UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE RD. SUITE 210
LISLE, IL 60532-4352
August 18, 2014

Mr. John Sauger, General Manager
Zion Restoration Project
Zion*Solutions*, LLC
101 Shiloh Boulevard
Zion, IL 60099

SUBJECT: NRC INSPECTION REPORT 05000295/2014008(DNMS); 05000304/2014008(DNMS); 07201037/2014002(DNMS) – ZION NUCLEAR POWER STATION

Dear Mr. Sauger:

On June 24, 2014, the U.S. Nuclear Regulatory Commission (NRC) completed onsite inspection activities for the second calendar quarter of 2014 at the permanently shut-down Zion Nuclear Power Station in Zion, Illinois. The inspection continued with in-office review through July 15, 2014. The purpose of the inspection was to determine whether activities associated with decommissioning and ongoing spent fuel loading were conducted safely and in accordance with NRC requirements. The enclosed report presents the results of this inspection, which were discussed with members of your staff on July 24, 2014.

During the quarterly inspection period, the NRC inspectors reviewed the licensee's execution of the site decommissioning project focusing on the radiological environmental monitoring program, spent fuel pool safety and spent fuel transfer operations, aspects of the occupational radiation exposure control program, the review of a radioactive waste shipment, and implementation of the corrective action program.

The inspection consisted of an examination of activities at the site as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of Title 10 of the *Code of Federal Regulations* (CFR) Part 50 license and 10 CFR Part 72 general license. Areas examined during the inspection are identified in the enclosed report. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observation of work activities, independent radiation measurements, and interviews with personnel.

Based on the results of this quarterly inspection, one violation of regulatory requirements was identified associated with spent fuel pool area radiation monitor alarm capabilities. The violation is categorized at Severity Level IV (very low safety significance). Since the safety significance of the violation is low and it is documented in your corrective action program, the violation is dispositioned as a non-cited violation (NCV) in accordance with Section 2.3.2 of the Enforcement Policy. Additionally, two violations of minor safety significance are described in the inspection report.

No response is required for the non-cited violation or the violations of minor safety significance. However, if you contest the subject or severity level of the NCV, you should provide a response

within 30-days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Regional Administrator – Region III; and the Director, Office of Enforcement, Washington, DC.

In accordance with Title 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and the enclosed report will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Document Access and Management System (ADAMS), accessible from the NRC's website at http://www.nrc.gov/reading-rm/adams.html.

We will gladly discuss any questions you may have regarding this inspection.

Sincerely,

/RA/

Robert J. Orlikowski, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Docket Nos. 050-00295; 050-00304; 07201037
License Nos. DPR-39; DPR-48

Enclosure:
Inspection Report No. 05000295/2014008(DNMS);
05000304/2014008(DNMS); 07201037/2014002(DNMS)

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REGION III

Docket Nos.:	050-00295; 050-00304; and 072-01037
License Nos.:	DPR-39; DPR-48
Report Nos.:	050-00295/2014-008(DNMS) 050-00304/2014-008(DNMS) 072-01037/2014-002(DNMS)
Licensee:	Zion*Solutions*, LLC
Facility:	Zion Nuclear Power Station (permanently shut-down)
Location:	101 Shiloh Boulevard Zion, IL 60099
Dates:	Onsite Inspection on April 24, 25, April 28 - May 1, May 12 - 16, June 9 -13, June 17 - 21 and June 24, 2014
NRC Inspectors:	Wayne J. Slawinski, Senior Health Physicist Matthew C. Learn, Reactor Engineer Lionel Rodriguez, Reactor Engineer Jeremy E. Tapp, Health Physicist Robert R.Temps, Senior Transportation Safety Inspector
Observer:	David A. Spackman, Nuclear Safety Professional Development Program
Approved by:	Robert J. Orlikowski, Chief Materials Control, ISFSI, and Decommissioning Branch Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

Zion Nuclear Power Station, Units 1 and 2
NRC Inspection Report No. 050-00295/2014-008(DNMS); 050-00304/2014-008(DNMS); and No. 072-01037/2014-002(DNMS)

The Zion Nuclear Power Station is a permanently shut-down and defueled power reactor facility that was maintained in a safe storage (SAFSTOR) condition with spent fuel in wet storage from 1998 through 2010. In 2011, active decommissioning began and continued to varying degrees throughout the inspection period. In late 2013, the spent fuel transfer campaign commenced and is scheduled to continue throughout 2014. This routine safety inspection reviewed the licensee's execution of the site decommissioning project focusing on the radiological environmental monitoring program, spent fuel pool safety, spent fuel transfer operations, aspects of the occupational radiation exposure control program, review of a shipment of radioactive waste and implementation of the corrective action program.

