

SAFETY EVALUATION REPORT BY THE  
OFFICE OF NUCLEAR SECURITY AND INCIDENT RESPONSE  
RELATED TO ZION NUCLEAR POWER STATION, UNITS 1 AND 2  
DEFUELED STATION EMERGENCY PLAN LICENSE AMENDMENT  
DOCKET NOS. 50-295, 50-304 and 72-1037

1.0 INTRODUCTION

ZionSolutions, LLC (ZS) is the holder of Facility Operating License Nos. DPR-39 and DPR-48, which authorize the licensee to possess and store spent nuclear fuel and Greater-than-Class C (GTCC) radioactive waste at the Zion Nuclear Power Station (ZNPS), Unit Nos. 1 and 2. The license, pursuant to the Atomic Energy Act of 1954, as amended, and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, allows ZNPS to possess spent nuclear fuel at the permanently shutdown and defueled ZNPS facility. In a letter dated April 13, 1999 (Reference 1), ZNPS informed the U.S. Nuclear Regulatory Commission (NRC) that ZNPS had permanently ceased power operations, removed fuel from the reactor to the spent fuel pool (SFP), and began to develop detailed plans to decommission the facility.

In a letter dated May 27, 2014 (Reference 2), and as supplemented by letter dated November 6, 2014 (Reference 3), ZS submitted a license amendment request for prior approval of proposed changes to the ZNPS Defueled Station Emergency Plan (DSEP). These changes would reflect the change in status of the site where all of the spent nuclear fuel has been transferred from the SFP to a dry cask independent spent fuel storage installation (ISFSI).

ZS provided a Revision 16 to the ZNPS DSEP for the NRC staff's review in Reference 2 that was later revised and supplemented in Reference 3. ZS also states that the emergency plan was also reformatted to current industry standards, containing information consistent with Spent Fuel Project Office Interim Staff Guidance - 16 (ISG-16), "Emergency Planning" (Reference 4), and that the emergency actions levels (EALs) were modified to align with the Nuclear Energy Institute (NEI) document NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors" (Reference 5).

2.0 REGULATORY EVALUATION

This safety evaluation addresses the impact of the proposed changes on the ZNPS DSEP. The regulatory requirements, as exempted and guidance on which the NRC based its acceptance are as follows:

## 2.1 Regulations

- 10 CFR 50.47(b)(1) states, in part: “[E]ach principal response organization has staff to respond and to augment its initial response on a continuous basis”;
- 10 CFR 50.47(b)(2) states, in part: “[A]dequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available ...”;
- 10 CFR 50.47(b)(4) states, in part: “A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee...”;
- 10 CFR 50.47(b)(8) states: “Adequate emergency facilities and equipment to support the emergency response are provided and maintained.”
- 10 CFR Part 50, Appendix E, Section IV.A, states, in part: “The organization for coping with radiological emergencies shall be described, including definition of authorities, responsibilities, and duties of individuals assigned to the licensee’s emergency organization...”; and
- 10 CFR Part 50, Appendix E, Section IV.C.1, states, in part: “The entire spectrum of emergency conditions that involve the alerting or activating of progressively larger segments of the total emergency organization shall be described. The communication steps to be taken to alert or activate emergency personnel under each class of emergency shall be described....”
- 10 CFR Part 50, Appendix E, Section IV.E, states, in part: “Adequate provisions shall be made and described for emergency facilities and equipment....”

## 2.2 Guidance

Revision 1 to NUREG-0654/FEMA-REP-1, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants” (Reference 6), provides a common reference and guidance source for nuclear facility licenses to develop radiological emergency response plans.

NEI 99-01, Revision 6, “Development of Emergency Action Levels for Non-Passive Reactors,” dated November 2012 (Reference 5) was found by the NRC in a March 28, 2013, letter to be acceptable alternatives for licensees to consider in the development of their plant-specific EAL schemes, as well as allowing licensees to develop plant-specific EALs based upon an alternative approach not endorsed by the NRC.

