit (also known as the Shallow Aquifer): Dense to very dense granular soils which range in gradation from very fine sand to fine to coarse sand, and which contains some gravel and occasional cobbles and boulders (i.e. shallow granular lake deposits). This unit includes both native and fill sand. Depth ranges from the ground surface to an elevation of approximately 555 feet AMSL.

- Upper silty clay unit: Hard silt, silty clay, clayey silt, and sandy silt which contain some sand and gravel and occasional cobbles and boulders. Depth ranges from approximately 525 feet to 555 feet AMSL.
- Lower sand unit: Dense to very dense sands and silty sands which contain some gravel, occasional cobbles and boulders, and layers of hard silty clay, clayey silt, and sandy silt. Depth ranges from approximately 480 feet to 525 feet AMSL. This unit is discontinuous.

The lower unconsolidated sand unit layer overlies an upper bedrock layer. This upper bedrock layer is the Niagara Dolomite, a consolidated layer of carbonaceous marine sediments laid down in the Silurian Period. It is about 200 feet thick in the vicinity of ZNPS.

There is no indication of faulting beneath the site. The area within 100 miles of the site is considered to be one of minor seismic activity. Few events of moderate significance have occurred in the region in the last 150 to 200 years.

Information on recent earthquakes near Lake County was obtained from the Illinois State Geological Survey (Reference 8-19). This review indicated a small 2.4-magnitude earthquake on January 30, 2012 at an epicenter of 42.340 latitude and -88.243 longitude, 2 miles east of McHenry and approximately 30 miles west of ZNPS. A previous earthquake of 3.8 magnitude occurred on February 10, 2010; this seismic event was located about 2 miles northwest of Lily Lake in Kane County, southwest of Zion, approximately 70 miles from ZNPS.

8.5.4. Hydrology and Hydrogeology

Hydrology and hydrogeology information was primarily obtained from two Conestoga Rovers & Associates reports (References 8-11 and 8-18). Groundwater is encountered at a depth less than 20 feet below ground surface in the shallow granular lake deposits identified above as the Upper Sand Unit This shallow water-bearing zone is isolated from the underlying regional bedrock aquifers by a significant thickness (~30 to 50 feet) of glacial silts and clays that act as an aquitard.

Lake Michigan it the major regional discharge zone for groundwater. The groundwater flow in the region is generally towards the lake. Based on borehole observations and the hydrogeological setting, groundwater flow at ZNPS proceeds predominantly easterly to southeasterly toward Lake Michigan, with a more complex localized flow around deep foundations, utilities and the retaining wall that was installed during construction.

The Upper Sand Unit is a high permeability unit that is in hydraulic communication with Lake Michigan, the regional discharge feature, and which generally allows unrestricted lateral groundwater flow, with the exception of the areas around plant structures and the cutoff wall: these deep structures local alters the local flow patterns, however ultimate discharge of groundwater is to the Lake. Vertical groundwater flow is limited by the underlying Silt-Clay Unit which has a low permeability and is approximately 30 feet thick (Dames and Moore *"Foundation Investigation, Proposed Nuclear Power Plant, Zion, Illinois"* [Reference 8-20]).

8.6. Environmental Effects of Decommissioning

8.6.1. Summary

The evaluation of the environmental effects (or impacts) of the decommissioning of ZNPS follows the approach outlined in NUREG-0586. The methodology is described in NUREG-0586, Supplement 1. This approach includes identification of environmental issues as either generic or site-specific. If the issue is considered to be generic, it is assigned a significance level of either "Small", "Moderate", or "Large." If identified as generic, the environmental impact is considered to be bounded by the evaluation in the GEIS which concludes that the impact significance is "Small." In this event, site specific evaluation by licensees is generally not required.

For those environmental issues or decommissioning activities that require site-specific evaluation, a standard approach is followed. It is summarized as follows:

1) The issue or activity is summarized including a summary of the impacts as reported in the original Environmental Statement (ES) and PSDAR. Note that many decommissioning activities are not identified in these documents.

2) Applicable regulations, permits, limits or other regulatory requirements are identified.

3) Potential impacts from decommissioning activities relating to the environmental issue are described.

4) An evaluation is performed. This includes analysis and professional judgment to estimate or determine whether the activity is likely to make a noticeable impact on the environment considering the available information. If an impact is likely, existing and additional mitigation measures that can be taken are evaluated. If an impact cannot be avoided, a determination is made as to whether the impact is likely to seriously damage the resource or attribute.

5) A conclusion is reached.

A conclusion is derived from the evaluation steps summarized above. The conclusion identifies the level of significance of the impacts. Site-specific issues are not bounded by the GEIS evaluation.

Table 8-1 was used as the basis for the site specific environmental impact assessment for ZNPS. It is excerpted from Table 6.1 of NUREG-0586, Supplement 1. The first step in this process is to screen the issues to identify site-specific issues. Decommissioning activities specific to ZNPS are then reviewed and the activities that may require site-specific evaluation are identified. The screening identified the following;

- Offsite land use activities: changes in demographics and zoning that have occurred in the past 40 years.
- Aquatic ecology affected by activities beyond the operational area; changes in designation of sensitive areas (local wetlands and expansion of Illinois State Beach).
- Terrestrial Ecology affected by activities beyond the operational area: changes in designation of sensitive areas (local wetlands and expansion of Illinois State Beach).

- Threatened and endangered species: changes in local flora and fauna and designation of threatened and endangered species that have occurred in the past 40 years.
- Environmental Justice: changes in demographics and socioeconomic status in the past 40 years.
- Cultural and Historic Resource impacts beyond the operational areas: changes in local historic landmark designations and other cultural resources.

The following decommissioning activities were identified which required evaluation of impacts across several environmental attributes or issues.

- ISFSI construction: land use impacts (onsite).
- Vertical Concrete Cask (VCC) construction for the ISFSI: land use impacts (onsite).
- Rail line upgrade and extension (onsite and offsite).
- Circulating Water inlet and outlet piping disposition: aquatic ecology (within and beyond the operational area).
- Placement of clean construction demolition debris (CCDD) and sand mix in major building basements: terrestrial ecology and transportation.

8.6.2. Radiological Effects of Decommissioning

8.6.2.1. Occupational Radiation Exposure

During decommissioning, Zion*Solutions* has and will continue to implement a Radiation Protection Program in accordance with the license specifications and the requirements of 10 CFR Part 20. The objectives of the Radiation Protection Program are to control radiation hazards, avoid accidental radiation exposures, maintain occupational worker exposures to less than the administrative limit of less than 2,000 mrem/yr Total Effective Dose Equivalent (TEDE) and, to maintain doses to workers and the public As Low As Reasonably Achievable (ALARA).