Operation of an Independent Spent Fuel Storage Installation

- The ongoing dry fuel storage cask loading campaign was conducted in a safe and methodical manner. Adequate radiological controls were implemented during fuel transfer operations (Section 1.1).

Self-Assessments, Audits and Corrective Actions

- Issues were being identified at appropriate thresholds of the licensee's organization and entered into the corrective action program. Issues were effectively screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of individual issues, while recurring issues and those with potential increased significance were being evaluated through appropriate means (Section 2.1).

Decommissioning Performance and Status

- Workers followed radiation work permit instructions and were aware of the radiological conditions of the work area. Radiological barriers, postings and area controls satisfied regulatory requirements (Section 3.1).

Spent Fuel Pool Safety

- The spent fuel pool was maintained in accordance with design basis as described in the Defueled Safety Analysis Report (DSAR). No unanalyzed siphon or drain paths were identified. In addition, the current spent fuel pool (SFP) configuration was confirmed to be bounded by the loss of pool water inventory event analyzed in the DSAR. Adequate controls existed to prevent an inadvertent siphoning of the SFP from the use of temporary hoses. Surveillances and monitoring of the SFP were adequate to detect a loss of inventory event in a timely manner and to mitigate adverse impacts (Section 4.1).

- Adequate procedures and instrumentation were in place to maintain the safety of the SFP. The pool was monitored adequately to ensure that negative trends would be identified in a timely manner. However, area radiation monitors used in lieu of a criticality monitoring system in the fuel handling building were not equipped with audible/visible alarms sufficient

to promptly alert workers throughout the building of elevated radiation levels, in violation of 10 CFR 50.68 (Section 4.2).

- The licensee maintained adequate housekeeping in and around SFP areas. SFP chemistry was adequately monitored with calibrated instruments, and controlled to ensure the safe storage of spent nuclear fuel. However, while no FME or fire protection concerns were identified, procedurally driven operational surveillances of the fuel handling building did not include specific guidance to ensure consistent implementation (Section 4.3).

- Procedures for developing spent fuel move packages ensured that criticality safety was maintained in accordance with Plant Technical Specifications.

- The SFP and spent fuel nuclear island (SFNI) were operated and maintained adequately. The corrective action program was used effectively to identify and address equipment issues relevant to continued safe operation of the SFP. Operational procedures were adequate to maintain SFP safety (Section 4.5).

- The licensee maintained alternative make-up sources to the SFP in accordance with current design basis, as specified in the DSAR. Adequate time and resources were available to implement actions if SFP cooling systems were lost (Section 4.6).

Maintenance and Surveillance

- Troubleshooting and repair efforts for SFNI cooling system transients were timely and appropriate to the circumstances. The licensee established appropriate performance criteria and monitored the SFNI cooling system consistent with 10 CFR 50.65 (Section 5.1).

Occupational Radiation Exposure – Radiation Surveys and Job Controls

- Radiological activities in Units 1 & 2 were conducted as specified in radiation work permits and as-low-as-is-reasonably-achievable reviews. Radiation surveys were performed adequately to identify the hazards present (Section 6.1).

Radiological Environmental Monitoring Program

- The radiological environmental monitoring program was adequately developed consistent with industry guidance and regulatory standards. The licensee planned to reestablish food product sampling to conservatively address potential receptor dose from alternate pathways (Section 7.1).

- Annual Radiological Environmental Operating Reports were submitted timely and satisfied NRC required informational content with minor exceptions (Section 7.2).

- Environmental air samples, drinking water and other sample media were collected and analyzed as required. Sample collection, preparation and analyses techniques assured that viable results were obtained and lower-limits of detection were achieved for all nuclides except certain short-lived materials not generated at the site (Section 7.3).

- Hydrogeologic features of the site were adequately evaluated to establish site characteristics. The radiological impact to the groundwater from historic site operations was assessed and continued to be monitored consistent with operating reactor industry initiatives and licensee procedures (Section 7.4).

Packaging and Transport of Radioactive Waste

- A June 21, 2014 shipment of radioactive waste was properly packaged and classified to satisfy applicable regulatory, cask Certificate of Compliance and special NRC authorization requirements with one exception related to cask drawings, resulting in a violation of minor safety significance (Section 8.1).

- A June 21, 2014 radioactive waste shipment was prepared and shipped in accordance with procedure, the cask compliance certificate, and a special NRC authorization with one exception related to a radiation survey, resulting in a violation of minor safety significance (Section 8.2).