As part of the review of ZS’s current license amendment request, the NRC also used the emergency planning guidance in ISG-16 as references to ensure consistency between specific-licensed and general-licensed ISFSIs.

### 3.0 TECHNICAL EVALUATION

The NRC staff has reviewed the licensee's regulatory and technical analyses in support of its proposed emergency plan changes, as described in Attachment 1 to ZS's license amendment request, and as supplemented by its letters. The staff's technical evaluation is detailed below.

#### 3.1 Background

ZNPS was shut down on February 21, 1997, and is currently in a permanently shutdown and defueled condition. In a letter dated May 4, 1998 (Reference 7), the NRC acknowledged that pursuant to 10 CFR 50.82(a)(2), the 10 CFR Part 50 licenses for ZNPS, Units 1 and 2, no longer authorized operation of the reactor, or emplacement or retention of fuel in the reactor vessel.

On August 31, 1999 (Reference 8), the NRC issued an exemption from certain requirements of 10 CFR Part 50 for ZNPS to discontinue offsite emergency planning activities and to reduce the scope of onsite emergency planning. Additionally, the NRC approved the ZNPS DSEP. The NRC concluded that an exemption was acceptable in view of the greatly reduced offsite radiological consequences associated with the permanently shutdown and defueled status of the facility. The NRC found that the postulated dose to the general public from any reasonably conceivable accident would not exceed the U.S. Environmental Protection Agency (EPA) Protective Action Guides (PAGs) beyond the exclusion area boundary (EAB). The safety evaluation report contained in the August 31, 1999 (Reference 8) letter documenting this approval established emergency planning requirements for ZNPS in its permanently shutdown and defueled status.

In a letter dated May 24, 2004 (Reference 9), Exelon Generation Company, LLC (the then-owner of ZNPS) requested approval of additional changes to the ZNPS DSEP. These proposed changes would allow for more efficient staffing of the defueled emergency response organization (DERO) and provide more flexibility in the time to augment the control room staff with the DERO. This request was approved in a letter dated December 15, 2004 (Reference 10).

In a letter dated May 25, 2007 (Reference 11), Exelon Generation Company, LLC requested approval of proposed changes to the ZNPS DSEP. These proposed changes would allow implementation of EALs developed from the guidance in NEI 99-01, Revision 4 (Reference 12). This request was approved in a letter dated February 25, 2008 (Reference 13).

In a letter dated January 25, 2008 (Reference 14), Exelon Generation Company, LLC notified the NRC that the spent nuclear fuel and GTCC will be stored in an ISFSI to be constructed by ZionSolutions, LLC and maintained onsite until final disposition. The site is currently in an active DECON<sup>1</sup> status.

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<sup>1</sup> DECON is a method of decommissioning, in which structures, systems, and components that contain radioactive contamination are removed from a site and safely disposed at a commercially operated low-level waste disposal facility, or decontaminated to a level that permits the site to be released for unrestricted use shortly after it ceases operation. For further information, see the Fact Sheet on Decommissioning Nuclear Power Plants. (<http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.pdf>)

On November 23, 2011, the NRC issued a Final Rule amending certain emergency planning (EP) requirements in the regulations that govern domestic licensing of production and utilization facilities (76 Federal Register (FR) 72560). On June 20, 2012, ZNPS submitted a letter (Reference 15), requesting exemption from certain standards of 10 CFR 50.47, "Emergency Plans," and specific requirements of Appendix E to 10 CFR Part 50 for the ZNPS DSEP. The NRC approved this request in a letter dated March 30, 2015 (Reference 16). The current ZNPS DSEP continues to meet the emergency planning requirements contained in 10 CFR Part 50 applicable to the permanently shutdown and defueled facility.