On March 9, 1998, Commonwealth Edison (ComEd), the licensee at the time, placed both units at ZNPS in a SAFSTOR condition (a period of safe storage of the stabilized and defueled facility). The reactors at Zion remained in a SAFSTOR condition until September of 2010, when active decommissioning activities commenced. This period of time allowed for the decay of most short-lived radionuclides which subsequently, reduced radiation levels at the facility. This fact, combined with the effective implementation of the Radiation Protection Program and ALARA measures minimizes the projected and actual occupational radiation dose exposure during the decommissioning of ZNPS. It is anticipated that the most significant contributors to occupational dose from remaining dismantlement activities is the segmenting, packaging and shipping of the reactor vessel internals and the reactor vessel.

The GEIS estimates that 1,115 Rem will be needed to decommission a PWR similar in size to the Zion units. Current occupational dose expended and dose expected to complete decommissioning for both units is less than 1,000 Rem. This is well below the GEIS estimate of 2,230 Rem for two units.

As the occupational dose for the decommissioning will meet the regulatory standards of 10 CFR 20, it is therefore bounded by the criteria in the GEIS and the impact is considered as "Small".

8.6.2.2. Offsite Radiation Exposure and Monitoring

Zion*Solutions* implements a regulatory compliant Radiological Environmental Monitoring Program (REMP) at ZNPS, which provides annual reports with an accurate assessment of the radiological environment in and around the environs of the site. The REMP program provides assurance that the radioactive gaseous and liquid effluent releases during plant operations do not exceed the concentration limits of 10 CFR 20, the dose limits of 10 CFR 50, Appendix I, or the fuel cycle dose limits of 40 CFR 190. Zion*Solutions* will continue to adhere to these limits throughout the course of the decommissioning. Consequently, the public dose from decommissioning is bounded by the criteria in the GEIS and the impact is considered as "Small".

At ZNPS, the Circulating Water Discharge Tunnels are the main authorized effluent release pathway for the discharge of treated and filtered radioactive liquid waste to Lake Michigan. Liquid effluents are monitored and sampled prior to release from onsite storage tanks.

The gaseous pathway analysis is subject to the meteorological conditions during the time of the release. Due to plant shutdown and cessation of noble gas and other radionuclide generation, gaseous effluents do not present a significant release or exposure pathway. Routine grab air sampling is performed to determine the dose due to radioactive gaseous releases.

The direct radiation exposure is measured continuously with the use of passive monitoring devices. The dose is integrated over three months to accumulate a statistically significant exposure.

The design basis for the ISFSI precludes airborne radioactive releases during spent fuel storage and provides adequate shielding to minimize exposure. Radiation monitoring for the ISFSI is performed in accordance with the Radiation Protection Program implemented at ZNPS. In accordance with the worst case scenario in the design basis, the projected doses at the site boundary are substantially below the limits established in 10 CFR 72.106(b) where there is total loss of the confinement barrier. Exposure from the ISFSI to the nearest permanent resident will not exceed 25 mrem/year as specified in 10 CFR 72.104 and 40 CFR Part 190.

8.6.2.3. Environmental Effects of Accidents and Decommissioning Events

Decommissioning accident analysis is integral to the licensing design basis for ZNPS. While decommissioning radioactively contaminated structures, systems and components at ZNPS, it is necessary to assure the safety of the public in the surrounding area and workers. Worker safety is addressed in the Radiation Protection and Safety programs for the Zion Station Restoration Project (ZSRP) which rely on ALARA principles and the Zion*Solutions* ZS-SA-01, "*Zion Restoration Project Health and Safety Plan*" (HASP) (Reference 8-21). The safety of the public is principally related to potential hazards associated with an airborne release of radioactive materials during decommissioning operations.

During decommissioning, ZSRP will perform decontamination and dismantlement of structures, systems, and components in addition to maintenance, waste management, and surveillance. The

accidents discussed in NUREG-0586, Supplement 1 associated with immediate dismantling would also be applicable during the decommissioning of ZNPS. However, the potential consequences associated with those accidents would be less at ZNPS due to the reduction of the total radionuclide inventory at ZNPS due to:

- Decontamination efforts made before decommissioning,
- Prior radioactive waste shipments, and
- Radioactive decay.

Consequently, the potential decommissioning accidents at ZNPS are bounded by the accident evaluation presented in NUREG-0586, Supplement 1.

Operational accidents during decommissioning could result from equipment failure, human error, and service conditions. With the spent nuclear fuel removed from the reactors, operational accidents during decommissioning can be categorized as follows:

- Radioactive waste transportation accidents,
- Explosions and/or fires associated with explosive and/or combustible materials,
- Loss of contamination control,
- Natural phenomena, and
- Human caused events external to ZNPS.

These potential operational accidents during decommissioning are addressed in NUREG-0586, Supplement 1 for immediate dismantlement and consequently, are bounding for the decommissioning of ZNPS.

8.6.2.4. Storage and Disposal of Low-level Radioactive Waste

The decommissioning of ZNPS has, and will continue to require the disposal of large volumes of low level radioactive waste, including contaminated equipment, tools, clothing and bulk debris materials such as concrete, metal, and asphalt. Materials that cannot be free released are, and will continue to be dispositioned as low-level radioactive waste. Through the proper implementation of the Waste Management Program, Process Control Program and associated procedures, Zion*Solutions* ensures the appropriate segregation, classification, processing, packaging, shipment and control of solid, liquid and gaseous radioactive wastes.

The majority of the Class A low-level radioactive waste from ZNPS will be shipped to the Energy*Solutions* disposal site in Clive, Utah. The radioactive materials are typically packaged in SuperSacs and then placed into Energy*Solutions* owned 100 ton, high-capacity SuperGondola railcars for transport on Union Pacific rail lines to the disposal site. Oversized or overweight components, such as the Reactor Vessel Head, are shipped using multiple axle tractor/trailer rigs or special rail cars. Rail and truck shipments are made in accordance with Department of Transportation (DOT) regulations. Class B and C low-level radioactive waste from ZNPS will be shipped to the Waste Control Specialists disposal site in Andrews, Texas.