Report Details

Summary of Plant Activities

During the quarterly inspection period, active decommissioning work was ongoing at the site and consisted of continued segmentation of the Unit-1 and Unit-2 reactor vessel internals, waste packaging and shipment activities, preparations for batch discharges of liquid effluents, and continuing efforts to re-baseline project scheduling. Spent fuel transfer operations commenced in late 2013, and continued throughout the inspection period.

1.0 Spent Fuel Transfer and Independent Spent Fuel Storage Installation (ISFSI) Operations (IP 60855.1)

a. Inspection Scope

The inspectors evaluated the licensee's loading of multiple canisters during the ongoing spent fuel storage campaign to assess compliance with the cask Certificate of Compliance, Technical Specifications, regulations, and associated procedures.

The inspectors observed loading of spent fuel assemblies from the spent fuel pool (SFP) into the transportable storage canisters (TSCs) and heavy loads movements inside the fuel handling building (FHB) as a means to assess performance and procedure compliance. Heavy loads activities assessed included: lifting of the TSC lid onto the TSC within the SFP, lifting of the TSC within the transfer casks from the SFP to the cask preparation area and lifting of the TSC within the transfer cask from the preparation area to the canister transfer location. The inspectors also observed heavy loads operations outside of the FHB including: transfer of the VCC from within the FHB to outside of the FHB on a low profile cask transfer cart, and transfer of the VCC to the ISFSI pad.

The inspectors evaluated TSC processing operations including: decontamination and surveying, TSC welding, visual weld testing, liquid penetrant weld testing, TSC draining, vacuum drying and helium backfilling.

During performance of the activities, the inspectors evaluated the licensee staff's familiarity with procedures, supervisory oversight, and communication and coordination between working groups. The inspectors reviewed loading and monitoring procedures and evaluated the licensee's adherence to these procedures.

The inspectors interviewed licensee staff and management to assess knowledge of and compliance with regulatory requirements. The inspectors also performed walkdowns of the ISFSI pad to assess the material condition of the pad and loaded storage casks. The inspectors attended licensee briefings including both pre-job briefs and in-field briefs to assess the licensee's ability to identify critical steps of the evolution, potential failure scenarios, and tools to prevent errors.

The inspectors reviewed corrective action reports and the associated follow-up actions that were generated during the inspection quarter. The inspectors also reviewed selected 10 CFR 72.48 screenings, and non-conformance reports for adequacy.

b. Observations and Findings

During the inspection quarter the licensee had completed loading a total of 25 of 61 planned spent fuel VCCs on the ISFSI pad.

The inspectors found that the licensee generally utilized human performance tools effectively. For example, three way communications, peer and self-check, circle slash for procedural tracking, and two minute drills. In addition, the inspectors observed the licensee consistently make conservative decisions to address issues that arose during the loading campaign.

The inspectors found that the licensee performed work and controlled activities using appropriate health physics practices. The licensee maintained consistent communications between radiation protection and the other work groups in the field. The inspectors found that contamination and radiation levels for the TSC, MTC, and VCC cask were below the regulatory, TS, and administrative limits during the loading process. Radiological controls and radiation surveys were conducted appropriately as required by site procedures commensurate with the work performed.

The inspectors noted that when issues were encountered during loading activities, the licensee entered the issues into their corrective action program and initiated appropriate corrective actions to remediate the issues**.**

No violations of significance were identified.

c. Conclusions

The licensee performed the ongoing loading of the dry fuel storage casks in a safe and methodical manner. During observations of field work, the inspectors determined that adequate radiological controls were used by the licensee.

2.0 Self-Assessments, Audits and Corrective Actions (IP 40801)

2.1 Identification, Resolution and Prevention of Problems

a. Inspection Scope

The inspectors reviewed self-assessments, quality assurance (QA) surveillance and QA audit reports related to the radiological environmental monitoring and spent fuel pool safety programs conducted by or for the licensee in 2013 through mid-2014. The review was performed to determine whether the licensee's evaluative efforts were sufficient to assess the subject areas, and to determine whether identified issues were captured in the corrective action program (CAP) and addressed.