### 3.2 Proposed Changes

The major changes that ZS is requesting are: the removal of the various emergency actions related to the former storage of spent fuel in the SFP; the transfer of responsibility for implementing the emergency plan to the ISFSI Shift Supervisor (ISS); revisions to the emergency plan organization; abandonment of the former Control Room consistent with the current state of decommissioning; and alignment of the EALs with the guidance provided in NEI 99-01, Revision 6 (Reference 5).

### 3.3 Evaluation

The NRC reviewed the proposed changes to the ZNPS DSEP, including the licensee's evaluation of the changes, to verify that the emergency plan as changed continues to meet the standards contained in 10 CFR 50.47(b) and the requirements of Appendix E to 10 CFR Part 50, as exempted, applicable to the approved Part 50 emergency plan for the long-term defueled conditions.

#### 3.3.1 Removal of emergency actions related to the storage of spent fuel in the SFP

The emergencies addressed in the proposed Revision 16 to the ZNPS DSEP are related to the waste handling accident analyzed in Chapter 5 of the ZNPS Defueled Safety Analysis Report (DSAR) (Reference 17) and the dry cask storage of spent nuclear fuel at the ISFSI, which includes off-normal, accident, natural phenomena and hypothetical events, and consequences as presented in the NAC International Modular, Advanced Generation, Nuclear All-purpose Storage System Final Safety Analysis Report (MAGNASTOR FSAR) (Reference 18).

The proposed Revision 16 to the ZNPS DSEP provides that the licensee's analyses of the radiological impact of potential accidents at the ISFSI conclude that any releases beyond the ISFSI Controlled Area Boundary are expected to be less than the EPA PAG exposure levels. The Controlled Area, as defined in 10 CFR 72.3, means the area immediately surrounding an ISFSI for which the licensee exercises authority over its use and within which ISFSI operations are performed.

The remaining bounding accident described in the ZNPS DSAR Chapter 5, "Accident Analysis," postulates the failure of a High Integrity Container containing dewatered radioactive demineralizer resin generated during decommissioning activities to the extent that entire solid, noncombustible contents escape. The results of the analysis indicate that the projected

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radiological doses at the Controlled Area Boundary are less than the EPA PAGs.

With all spent fuel relocated to the ISFSI, the previously analyzed events, which include a loss of SFP cooling, loss of SFP inventory, and fuel handling accident in the Fuel Building, are no longer credible. Accidents associated with the ISFSI are addressed in the MAGNASTOR FSAR.

Information related to cooling water supplies, the SFP, and reactor cavities was removed from the proposed Revision 16 of the ZNPS DSEP. Because the consequences to public health and safety for the postulated worst-case accidents related to the ISFSI are considered insignificant (because any releases beyond the ISFSI Controlled Area Boundary are expected to be less than the EPA PAG exposure levels), emergencies are classified as no higher than an Alert declaration.

In the event that an emergency declaration is made, the Emergency Director will notify site personnel and Zion *Solutions* management, and activate the onshift defueled emergency response organization (DERO) and, if needed, the augmented DERO. The onshift DERO can respond to most situations arising from implementation of the DSEP without assistance from others. However, for an emergency classification of an alert involving radiological consequences or at the discretion of ED, the augmented DERO can be activated. In the event of an alert classification involving radiological consequence, the minimum staffing for the augmented DERO will be the Radiation Protection Director.

Because the ZNPS DSEP contains an emergency classification system commensurate with the level of emergencies postulated for the site, the NRC concludes that the ZNPS DSEP, as described above, meets the planning standard of 10 CFR 50.47(b)(4) and the requirements in 10 CFR Part 50, Appendix E, Section C.1, as exempted, pertaining to the emergency classification system for emergency response, considering the permanently shutdown and defueled status of the facility, and the relocation of the spent fuel to the ISFSI. The evaluation of the EAL scheme for the implementation of NEI 99-01, Revision 6, is provided in Section 3.3.5 of this safety evaluation.