Zion*Solutions* completed the construction of the ISFSI in August 2013 and started spent nuclear fuel cask loading in December 2013. Zion*Solutions* anticipates completing the transfer of all its

spent nuclear fuel, in sixty-one (61) VCC to the ISFSI by early 2015. The multi-purpose fuel canisters within the casks are seal-welded and leak tight; therefore no leakage is expected during normal operation, off-normal conditions, or design basis accidents. The storage of the fuel at the ISFSI does not generate any gaseous, liquid, or solid radioactive waste. The spent nuclear fuel will remain in storage at the ISFSI under the Part 50 license until the fuel is transferred to a permanent repository. Greater-Than-Class C low-level radioactive waste will be stored in four seal-welded leak tight canisters within storage casks co-located at the ISFSI with the spent fuel.

8.6.2.5. Radiological Criteria for License Termination

Following the completion of decontamination, dismantlement and remediation activities, radiological surveys will be performed to demonstrate that the dose from any residual radioactivity remaining in as-left structure basements and soils at ZNPS (excluding the ISFSI) to the unrestricted release criteria as specified in 10 CFR 20.1402. Once the balance of the site is remediated and the as-left radiological conditions are demonstrated to be below the unrestricted release criteria, the 10 CFR Part 50 license will be reduced to the area around the ISFSI and the site will be transferred back to Exelon under the 10 CFR Part 50 license. LTP Chapter 5 and Chapter 6 provide the methodology for demonstrating compliance with the unrestricted release criteria.

8.6.3. Non-radiological Effects of Decommissioning

8.6.3.1. Onsite Land Use

The environmental impact associated with onsite land uses have been determined by the NRC, within section 4.3.1 of NUREG-0586, Supplement 1 to be generically considered as a “Small” impact.

The decommissioning project is located and executed within the boundary of the existing ZNPS property previously used for power generation; all work will be conducted in previously developed footprint. Some onsite roads have been refurbished and a reinforced heavy haul path was constructed to support the transfer of VCCs to the ISFSI. No barge slips are being constructed. The rail was originally installed during the construction of the station and was part of the operation of the facility. The onsite rail line was modified and refurbished to support decommissioning activities. Containers will be unloaded and loaded onsite. Onsite land activities such as vehicle parking and equipment/container laydown, storage, staging and waste loading are and continue to occur in a manner similar to when the facility was operational. Several structures such as the Switchyard, the ISFSI, the ISFSI warehouse, the microwave tower, and the Sewage Lift Station, as well as all roadways and rail lines, will remain at license termination as requested by Exelon.

Section 8.5 of Exhibit C, Lease Agreement, titled “Removal of Improvements; Site Restoration” integral to the Asset Sale Agreement requires the demolition and removal of all on-site buildings, structures, and components to a depth of at least three feet below grade. The major structures that will remain at license termination are the basements of the Unit 1 Containment Building, Unit 2 Containment Building, Auxiliary Building, Turbine Building, WWTF, the lower portion of the Spent Fuel Pool, Crib House and Forebay, Unit 1 and Unit 2 Steam Tunnels and the Circulating Water Intake and Discharge Tunnels below the 588 foot elevation. All systems,

components as well as all structures above the 588 foot elevation (with the exception of the structures previously noted) will be removed during the decommissioning process and disposed of as a waste stream. In both Containment basements, all concrete will be removed from the interior side of the steel liner, leaving only the remaining exposed liner below the 588 foot elevation and the structural concrete outside of the liner. In the Auxiliary Building, all interior walls and floors will be removed, leaving only the exterior walls and basement floor. In the Turbine Building basement, the remaining structures will consist of reinforced concrete floors and exterior foundation walls and the sub-grade portions of the pedestals below the 588 foot elevation. For the Fuel Handling Building, the only portion of the structure that will remain is the lower 12 feet of the Spent Fuel Pool below 588 foot elevation and the concrete structure of the Fuel Transfer Canals once the steel liner has been removed. Other below ground structures that will remain are the lower concrete portions of the WWTF, Main Steam Tunnels, and Circulating Water Inlet Piping and Discharge Tunnels.

The decommissioning approach for ZSRP also calls for the beneficial reuse of concrete from building demolition as clean fill. Uncontaminated concrete that meets the definition of CCDD and where radiological surveys demonstrate that the concrete is free of plant derived radionuclides above background will be used. Demolition debris found to be contaminated or potentially contaminated based on process knowledge will be disposed of as low-level radioactive waste. Consequently, the burial of demolition debris contaminated with residual radioactivity will not have the potential to affect land use and ground or surface water quality. Similarly, painted concrete will only be used if the chemical analysis demonstrates that the chemical constituents are below USEPA and IEPA regulatory criteria.

As during the operation of the facility, decommissioning activities have not been conducted in wetlands. The wetlands around the plant have been protected in accordance with environmental regulations and permits.

There is no information pertaining to any significant environmental changes associated with the site-specific decommissioning activities. Site closure will comply with applicable USEPA and IEPA regulatory requirements.

In accordance with the guidance presented in the GEIS, the potential impacts to land use onsite are considered as “Small”.

8.6.3.2. Offsite Land Use (in the Vicinity)

Only areas within the existing site boundary will be used to support decommissioning and license termination activities (such as temporary storage and staging areas). Appropriate isolation and control measures will be instituted to prevent the spread of contamination. These measures will also be monitored to ensure their effectiveness. Thus, no environmental impacts associated with the use of offsite lands are anticipated from the decommissioning activities at ZNPS.

Of the 331 acre site, about 87 acres are located within the fence-enclosed “Radiologically-Restricted Area”. The remainder, which lies mostly to the west of the station switchyard, which belongs to ComEd, is an open marshy area. This area is undeveloped except for overhead transmission lines and corridors maintained by ComEd.

The land area immediately west of the site, located between the site and the railway is zoned light industrial by the City of Zion (The City of Zion, Illinois, *"Comprehensive Plan 2010"* [Reference 8-22]). This area is about five blocks long, extending from 29th Street on the south to Shiloh Boulevard on the north and is about four blocks wide in the east-west direction centered on Deborah Avenue. It is currently occupied by several warehouses and associated truck shipping operations, an industrial cleaning-service company, several auto service garages, a salvage yard, a former manufacturing facility and a number of vacant lots.

A significant factor which affects land use in the near vicinity of ZNPS is the Illinois Beach State Park. The Illinois Beach State Park has been expanded since the construction of ZNPS, at which time it only comprised an area located south of the site along the Lake Michigan shoreline. The present day Illinois Beach State Park is comprised of a section north and a section south of ZNPS. The Park is part of a state-owned coastal management area, which extends from Winthrop Harbor (about three miles north of the ZNPS site) to about three miles south of the ZNPS site. The area from Winthrop Harbor Marina on the north to the southern end of the Illinois Beach State Park has been incorporated into the Illinois Coastal Management Program (ICMP). The ICMP has identified this area 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 (Illinois Coastal Management Program, *"Illinois Beach State Park and North Point Marina, Including the Dead River and Kellogg Creek Watersheds, 2011"* [Reference 8-23]).