The inspectors reviewed fuel transfer campaign CAP documents and the associated follow-up actions generated since the NRC's first quarter 2014 inspection (Inspection Report Nos. 050-00295/14-007(DNMS); 050-00304/14-007(DNMS); 072-01037/14-001 (DNMS)). The inspectors reviewed a variety of other CAP documents that were generated during the quarterly inspection period to determine if a sufficiently low threshold for problem identification existed, to determine the quality of followup evaluations including extent of condition, and to determine whether the licensee assigned

timely and appropriate prioritization for issue resolution. Repetitive issues and those with the potential for safety or regulatory significance were evaluated further by the inspectors to determine whether apparent and/or common cause evaluations were being pursued by the licensee.

b. Observations and Findings

The inspectors found that the licensee's environmental and spent fuel pool safety program assessments were performed by personnel knowledgeable of the subject matter and reached conclusions that were supported by the assessment results. Adequate corrective actions were taken for assessment identified issues.

The inspectors determined that individual issues were identified by the licensee at an appropriate threshold and entered into the CAP. Issues were effectively screened and prioritized through the management review committee process and evaluated commensurate with safety significance. For individual issues, the licensee implemented adequate actions to resolve the immediate concern. The inspectors also found that the scope and depth of evaluations for identified problems was adequate in that they addressed the significance of issues and assigned a course of corrective action.

In 2012, a licensee consultant performed an evaluation of the radiological environmental monitoring program (REMP) in response to a non-cited violation documented in NRC Inspection Report 05000295/2012-007(DNMS); 05000304/2012-007(DNMS). The evaluation prompted enhancements to the REMP; however, the evaluation did not fully address potential compliance issues associated with environmental air sampling stations located in meteorological sectors with the highest calculated deposition. Following additional licensee and NRC review during the quarterly inspection, the inspectors concluded that air samplers were located appropriately to bound public dose from gaseous effluents (refer to Section 7.1).

No findings of significance were identified.

c. Conclusions

Issues were being identified at appropriate thresholds of the licensee's organization and entered into the CAP. Issues were effectively screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of individual issues, while recurring issues and those with potential increased significance were being evaluated through appropriate means.

3.0 Decommissioning Performance and Status Review (IP 71801)

3.1 Plant Tours/Walkdowns

a. Inspection Scope

The inspectors conducted plant tours throughout the inspection period to observe field conditions, to discuss radiological safety with workers, and to assess the impact of work activities on safe decommissioning. Walkdowns were conducted in the Containment Buildings, the Auxiliary Building and in select outdoor areas where radioactive materials or waste was stored. During these walkdowns, the inspectors evaluated material

condition and housekeeping, area radiological conditions, radiological access control and associated posting/labeling, and reviewed the overall condition of systems, structures and components that support decommissioning. Independent radiation measurements were made by the inspectors in areas toured to determine if those areas were controlled properly and posted as prescribed in 10 CFR Part 20.

b. Observations and Findings

The inspectors found that controls associated with work in Unit-1 & Unit-2 Containment Buildings included those required to prevent unauthorized entry into contaminated areas, high and locked high radiation areas and for purposes of control over radioactive material quantities of concern (RAMQC) were adequate.

During walkdowns, the inspectors found that work coverage provided by the radiation protection staff was adequate for the work observed. The inspectors found that personnel were aware of job controls specified in work instructions and demonstrated proper radiological awareness.

No findings of significance were identified.

c. Conclusions

Workers followed radiation work permit instructions and were aware of the radiological conditions of the work area. Radiological barriers, postings and area controls satisfied regulatory requirements.

4.0 Spent Fuel Pool Safety (IP 60801)

4.1 Siphon and Drain Protection

a. Inspection Scope

The inspectors performed walk-downs of the spent fuel pool (SFP) during the week of May 12, 2014, and reviewed SFP system drawings to determine whether conditions existed that could siphon or drain water out of the SFP. The walk-downs included portions of the fuel handling building (FHB) that contain support systems for the SFP such as the heat exchanger and SFP pump rooms.

The inspectors interviewed licensee staff, and reviewed site documents such as the Defueled Safety Analysis Report (DSAR) to ascertain design basis information for the SFP, the transfer canal and weir gate.

The inspectors accompanied an operator on May 14, 2014, to assess how siphon and drain protection were evaluated during routine surveillances of the SFP. The inspectors also reviewed the most current SFP liner and transfer canal leakage surveillance results to determine the integrity of the SFP structure. Finally, the inspectors reviewed the licensee's abnormal operating procedures (AOPs) to determine if proper actions were established for a SFP loss of inventory event.

b. Observations and Findings

Inspector walk-downs revealed no unanalyzed siphon or drain paths that could drain water from the SFP. The inspectors observed that a hard-piped manifold had recently been installed near the surface of the pool water to support dry cask activities. Inspectors confirmed that the pipes penetrated less than two feet into the water and could not siphon water from the pool below the Technical Specification required level.