### 3.3.2 Transfer of responsibility of implementing the emergency plan to the ISS

If an emergency condition develops, the ZNPS DSEP provides that the on-shift ISS is responsible for classifying the event and assuming the role of the Emergency Director. The Emergency Director and on-shift Radiation Protection Technician are responsible for performing emergency response activities until augmented with additional personnel in the event of an Alert declaration or at the discretion of the Emergency Director. The Emergency Director will assure that notification is made to the States of Illinois and Wisconsin, and the NRC. The Emergency Director may delegate the notification duties to other personnel onshift. The Emergency director will assess conditions at the facility and will implement corrective actions in accordance with station procedures to restore the facility to a normal safe condition.

Because the ZNPS DSEP describes the roles of individuals responsible for responding to emergencies, the NRC concludes that the ZNPS DSEP, as described above, meets the planning standard of 10 CFR 50.47(b)(1) and the requirements in 10 CFR Part 50, Appendix E, Section A, as exempted, pertaining to responsibilities for emergency response, considering the permanently shutdown and defueled status of the facility, and the relocation of the spent fuel to

the ISFSI.

### 3.3.3 Revised emergency response organization

The DERO consists of an on-shift ISS (Emergency Director) and an on-shift Radiation Protection Technician, and augmented staffing consisting of a Radiation Protection Director. The Emergency Director may elect to utilize any employees or contract personnel that may be on site at the time of the emergency.

The ZNPS DSEP further provides that the Emergency Director can utilize other resources and offsite support organizations (firefighting, local law enforcement, and medical facilities) as needed to support the emergency response and recovery actions. The Emergency Director will provide personnel with appropriate instructions and assignments to ensure that assistance resources are used effectively.

With all spent fuel relocated to the ISFSI, the Shift Supervisor and Control Room personnel are no longer required. As discussed previously, the on-shift ISS (Emergency Director) and Radiation Protection Technician are responsible for performing emergency response activities until augmented with additional personnel in the event of an Alert declaration or at the discretion of the Emergency Director.

Because the ZNPS DSEP describes the roles of individuals responsible for responding to emergencies, the NRC concludes that the ZNPS DSEP, as described above, meets the planning standard of 10 CFR 50.47(b)(2) and the requirements in 10 CFR Part 50, Appendix E, Section A, as exempted, pertaining to the onsite emergency organization for emergency response, considering the permanently shutdown and defueled status of the facility, and the relocation of the spent fuel to the ISFSI.

### 3.3.4 Abandonment of the former Control Room

With all spent fuel relocated to the ISFSI, the use of the Control Room as the location for Command and Control will be eliminated and replaced with the Emergency Response Facility (ERF) currently designated as the ISFSI Monitoring Building. Emergency conditions will be managed by the Emergency Director at this location. The licensee provides that the ERF provides sufficient space to accommodate on-shift DERO personnel and has redundant communications systems and other necessary equipment, including first aid supplies and controlled copies of appropriate facility documents available.

ZS further provides that if the augmented DERO is activated, personnel might be directed to assemble at the Emergency Support Center (ESC) instead of the ERF. Because of ongoing decommissioning activities, the location of the ESC may frequently change, therefore, the location and equipping of the ESC is addressed in plant procedures.

Because the ZNPS DSEP provides for facilities and equipment to support emergency response, the NRC concludes that the ZNPS DSEP, as described above, meets the planning standard of 10 CFR 50.47(b)(8) and the requirements in 10 CFR Part 50, Appendix E, Section IV.E, as exempted, pertaining to the emergency facilities and equipment for emergency response, considering the permanently shutdown and defueled status of the facility, and the relocation of the spent fuel to the ISFSI.

### 3.3.5 Implementation of NEI 99-01, Revision 6, EALs

In its application and supplemental letter, the licensee submitted a proposed EAL scheme for ZNPS and supporting technical basis, a comparison matrix, the EAL numbering scheme, and an explanation for any difference or deviation from NEI 99-01, Revision 6 (Reference 5). The comparison matrix provided a cross reference relating the proposed EAL scheme to the EAL scheme in NEI 99-01, Revision 6 (Reference 5).