The ZNPS site and the surrounding land on all sides are identified as "environmentally sensitive" in the Zion City planning document. The Lake County Regional Framework Plan identifies the western portion of the ZNPS site and adjacent land, as wetlands and areas with "environmental limitations". In the Lake County Plan, this area is also assigned a "high priority for open space". This includes the strip of land between the Chicago and Northwestern Railway on the west and the Illinois Beach State Park on the east, bisected by the Deborah Avenue light industrial area and the ZNPS site.

Decommissioning activities are not being performed in areas defined as "environmentally sensitive" within the site boundary, nor in land which adjoins similar offsite land areas, City of Zion industries, or the State beach park areas. Consequently, the offsite land areas are not affected by the decommissioning activities and the potential impacts to land use offsite are considered "Small".

8.6.3.3. Water Use

In accordance with section 4.3.2 of NUREG-0586, Supplement 1, the environmental impact associated with water use has been determined to be generally applicable with a "Small" impact.

ZNPS is located on the shores of Lake Michigan. The lake is 307 miles long from north to south and has an average width of 70 miles. The predominant water usage during the operation of ZNPS was the use of water from Lake Michigan as secondary cooling water for the reactor systems. With the plant shutdown and fuel removed from the reactor, the cooling water system is currently used for the cooling of the Spent Fuel Pool, building environmental systems such as air conditioning and heating, and fire suppression. The use of water from Lake Michigan during decommissioning activities is significantly less than the usage during operations.

Water from Lake Michigan is also extensively used for municipal and domestic water supplies. There is multiple potable water intakes located in Lake Michigan in the vicinity of ZNPS. The nearest intake is located about 1 mile north of the ZNPS site and approximately 3,000 feet out into the lake. The City of Zion provides potable water services to support ZNPS. The sewage system is connected to the North Shore Sanitary District (NSSD). Potable water use during decommissioning operations is not expected to be greater than the potable water use experience during operations. Water will continue to be processed in accordance with the site National Pollutant Discharge Elimination System permit (NPDES). Consequently, in accordance with the GEIS, the potential impacts to water use are considered "Small".

8.6.3.4. Water Quality

This section evaluates potential project effects on those portions of the natural environment related to surface water and groundwater. Surface water generally refers to streams, rivers, ponds, reservoirs and lakes. At ZNPS, the nearby bodies of water are Lake Michigan and surface streams near the site, including Kellogg Creek (1.25 miles north), Dead River (3 miles south), and Bull Creek (0.2 mile south) and surrounding wetlands.

The environmental impact evaluation associated with surface and groundwater quality in section 4.3.3 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

At ZNPS, all non-radiological water discharges to Lake Michigan are controlled under an NPDES permit which is issued by the Illinois Environmental Protection Agency (IEPA). Zion*Solutions* has filed a Notice of Intent (NOI) with the IEPA, implemented a Storm Water Pollution Prevention Plan (SWPPP) and obtained a Watershed Development Ordinance (WDO) permit from the Lake County Stormwater Management Commission (SMC) for the demolition of the site structures. In addition, impacts to the lake and nearby creeks will be greatly reduced through implementation of appropriate Best Management Practices (BMP) for soil erosion and sedimentation control.

Radiological impacts are minimized through adherence to Off-site Dose Calculation Manual (ODCM) limits and assessed through the Radiological Environmental Monitoring Program (REMP) and the Radiological Groundwater Protection Program (RGPP). Potential groundwater impacts are monitored by the routine sampling of eleven (11) permanent onsite RGPP wells at ZNPS.

As the water from Lake Michigan is no longer used to cool operating reactor systems at ZNPS, the thermal impact to Lake Michigan has been reduced.

No adverse impacts on surface water and groundwater are expected from the implementation of decommissioning activities. Consequently, the potential impacts to surface and groundwater quality are bounded by the GEIS and considered "Small".

8.6.3.5. Air Quality

The environmental impact evaluation associated with air quality in section 4.3.4 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

ZNPS complies with all applicable Federal and State air quality regulations, including the requirements of the IEPA, Bureau of Air, and will implement BMP to minimize fugitive dust during demolition and decommissioning activities. Air emission sources such as the diesel generators are no longer in service and the auxiliary boiler has been removed. A minor emission source for the above ground storage gasoline tank (1000 gallons) is permitted under the IEPA Registration of Smaller Sources (ROSS) program. This tank will be removed when the decommissioning is complete.

Fugitive dust will be generated from various decommissioning activities, including the demolition of concrete building structures and the excavation of soil. Careful planning and controlled demolition and dismantlement techniques, with appropriate assessments by Zion*Solutions* Radiation Protection, Environment, and Health and Safety staff, will be conducted to ensure excessive and harmful dust emissions are not generated. As necessary, measures such as dust suppression by misting water will be used to mitigate dust emissions.

Demolition equipment will be operated and maintained in accordance with manufacturer's specifications which will prevent increased exhaust emissions. Appropriate Health and Safety assessments and controls will also be established during expected extended periods of operation to ensure that personnel and the environment are not adversely impacted by excessive exhaust emissions.

No adverse impacts on air quality are expected from the implementation of decommissioning activities. Consequently, the potential impacts to air quality are bounded by the GEIS and considered "Small".

8.6.3.6. Aquatic Ecology

The environmental impact evaluation associated with aquatic ecology in section 4.3.5 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

The aquatic habitat at ZNPS includes the area from the intake structure integral to the Crib House at the shoreline to the diffuser structure that extends out into Lake Michigan approximately 870 feet from the lakeshore. Habitats associated with this area were previously disturbed during the initial construction of the facility. However, the implementation of decommissioning activities is not expected to disturb existing aquatic habitats, their flora and fauna in the lake and also nearby streams and wetlands.

Various fresh water fish species, macro-invertebrate populations, and vegetation exist within these aquatic environments and were identified during a study contracted by Zion*Solutions*. Zion*Solutions* contracted an independent environmental analysis to assist with the decision for removing or leaving the Forebay and Circulating Water Discharge Tunnels at ZNPS. This analysis was documented in the previously cited report by AMEC, Inc. pertaining to the Discharge Piping. The report concludes that no action should be taken for the removal of the Forebay and Circulating Water Discharge Tunnels as no action decision resulted in the least impact to the environment, including aquatic ecology considerations.

Plans for the demolition of structures at ZNPS do not include the removal of waste or equipment by barge. Consequently, there is no impact to the beach or shoreline from this type of activity.