The inspectors reviewed design drawings and determined they accurately depicted the SFP and its supporting equipment consistent with the DSAR. A small discrepancy was identified between a drawing and the actual configuration for pipes/hoses from a make-up water source to the SFP because the final changes to the controlled drawing had not yet been incorporated, as allowed by the licensee's engineering change process.

The inspectors noted that the weir gate which allows the SFP to be isolated from the transfer canal had been removed and was stored on a stand in the SFP. The transfer canal was flooded and in communication with the SFP. The transfer canal was equipped with two isolation valves, one on each unit, to prevent SFP water from reaching the Unit-1 and Unit-2 reactor vessel cavities. Additionally, blind flanges on the ends of the transfer canal provided a second barrier to prevent loss of SFP water into the reactor vessel cavities.

During the inspection, both Unit-1 and Unit-2 reactor vessel cavities were water filled so visual observation of potential leakage past the blind flanges was not possible. The inspectors determined from discussions with licensee staff, review of SFP level monitoring instruments and thru operational surveillances that adequate methods existed to identify leakage into or out of the SFP in the unlikely event that the transfer canal isolation valves and the blind flanges fail successively. Additionally, data from the licensee's weekly sampling of SFP water chemistry was used to detect changes indicative of possible leakage. Consequently, the inspectors concluded that leakage identification mechanisms were adequate to allow timely actions should problems arise.

The inspectors reviewed a 10 CFR 50.59 evaluation for the removal of the weir gate to ensure that the current configuration was bounded in the DSAR accident analyses. Section 5.1.2, "Loss of Spent Fuel Pool Inventory," of the DSAR discussed an accident scenario where the weir gate failed and pool water drained into an empty transfer canal. The discussion credited the isolation valve and blind flange on each end of the transfer canal to prevent additional SFP inventory loss. The DSAR also analyzed a rupture of the SFP cooling water pump return line as the bounding accident scenario for a loss of SFP inventory. The inspectors determined that if either an isolation valve or a blind flange failure occurred with the current SFP and transfer canal configuration, the redundant isolation features would prevent a loss of SFP inventory. The inspectors noted that the licensee's application of single failure criteria aligned with the guidance found in ANSI/ANS-58.9-1981, "Single Failure Criteria for Light Water Reactor Safety-Related Fluid Systems." Therefore, the inspectors determined that the removal of the weir gate did not create a more severe accident than the return line rupture analyzed in the DSAR.

During the operator surveillance accompaniment on May 14, 2014, the inspectors observed that there were no temporary hoses routed into the SFP; however, the surveillance procedure had no specific criteria to identify temporary hoses that could

present a siphon path from the SFP. A review of licensee procedures, other documentation and interviews with licensee personnel disclosed that adequate controls were in place to prevent a siphoning event from the use of temporary hoses.

The inspectors reviewed the most current SFP liner and transfer canal leakage surveillance results and verified that the documented leakage rate was orders of magnitude below the maximum allowed rate. A review of the licensee's abnormal operating procedures relating to a loss of inventory event of the SFP demonstrated adequate actions to restore SFP water level and mitigate adverse effects from such events.

No findings of significance were identified.

c. Conclusions

The spent fuel pool was maintained in accordance with design basis as described in the DSAR. No unanalyzed siphon or drain paths were identified. In addition, the current SFP configuration was confirmed to be bounded by the loss of SFP inventory event analyzed in the DSAR.

Adequate controls existed to prevent an inadvertent siphoning of the SFP from the use of temporary hoses. Surveillances and monitoring of the SFP were adequate to detect a loss of inventory event in a timely manner. In addition, adequate procedures were developed to restore SFP water level and mitigate the adverse effects of a loss of inventory event.

4.2 SFP Instrumentation, Alarms, and Leakage Detection

a. Inspection Scope

On May 14, 2014, the inspectors accompanied an operator during one of the daily surveillance rounds of the fuel handling building to review the licensee's monitoring process for the SFP, and the actual conditions of the SFP. The inspectors also reviewed the licensee's procedures for monitoring spent fuel parameters and toured the control room to observe the licensee's SFP monitoring equipment readouts.

Additionally, the inspectors reviewed documentation for SFP monitoring equipment to determine whether the equipment was functionally tested, calibrated and provided the desired monitoring information. This review included the most recent results of the SFP parameter alarm system functional test. The inspectors also reviewed the documented results of SFP evaluations for a recent heat-up test.

b. Observations and Findings

The SFP surveillance observed by the inspectors was well documented. All pool parameters observed, including level and temperature, were within the required acceptance criteria. The SFP cooling equipment was operational and had no indications of problems. The frequency of operator rounds was sufficient to detect negative trends of SFP parameters.