As discussed previously, ZNPS currently utilizes an EAL scheme based on the generic EAL scheme development guidance from NEI 99-01, Revision 4 (Reference 12), with site-specific modifications due to design issues and/or licensee preference. The licensee is converting to an EAL scheme using the development guidance from NEI 99-01, Revision 6 (Reference 5), with site-specific modifications due to design issues and/or licensee preference.

The proposed site-specific EAL scheme is unique to ZNPS; however, to ensure consistency with NEI 99-01, Revision 6, the NRC staff reviewed the proposed site-specific EAL scheme to ensure the following key characteristics of an effective EAL scheme, as provided in NEI 99-01, Revision 6, are in place:

- Consistency (i.e., the EALs would lead to similar decisions under similar circumstances at different plants), up to and including standardization in intent, if not in actual wording;
- Human engineering and user friendliness;
- Potential for classification upgrade only when there is an increasing threat to public health and safety;
- Ease of upgrading and downgrading;
- Thoroughness in addressing and disposing of the issues of completeness and accuracy raised regarding Appendix 1 to NUREG-0654/FEMA-REP-1 (Reference 6);
- Technical completeness for each classification level;
- Logical progression in classification for multiple events; and
- Objective and observable values.

The NRC staff has reviewed the technical basis for the proposed EAL scheme, the modifications from NEI 99-01, Revision 6, and the licensee's evaluation of the proposed changes. ZNPS chose, in part, to modify its EAL scheme from the generic EAL scheme development guidance provided in NEI 99-01, Revision 6, in order to adopt a format more in alignment with its currently approved EAL scheme, as well as in alignment with licensee-specific writer's guides and preferences. The staff determined that these modifications are administrative in nature and do not alter the intent of any specific EAL within an EAL set, EAL category, or within the entire EAL scheme as stated in NEI 99-01, Revision 6.

Based on its review, the NRC staff determined that the proposed EAL scheme uses objective and observable values, is worded in a manner that addresses human engineering and user friendliness concerns, follows logical progression for escalating events, and allows for event downgrading and upgrading based upon the potential risk to the public health and safety. Risk assessments were appropriately used to set the boundaries of the emergency classification levels and ensure that all EALs that trigger emergency classification are in the same range of relative risk.

#### 4.0 ENVIRONMENTAL CONSIDERATION

The amendment includes changes to requirements with respect to installation or use of a facility component located within the protected area and changes to recordkeeping, reporting, or administrative procedures or requirements. NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration (79 FR 42553; July 22, 2014), and there has been no public comment on such finding. The November 6, 2014, supplement provided clarifying information and did not change the scope of the application. Accordingly, the amendment meets the eligibility criteria for categorical exclusions set forth in 10 CFR 51.22(c)(9) or 10 CFR 51.22(c)(10)(ii). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

#### 5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment. The State official had no comments.

#### 6.0 CONCLUSION

The NRC staff finds that the proposed changes in Revision 16 to the ZNPS DSEP meet the applicable standards in 10 CFR 50.47(b) and requirements in Appendix E of Part 50, as exempted, and the DSEP, as modified by Revision 16, would continue to provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. Therefore, the NRC concludes that the licensee's proposed changes to the ZNPS DSEP in its application dated May 27, 2014 and as supplemented by the letter dated November 6, 2014, are acceptable. In addition, the staff concludes that the revised ZNPS DSEP would meet the emergency planning requirements contained in 10 CFR Part 72 for an ISFSI not located on the site of an operating reactor.