Zion*Solutions* will continue to maintain its NPDES permit and decommissioning operations will be performed within applicable NPDES limits. Furthermore, protection of the onsite and adjacent wetlands is, and will continue to be a priority when planning any onsite dismantlement or waste management operation. In addition, the SWPPP is implemented with BMPs to prevent impacts to the aquatic systems.

Exotic species can threaten native species and ecosystems due to aggressive growth, reproduction or survival rate, and diseases or parasites they may transmit to native species. The decommissioning of ZNPS will not introduce any exotic plants or animals into the environment.

The potential impacts to the aquatic ecology within the site boundary are bounded by the GEIS and considered to be "Small". The potential impacts to the aquatic ecology beyond the site boundary have also been evaluated and considered to be "Small".

8.6.3.7. Terrestrial Ecology

The environmental impact evaluation associated with terrestrial ecology in section 4.3.6 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

Exotic/invasive species are known to occur in only few locations near ZNPS. These exotic/invasive species include common reed (*Phragmites australis)* and purple loosestrife *Lythrum salicaria)*, both of which are found in the swale and wetland habitats that are located behind the sand dunes along Lake Michigan. Zion*Solutions* continues to be a partner and support the work of Illinois Department of Natural Resources (IDNR) to remove invasive species (Lime Grass) along the beach. No known exotic or invasive species occur within the decommissioning project area. To minimize the introduction of exotic or invasive species, appropriate BMPs are, and will continue to be followed.

The land around ZNPS was initially disturbed by the construction of the facility and no longer resembles the dune formations prevalent in surrounding areas. This alteration results in a less desirable habitat for many species that rely on dune formations for habitat. Given the short-term nature of the work associated with decommissioning, and the fact that the project area is separated from the Illinois Beach State Park, no direct impacts to sensitive species are anticipated. Additionally, upon completion of construction activities, the land is going to be brought to existing grade and stabilized with guidance on native vegetation, therefore minimizing any long-term impacts to sensitive species. In addition, the planned demolition activities do not include the removal of waste or equipment by barge and consequently, there is no anticipated impact to the beach or shoreline.

Floodplain management requires that long-term and short-term adverse impacts associated with modification of floodplains be avoided to the extent possible. Diverse wetland habitats, including marsh, fen, panne, sedge meadow, and ponds occur within the ZNPS property. Wetlands have been delineated and permits have been obtained for work activities that are in the vicinity of wetlands and wetland buffer zones. Compliance with these permits and the implementation of BMPs mitigates the potential impact on wetlands from decommissioning activities.

The potential impacts to terrestrial ecology are bounded by the GEIS and considered "Small".

8.6.3.8. Threatened or Endangered Species

The only "Threatened" or "Endangered" species that has been observed at ZNPS is the Blanding's turtle. The Blanding's Turtle (Emydoidea, blandingii) is listed as a "Threatened" species in the state of Illinois. During the decommissioning process, Blanding's turtles have been observed, rescued, and protected. Blanding's turtle awareness signs have been posted and inspections are performed to ensure that the Blanding's turtles are protected in accordance with the IDNR recommendations and the IEPA, NPDES, and SWPPP. During the refurbishment of a rail crossing located north of ZNPS, Zion*Solutions* worked with local stakeholders and the IDNR to rescue a den of snakes which included several Western Fox snakes. A hibernaculum was established nearby for the relocation of the rescued snakes. The Western Fox snake is not listed as "Threatened" or "Endangered" but they are considered an important part of the ecosystem.

Other listed species such as the Piping Plover birds and the Massasauga rattlesnake have not been observed on site. No adverse impact to any listed species is anticipated since they are not present in locations expected to be impacted by decommissioning activities. Monitoring and awareness programs have been put in place to for the Blanding's turtles and other protected species that may be identified during the decommissioning activities.

The potential impacts to "Threatened" or "Endangered" species are bounded by the GEIS and considered "Small".

8.6.3.9. Occupational Issues/Safety

The environmental impact evaluation associated with occupational issues in section 4.3.10 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact. While decommissioning involves increased industrial activities and safety focus, similar programs addressing worker safety were implemented during the operation of the facility and also during repair and refueling outages. The occupational issues and safety impacts assessed are those related to human health and safety, including impacts from physical, chemical, ergonomic, and biological hazards. Radiological impacts, were previously discussed in section 8.6.2.1.

Zion*Solutions* is committed to decommissioning ZNPS safely and has established a HASP to implement a program to effectively control hazards in the work environment and prevent occupational injuries and illnesses. The HASP and Zion*Solutions* Health and Safety Program complies with federal and state regulations including Illinois Department of Labor and the U.S. Occupational Health and Safety Administration (OSHA) requirements. The HASP applies to all Zion*Solutions* employees as well as visitors and contract personnel working under direct Zion*Solutions* supervision.

Numerous safety practices and communications are conducted at the site and include, but are not limited to:

- Safety is emphasized as the first topic of discussion at meetings.
- All workers are provided a Health and Safety booklet.
- Worker training and required certifications are reviewed prior to assignment to tasks requiring specific worker qualifications. Certain specialty subcontractors are mobilized, as

necessary, such as the asbestos abatement firm contracted for the removal of all asbestos from the Turbine Building.

- Safety Data Sheets are obtained and reviewed for chemicals bought onsite.
- Health and Safety staff are involved in reviewing and approving decommissioning work packages and participating in pre-job walkdowns, work condition assessments and reviews.
- Daily and weekly safety messages are issued as well as Safety Bulletins to communicate awareness of significant safety issues and lessons learned.
- Safety stand-downs are held whenever serious safety events occur to communicate and reinforce safety events and lessons learned site-wide.

Therefore, occupational issues/safety is evaluated to be bounded by the GEIS and the impact is considered "Small".

8.6.3.10. Cost

A detailed discussion of the site decommissioning project costs is presented in Chapter 7 of this LTP.

8.6.3.11. Socioeconomic Impacts

ComEd's original decision to permanently cease plant operations was not subject to NRC review or approval. On January 14, 1998, the Unicom Corporation and ComEd Boards of Directors authorized the permanent cessation of operations at ZNPS for economic reasons. The economic growth and job opportunities in the Chicago Metropolitan area and the nuclear industry at the time of shutdown in 1998, minimized the effects of unemployment that resulted from the plant shutdown.

In September of 2010, decommissioning activities began and a demolition permit was obtained from the City of Zion. Some of the labor requires specialized skills and equipment from out-of-state. Overall, the decommissioning activities have a short-term positive economic impact on the local community due to the permit fee, and the impact on the local workforce and opportunities for local business.