The inspectors toured the control room and observed the licensee's SFP monitoring

capabilities. The inspectors found that control room operators were cognizant of annunciator alarm response procedures. The licensee utilized a SFNI Data Acquisition System (DAS) equipped with alarming pager capability to provide real time monitoring of SFP parameters such as level, temperature, fuel building radiation, SFNI pump and cooling tower operational status. The inspectors reviewed the results of the most recent annual functional test of the DAS alarm system and determined it was completed successfully.

The control room is not constantly manned by operations staff as operators conduct other activities and complete rounds in various areas of the plant. During periods when the control room is not manned, the pager system provides SFP parameter alarm status. Should the pager system activate, operators query the pager system to determine the source of the alarm, which allows for an informed response decision. Response actions, however, are not immediate since the operators return to the control room may take several minutes following pager activation.

The FHB is equipped with two SFP perimeter area radiation monitors (ARMs). The ARMs are used in lieu of a criticality monitoring system to satisfy the requirements of 10 CFR 50.68. The ARMs provide visual and audible alarm indication, triggered by radiation level and set sufficiently low consistent with the provisions of 10 CFR 70.24. The ARMS activate both local area and control room alarms. However, should the ARM alarm, only individuals positioned within a few feet of the alarm panel in the FHB would recognize the condition because of limitations with the audible and visible alarms. Since fuel transfer operations commenced in late 2013, workers routinely occupy areas of the FHB where the ARM alarm could not be seen or heard. Also, as indicated in the paragraph above, operations staff response to an alarming condition is not immediate.

10 CFR 50.68(b)(6) requires that radiation monitors be provided in storage and associated handling areas where fuel is present to detect excessive radiation levels and to initiate appropriate safety actions. Safety actions would consist of prompt withdrawal of personnel to designated low dose area(s) of the FHB or building evacuation. Since the radiation alarm is not audible or visible to workers in all potentially occupied areas of the FHB including those areas routinely occupied during ongoing fuel transfer operations and because control room operator response may not be timely, compliance with 10 CFR 50.68 was not achieved. Specifically, ARM alarms did not allow for appropriate safety actions to be implemented expeditiously. Consequently, a violation of 10 CFR 50.68(b)(6) was identified by the inspectors.

The violation is of greater than minor safety significance because of the potential radiological safety implications should a fuel handling problem emerge, generating excessive radiation levels without immediate worker knowledge. However, since all FHB workers are equipped with electronic dosimetry and because several barriers exist to prevent inadvertent criticality, the violation is classified at Severity Level IV (very low safety significance) as provided in Section 6.7 of the Enforcement Policy. In response to this issue, the licensee installed additional ARMs in the FHB equipped with enhanced alarm capability, then instructed workers in alarm response. The issue is dispositioned as a non-cited violation (NCV) consistent with the Enforcement Policy because the issue was documented in the licensee's corrective action program (CR 2014-000512 and 2014-000560) and met the other NCV criteria in the policy (NCV 05000295/2014-08-01; 05000304/2014-08-01).

Calibration documentation for the SFP level instrument demonstrated that it was properly calibrated and maintained. The inspectors found that pool perimeter area radiation monitors were also properly calibrated. The inspectors determined that the instruments were within the calibration frequency as required by the ODCM. During the inspection period, the licensee identified a discrepancy between the ODCM required calibration frequency and the manufacturer recommended calibration frequency for the ARMs. The issue was placed into the corrective action program and addressed.

One violation of very low safety significance was identified.

c. Conclusions

Adequate processes, procedures and monitoring instrumentation were in place to maintain the safety of the SFP. The pool was monitored adequately to ensure that negative trends would be identified in a timely manner. However, ARMs used in lieu of a FHB criticality monitoring system were not equipped with audible/visible alarms sufficient to promptly alert workers throughout the building of elevated radiation levels, in violation of 10 CFR 50.68.

4.3 SFP Chemistry and Cleanliness Control

a. Inspection Scope

The inspectors performed walk-downs of the SFP during the week of May 12, 2014, and accompanied an operator during their routine surveillance of the SFP on May 14, 2014, to assess the licensee's housekeeping in and around the SFP. The inspectors also reviewed licensee operational procedures related to SFP water chemistry and cleanup controls. In addition, the inspectors reviewed SFP chemistry data from January 2013 to May 2014, to identify any negative trends related to SFP chemistry.

b. Observations and Findings

The licensee conducted fuel transfer operations in the FHB during the inspection. The inspectors did not identify any housekeeping or foreign material exclusion (FME) concerns during walk-downs of the SFP. No items were identified in the SFP which could impact the safe storage of spent nuclear fuel. As mentioned in Section 4.1, the weir gate had been removed and was stored on a fixture along a SFP wall. Through discussions with the licensee, the inspectors were informed that the weir gate storage location was part of the original SFP design.