#### 7.0 REFERENCES

1. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, "Request for Approval of Defuel Station Emergency Plan and Exemption from Certain Sections of 10 CFR 50.47, 'Emergency Plans,'" for the Zion Nuclear Power Station," dated April 13, 1999, (ADAMS Legacy No. 9904220148).
2. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, "License Amendment Request for Proposed Revision to Defueled Station Emergency Plan and Request for Exemption from Certain Requirements of 10 CFR 50.47, and 10 CFR 50, Appendix E," dated May 27, 2014, (ADAMS Accession No. ML14148A295).
3. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information for Proposed Revision to Defueled Station Emergency Plan," dated November 6, 2014, (ADAMS Accession No.

ML14314A071).

4. Spent Fuel Project Office Interim Staff Guidance – 16, “Emergency Planning,” dated June 14, 2000 (ADAMS Accession No. ML003724570).
5. Nuclear Energy Institute (NEI) 99-01, Revision 6, “Methodology for Development of Emergency Action Levels,” November 2012 (ADAMS Accession No. ML12326A805).
6. U.S. Nuclear Regulatory Commission and Federal Emergency Management Agency, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” NUREG-0654/FEMA-REP-1, November 1980 (ADAMS Accession No. ML040420012).
7. Letter from U.S. Nuclear Regulatory Commission to Oliver Kingsley, Commonwealth Edison Company, “Certification of Permanent Cessation of Power Operation and Permanent Removal of Fuel from the Reactor for Zion Nuclear Power Station, Units 1 and 2, dated May 4, 1998, (ADAMS Legacy No. 99805080144).
8. Letter from U.S. Nuclear Regulatory Commission to Zion Nuclear Power Station, “Request for Approval of Defueled Station Emergency Plan and Exemption from Certain Requirements of 10 CFR 50.47, “Emergency Plans” – Zion Nuclear Power Station, Unit Nos. 1 and 2 (TAC Nos. MA5253 and MA5254),” dated August 31, 1999, (ADAMS Legacy No. 9909070087).
9. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, “Request for NRC Approval of Changes to the Emergency Plan,” dated May 24, 2004, (ADAMS Accession No. ML041540436).
10. Letter from U.S. Nuclear Regulatory Commission to Zion Nuclear Power Station, “Zion Nuclear Power Station Units 1 and 2 - Defueled Station Emergency Plan Changes for the Plant (TACs L52632 and L52633),” dated December 15, 2004, (ADAMS Accession No. ML043310235).
11. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, “Implementation of Emergency Action Levels Developed from NEI 99-01,” dated May 25, 2007, (ADAMS Accession No. ML04154043671510308).
12. NEI 99-01 Revision 4, “Methodology for Development of Emergency Action Levels,” dated January 2003 (ADAMS Accession No. ML041470143).
13. Letter from U.S. Nuclear Regulatory Commission to Zion Nuclear Power Station, “Emergency Action Level Revisions for Zion Nuclear Power Station (TAC Nos. J00327 and J00328),” dated February 25, 2008, (ADAMS Accession No. ML072680350).
14. Letter from Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission, “Application for License Transfers and Conforming Administrative License Amendments,” dated January 25, 2008, (ADAMS Accession No. ML080310521).
15. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission,

“Request for Exemption to Revised Emergency Planning Rule,” dated June 20, 2012, (ADAMS Accession No. ML12173A316).

16. The NRC approved this exemption request in letter dated March 30, 2015.  
ML053400324
  
17. Letter from Zion Nuclear Power Station to U.S. Nuclear Regulatory Commission, “Submittal of Defueled Safety Analysis Report,” dated November 10, 1998, (ADAMS Accession No. ML12300A258).
  
18. Letter from U.S. Nuclear Regulatory Commission to A.L. Patko Re: “Certificate of Compliance No. 1031 for the NAC International, Inc. Magnastor Cask System,” dated February 4, 2009, (ADAMS Accession No. ML090350509).
  
- 19 Letter from U.S. Nuclear Regulatory Commission to Ms. Susan Perkins-Grew, Director, Emergency Preparedness, Nuclear Energy Institute, Re: “U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 6, dated November, 2012,” dated March 28, 2013, (ADAMS Accession No. ML12346A463)

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Dated: May 14, 2015