Therefore, socioeconomic impacts are evaluated to be bounded by the GEIS and the impact is considered "Small".

8.6.3.12. Environmental Justice

While low-income and minority populations are present in the vicinity of the former ZNPS, the percentages of low-income and minorities within the ZNPS census tract are lower than those in other City of Zion census tracts. No impact to the greater population, including special groups, is expected.

An existing rail spur was refurbished to transport large components from ZNPS. The refurbished rail spur will be used to transport waste over an existing route. Decommissioning activities will cause increases in truck traffic to and from ZNPS to transport equipment and debris. The truck traffic will use existing main street routes. Since approximately 90% of the waste will be

removed by rail, the increase in truck traffic will be temporary. There will be no environmental justice impact relative to rail and truck transportation as a result of decommissioning.

There is no reason to believe that low-income and minority populations will be adversely impacted by the decommissioning project. Per the GEIS and this evaluation, the potential site specific impact is considered "Small".

8.6.3.13. Cultural, Historic, and Archaeological Resources

The AEC Environmental Statement included documentation from the State of Illinois, Department of Conservation which stated the following:

"This letter will certify that the Illinois Department of Conservation has reviewed the land sections to be affected by the Zion Nuclear Power Station and has determined that no archaeological, architectural, or historical resources are evident within the same."

ZNPS had an existing rail spur that was refurbished to ship waste and large components off-site. Land disturbance for the removal of large components is minimized since removal is primarily conducted via site rail system.

Land that was disturbed for projects beyond the operational areas (within the owner controlled site) was performed in accordance with the IEPA, NPDES permits and the Lake County SMC, Watershed Development Ordinance which included soil erosion controls and stormwater pollution prevention plans. Additional IEPA and SMC permits were obtained during 2014 for the demolition phase that will take place within the "Radiologically-Restricted Area". These permits included a review by the Illinois Historic Preservation Agency which identified no historic, architectural or archaeological sites exist on the ZNPS site.

Based on the historical information in the AEC Environmental Statement, the results of the reviews of historic, cultural and archaeological resources performed in 2013 and 2014, current transportation methods for large components, and soil erosion control work practices, the decommissioning will have no significant impact on cultural and historic resources. Consequently, as bounded by the GEIS and based upon this evaluation, the potential impacts to Cultural, Historic, and Archaeological Resources are considered "Small".

8.6.3.14. Aesthetics

The environmental impact evaluation associated with aesthetics in section 4.3.15 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

The impact of decommissioning on site aesthetics (e.g. visual skyline) is limited in terms of land disturbance and duration. These impacts are temporary and will cease when decommissioning is completed.

The location of the ISFSI is set back several hundred yards from the lake frontage and located adjacent to the existing switchyard. Once all of the major plant structures and buildings on the lake front are removed, aesthetics will improve by providing a more open view of Lake Michigan. Due to the proximity of the Illinois State Beach Park on the north and south of ZNPS,

restoration of the site to a natural grade will result in a contiguous open view of the Lake Michigan shoreline.

Aesthetics will improve once the site is returned to open space. The final determination on usage for the lake front property will be made by Exelon upon completion of the decommissioning and transfer of the license back to Exelon.

Therefore, the environmental impact associated with aesthetics is evaluated to be bounded by the GEIS and the impact is considered "Small".

8.6.3.15. Noise

The environmental impact evaluation associated with noise in section 4.3.16 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

ZNPS is located on the shore of Lake Michigan with the Illinois State Beach Park on the north and south perimeters of the Owner-Controlled Property. There are no residences within 2,000 feet of the station structures and no schools or hospitals within one mile. The center of the nearest community, Zion, Illinois is located approximately 1.6 miles to the west of the plant.

Noise generation will primarily result from demolition activities involving heavy construction equipment. The noise from the shipment of waste will be minimal since the primary transportation method for shipment of low level radioactive waste will be by rail. Noise associated with decommissioning and shipment of waste is intermittent and temporary and will occur primarily during daylight hours. The ISFSI construction was completed in 2013. The ISFSI is a passive facility and there will be minimal noise generated from its operation. Once the decommissioning is complete, noise levels in the vicinity of the ZNPS site will be reduced to levels below those experienced during the operation of the facility.

Due to the distance of the station from sensitive receptors, there will be limited temporary impacts on noise levels during decommissioning and demolition activities. During the decommissioning, Zion*Solutions* agrees to comply with any noise limitations imposed by the City of Zion.

Therefore, the environmental impact associated with noise is evaluated to be bounded by the GEIS and the impact is considered "Small".

8.6.3.16. Irretrievable Resources

The environmental impact evaluation associated with irretrievable resources in section 4.3.18 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

During the demolition and structural dismantlement of the station, recycling and asset recovery efforts will be made. Some metals (e.g. from turbine, transformer components, etc.) have been released as clean scrap. Low level radioactive waste has been and will be continue to be shipped to the Energy*Solutions* disposal site in Clive, Utah. This facility has sufficient space for the disposal of this waste. In addition, any Class B/C waste that is generated will be shipped to the Waste Control Specialist (WCS) facility in Andrews, Texas.

As stated in the GEIS, irretrievable resources that would occur during the decommissioning process are the materials used to decontaminate the facility (e.g., rags, solvents, gases, and tools), and fuel used for construction machinery and for transportation of materials to and from the site. These resource commitments are considered to be minor and are neither detectable nor destabilizing.

Therefore, the environmental impact associated with irretrievable resources is evaluated to be bounded by the GEIS and the impact is considered "Small".

8.6.3.17. Traffic and Transportation

The environmental impact evaluation associated with transportation issues in section 4.3.17 of NUREG-0586, Supplement 1 has been determined to be generally applicable to ZNPS with a "Small" impact.

The number of shipments and the volume of waste shipped are greater during decommissioning than during the operation of the facility. Non-radiological impacts of transportation include increased traffic and wear and tear on roadways. Because the majority of the waste will be transported by rail, the average number of daily shipments from the site will be relatively small. Consequently, it is anticipated that there will be no significant effect on traffic flow or road wear. The impacts of a transportation accident would be neither detectable nor destabilizing.

Therefore, the environmental impact associated with traffic and transportation is evaluated to be bounded by the GEIS and the impact is considered as "Small".

8.6.3.18. Placement of Clean Construction Demolition Debris (CCDD) and Sand Mix in Major Building Basements: Terrestrial Ecology and Transportation

Zion*Solutions* evaluated the use of CCDD for basement fill end-state and submitted a Request for Concurrence for Basement Fill End-State (ZS-2014-0272) to the Illinois EPA in August of 2014. This request included the results of a sampling plan for concrete candidate fill material to be used for the basement fill end-state. On October 3, 2014 Zion*Solutions* received a Letter of Concurrence from the Illinois EPA (ZS-2014-0349) for the use of CCDD for the basement fill end-state.