The SFP and areas immediately adjacent to it were observed to be controlled by the licensee as an FME area. The area was clearly posted and physical barriers were in place to preclude the introduction of foreign materials. The inspectors reviewed FME logs maintained near the entrance to the FME area and determined that the licensee was adequately logging equipment and tools into and out of the FME area, in accordance with procedure. In addition, no transient combustibles were identified which would present a fire hazard near the SFP or its associated equipment.

During the operator surveillance accompaniment on May 14, 2014, the inspectors noted that the surveillance check sheet (PT-0 App D Revision 76) required the operator to verify that there were no loose objects or fire protection concerns near the SFP. The inspectors

observed that the FME surveillance lacked rigor to ensure that the FME program requirements were being met. Similarly, the inspectors observed that the fire protection surveillance also lacked rigor to ensure that fire protection program requirements were being met. The surveillance procedure called for operations staff to assess the adequacy of controls but did not include acceptance criteria for all items assessed. Additional rigor in the surveillances was warranted particularly since dynamic conditions existed inside the FHB due to ongoing dry cask activities. The licensee acknowledged the observations.

During the procedure review, the inspectors noted that the licensee had abandoned the original SFP demineralizers. Inspector walk-downs confirmed that a portable underwater cleanup system was used for maintaining water chemistry and clarity. The SFP water clarity was observed to be adequately maintained.

The inspectors reviewed the weekly SFP chemistry data for the past year and did not identify any negative trends. Boron levels in the pool remained significantly above the minimum Plant Technical Specification required concentration of 500 parts per million (ppm) of boron. The SFP boron concentration was maintained at about 2,100 ppm to support dry cask activities. The inspectors also reviewed the calibration certificates for chemistry titration equipment used to measure SFP boron concentration, and observed a demonstration by the licensee on the use of the equipment. The equipment was determined to be within calibration and the licensee demonstrated proficient use of the equipment.

No findings of significance were identified.

c. Conclusions

The licensee maintained adequate housekeeping in and around SFP areas. However, while no FME or fire protection concerns were identified, the inspectors observed that procedurally driven operational surveillances of the fuel handling building did not include specific guidance to ensure consistent implementation and rigor. SFP chemistry was adequately monitored with calibrated instruments, and controlled to ensure the safe storage of spent nuclear fuel.

4.4 Criticality Controls

a. Inspection Scope

The inspectors reviewed fuel move procedures to determine whether they contained appropriate requirements for the movement of spent nuclear fuel. In addition, the inspectors reviewed the licensee's technical evaluation, 10 CFR 50.59 screening and associated justification for a revision to the surveillance frequency of the spent fuel storage rack boral content test.

b. Observations and Findings

The inspectors determined that fuel move procedures adequately addressed restrictions for the placement of spent fuel in certain locations of the SFP. Specifically, the procedures provided criteria that aligned with the requirements of the Plant Technical

Specifications for placing spent fuel in Region 2 of the SFP when developing fuel move packages.

The inspectors found that the licensee's evaluation to justify extending the frequency of its spent fuel storage rack boral coupon test surveillance was acceptable. The surveillance frequency was extended from 4 to 7 years based on the originally established design basis interval coupled with an assessment of the accumulated radiation dose to the storage racks. The spent fuel storage rack test procedure was revised to reflect the change in the surveillance interval.

No findings of significance were identified.

c. Conclusions

Procedures for developing spent fuel move packages ensured that criticality safety was maintained in accordance with Plant Technical Specifications.

4.5 SFP Operations and Power Supply

a. Inspection Scope

The inspectors toured the SFP and components of the SFNI inside and outside the FHB on the week of May 12, 2014, to determine if systems were being maintained and operated as provided in the DSAR. The inspectors also reviewed a list of corrective action documents to identify any significant equipment issues related to the SFNI. On May 14, 2014, the inspectors accompanied an operator during their rounds in the FHB to observe how SFP related surveillances were performed. In addition, the inspectors reviewed SFP operational procedures to ensure that the licensee had adequate procedures in place to maintain SFP safety.

b. Observations and Findings

The inspectors determined that SFP systems and components conformed to design basis documents. During the walk-downs, the inspectors verified that SFNI components such as heat exchangers, pumps, the SFNI cooling towers, and piping were adequately maintained. Electrical power to the SFNI equipment is provided by two dedicated SFNI busses which receive off-site power. The inspectors did not identify any issues related to the protection of the SFNI busses.