8.7. Overview of Regulatory Governing Decommissioning Activities and Site Release

8.7.1. Federal Requirements

Decommissioning activities that are subject to federal regulations include:

- Spent fuel storage at the ISFSI.
- Handling, packaging, and shipment of radioactive waste.
- Worker radiation protection.
- License termination and final site release.
- Worker health and safety.
- Liquid effluent releases.

- Hazardous waste generation/disposition.
- Handling and removal of asbestos.
- Characterization and removal of polychlorinated biphenyls (PCBs).
- Handling and removal of lead paint.

8.7.1.1. Nuclear Regulatory Commission

The majority of radiological activities falls under Title 10 of the Code of Federal Regulation and are administered by the NRC. Applicable Title 10 regulations include:

- Part 20 – Radiation protection.
- Part 50 – Decommissioning activities.
- Part 51 – Environmental protection.
- Part 61 – Disposal of radioactive waste.
- Part 71 – Packaging and transportation of radioactive waste (regulations in 49 CFR Parts 171 through 174 also apply).
- Part 72 – Licensing requirements for the independent storage of spent nuclear fuel, high-level radioactive waste, and reactor-related Greater-Than- Class- C (GTCC) waste.
- Part 73 – Physical Protection of Plants and Materials.

8.7.1.2. U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) regulations outlined in Title 40 of the Code of Federal Regulations apply as follows:

- Part 61 – Asbestos Handling and Removal
- Parts 122 to 125 –NPDES
- Part 141 – Safe Drinking Water Standards
- Part 190 – Radiation Protection Standards for Nuclear Power Operations
- Parts 260 to 272 – Resource Conservation and Recovery Act (RCRA)
- Part 280 – Underground Storage Tanks
- Part 761 – Toxic Substance Control Act (TSCA) for Polychlorinated Biphenyls (PCBs)
- Part 129-132 – Clean Water Act

8.7.2. State and Local Requirements

Permits and approvals from or notifications to state and local agencies are required for safety and environmental protection purposes. Decommissioning activities and related site operations that fall under State and local jurisdiction include but are not limited to the following:

- Lake County Stormwater Management Commission, Watershed Development Ordinance

- Illinois Environmental Protection Agency
- Illinois Historic Preservation Agency
- Clean Construction or Demolition Debris, Illinois Environmental Protection Act, Section 3.160(b)
- City of Zion Demolition Permit

This information provided above is a general overview of the applicable regulations and not intended to be all-inclusive.

8.8. Conclusion

As previously evaluated in the Zion PSDAR, the non-radiological environmental impacts from decommissioning ZNPS are temporary and not significant. The potential issues identified as "site-specific" in NUREG-0586, Supplement 1 (such as "Threatened" and "Endangered" species and environmental justice) have been evaluated and there is no significant impact. The potential environmental impacts associated with decommissioning ZNPS have already been predicted in and will be bounded by the previously issued environmental impacts statements (PSDAR, NUREG-0586, and Zion Environmental Statement). Therefore, there are no new or significant environmental change associated with decommissioning.

8.9. References

8-1 U.S. Nuclear Regulatory Commission Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors" – January 1999

8-2 Commonwealth Edison Company, "Environmental Report - Zion Nuclear Power Station" – May 1971, Supplement 1 – November 1971, Supplement II – December 1971, Supplement III – February 1972, Supplement IV – April 1972, Supplement V – May 1972

8-3 United States Atomic Energy Commission, Directorate of Licensing, "Final Environmental Statement related to the Operation of Zion Nuclear Power Station Units 1 and 2", Docket Nos. 50-295 and 50-304 – December 1972

8-4 U.S. Nuclear Regulatory Commission NUREG-0586, "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities", Supplement 1, Volume 1" – November 2002

8-5 Zion Nuclear Power Station, "Post Shutdown Decommissioning Activity Report" (PSDAR), – March 2008

8-6 "Zion Nuclear Power Station, Units 1 and 2 Asset Sale Agreement" – December 2007

8-7 AMEC, Inc., "Final Environmental Analysis of Alternatives Regarding Intake/Discharge Structure Disposition at the Former Zion Nuclear Generating Station, Zion, Illinois" – October 2013

8-8 U.S. Nuclear Regulatory Commission, NUREG-1496, Volume 2, "Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities" – July 1997

8-9 US Census Bureau, "2008-2012 American Community Survey" – 2012

8-10 "Zion Station Historical Site Assessment" (HSA) – September 2006

8-11 Conestoga-Rovers and Associates, "Hydrogeologic Investigation Report, Fleetwide Assessment, Zion Station, Zion Illinois", Revision 1 – September 2006.

8-12 Illinois Department of Commerce and Economic Opportunity, "Zion Illinois, General Information, Climate" – September 2012

8-13 "Illinois State Water Survey 1971 – 2000"

8-14 "Illinois Climate Network, 1991 – 2000 Data Set"

8-15 Zion Station, "Defueled Safety Analysis Report" (DSAR) – September 2014

8-16 "City of Zion" www.city-data.com/city/Zion-Illinois

8-17 Commonwealth Edison Company, "Zion Nuclear Power Station - Final Safety Analysis Report" (FSAR) – November 1970

8-18 Zion*Solutions* Technical Support Document 14-003, Conestoga Rovers & Associates (CRA) Report, "Zion Hydrogeologic Investigation Report"

8-19 "Illinois State Geological Survey" www.isgs.illnois.edu

8-20 Dames and Moore, "Foundation Investigation, Proposed Nuclear Power Plant, Zion, Illinois" – October 1967

8-21 Zion*Solutions* ZS-SA-01, "Zion Restoration Project Health and Safety Plan" (HASP)

8-22 The City of Zion, Illinois, "Comprehensive Plan 2010" – January 1992

8-23 Illinois Coastal Management Program, "Illinois Beach State Park and North Point Marina Including the Dead River and Kellogg Creek Watersheds" – 2011

Table 8-1 Summary of the Environmental Impacts from Decommissioning Nuclear Power Facilities

Section	Environmental Issue	GEIS	Impact Significance
8.6.2	Radiological		
	Activities resulting in occupational dose to workers	Yes	Small
	Activities resulting in dose to the public	Yes	Small
	Radiological Accidents	Yes	Small
8.6.3.1	Onsite land use activities	Yes	Small
8.6.3.2	Offsite land use activities	No	Site-specific
8.6.3.3	Water Use	Yes	Small
8.6.3.4	Water Quality		
	Surface water	Yes	Small
	Ground water	Yes	Small
8.6.3.5	Air Quality	Yes	Small
8.6.3.6	Aquatic Ecology		
	Activities within the operational area	Yes	Small
	Activities beyond the operational area	No	Site-specific
8.6.3.7	Terrestrial Ecology		
	Activities within the operational area	Yes	Small
	Activities beyond the operational area	No	Site-specific
8.6.3.8	Threatened and Endangered Species	No	Site-specific
8.6.3.9	Occupational Issues	Yes	Small
8.6.3.11	Socioeconomic	Yes	Small

Table 8-1 Summary of the Environmental Impacts from Decommissioning Nuclear Power Facilities (continued)

Section	Environmental Issue	GEIS	Impact Significance
8.6.3.12	Environmental Justice	No	Site-specific
8.6.3.13	Cultural and Historic Resource Impacts		
	Activities within the operational area	Yes	Small
	Activities beyond the operational area	No	Site-specific
8.6.3.14	Aesthetics	Yes	Small
8.6.3.15	Noise	Yes	Small
~~8.6.3.17~~	~~Transportation~~	~~Yes~~	~~Small~~
8.6.3.16	Irretrievable Resources	Yes	Small
8.6.3.17	Traffic and Transportation	Yes	Small
8.6.3.18	Placement of clean construction demolition debris (CCDD) and sand mix in major building basements: terrestrial ecology and transportation.~~ISFSI construction: land use impacts (onsite)~~	No ~~No~~	Site-specific ~~Site-specific~~
~~8.6.3.19~~	~~VCC construction for the ISFSI: land use impacts (onsite)~~	~~No~~	~~Site-specific~~
~~8.6.3.20~~	~~Rail line upgrade and extension (onsite and offsite)~~	~~No~~	~~Site-specific~~
~~8.6.3.21~~	~~Circulating Water inlet and outlet piping disposition: aquatic ecology (within and beyond the operational area)~~	~~No~~	~~Site-specific~~
~~8.6.3.22~~	~~Placement of clean construction demolition debris (CCDD) and sand mix in major building basements: terrestrial ecology and transportation.~~	~~No~~	~~Site-specific~~

Note: Cost, section 4.3.11 in GEIS Supplement 1, is not evaluated using environmental significance levels and is not identified as a generic or site-specific issue.

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1009

Figure 8-1 Zion Nuclear Power Station Geographical Location

Figure 8-2 Zion Nuclear Power Station Owner Controlled Area

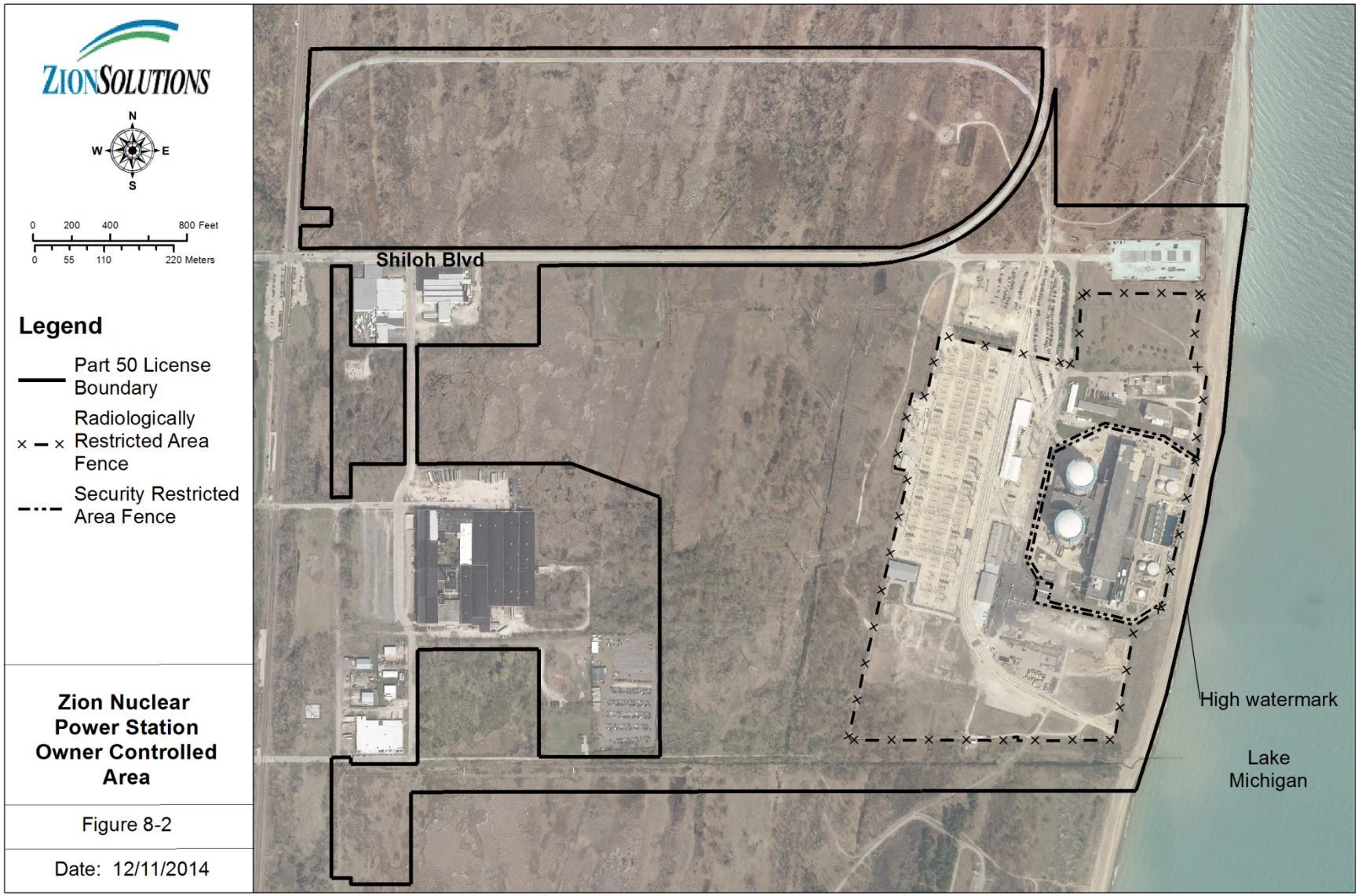

Figure 8-3 Zion Nuclear Power Station Topographical Map