Review of SFP system corrective action documents did not identify significant equipment issues or emerging negative trends. The licensee's corrective action system was effective in identifying and addressing equipment issues to ensure the continued safe operation of the SFP.

Operational procedures reviewed by the inspectors were adequate to maintain SFP safety. Changes made to the SFNI system since the previous NRC inspection in 2012 were reviewed and determined to be incorporated into site procedures. These changes included the abandonment of the original SFP demineralizers, as discussed above, and the re-routing of make-up sources to the SFP. The inspectors also evaluated the licensee's placement of the SFP procedure for lowering level (SOI-75N) on administrative hold. The licensee's administrative hold process allowed the actions taken. In addition,

through discussions with licensee personnel, the inspectors determined that there were no operational scenarios where the licensee would be required to lower the SFP level. If SFP water level was higher than normal, the SFP design is such that any overflow would be routed to the auxiliary building drain system.

During the operator surveillance accompaniment on May 14, 2014, the inspectors noted that the surveillance check sheet (PT-0 App D Revision 76) required the operator to verify that the FHB was being maintained at a negative pressure relative to the outside atmospheric pressure. This surveillance ensured that air flow is from outside into the FHB and thereby prevents an unmonitored release of air from the FHB. If the FHB pressure is not negative, the surveillance requires that the radiation protection department be contacted so that air sampling can be performed to monitor any potential release. During the surveillance, the FHB missile barrier door was opened to permit the entry of a dry cask component into the FHB. When the FHB door was opened, the inspectors observed that the FHB pressure increased but still remained slightly negative compared to the outside atmospheric pressure. During discussions with the licensee, the inspectors were informed that FHB pressure is not verified each time the FHB doors were opened to the outside. The inspectors discussed with the licensee the requirement to monitor any releases from the FHB, or the need to otherwise ensure that no releases occur whenever the missile doors are opened.

During the inspection exit meeting debrief on May 15, the inspectors provided an overall observation related to the licensee's surveillances inside the FHB. The inspectors discussed the value of defining acceptance criteria for all surveillance items to ensure quality standards are understood and consistently applied. Specifically, acceptance criteria or guidance could be provided for monitoring: (1) temporary hoses that could present a siphon path from the SFP; (2) FME program requirements in and around the SFP; (3) fire protection program requirements in and around the SFP; and (4) FHB negative pressure when the building is in its most vulnerable configuration. The licensee acknowledged the observation and planned to enhance the procedure to include specific guidance.

No findings of significance were identified.

c. Conclusions

The SFP and SFNI were operated and maintained adequately. The corrective action program was used effectively to identify and address equipment issues relevant to continued safe operation of the SFP. Operational procedures were adequate to maintain SFP safety; however, the FHB surveillance procedure did not provide guidance sufficient to ensure consistently rigorous implementation.

4.6 SFP Makeup Sources and Future Plans

a. Inspection Scope

The inspectors reviewed the DSAR, Fire Protection Report, licensee procedures, and other licensee documents to understand the current make-up sources for the SFP. The inspector's also walked-down portions of the make-up source lines leading to the SFP during the week of May 12, 2014. The inspectors reviewed the latest SFP heat-up test to verify the length of time the licensee would have to implement corrective actions if

SFP cooling were lost for any reason (including a loss of offsite power). Finally, the inspectors discussed with the licensee future decommissioning plans which could have an impact on the make-up sources to the SFP.

b. Observations and Findings

Through a review of the DSAR, the inspectors noted that make-up water sources to the SFP included the Condensate Storage Tanks, water from the Fire Protection Header (normally fed by Service Water), and from an off-site municipal water supply (City of Zion water). The inspectors' walked-down portions of the water transfer lines from the Condensate Storage Tanks and municipal water into the SFP. Through a review of the Fire Protection Report and discussions with the licensee, the inspectors noted that the fire protection header was supplied by two service water pumps that draw suction from the Crib House forebay. The Crib House forebay was directly supplied by Lake Michigan. In the event that the fire protection header pressure cannot be maintained by the two service water pumps, a motor-driven fire pump would automatically start and supply the header. The motor-driven fire pump also drew suction from the Crib House forebay. In the event of a loss-of-offsite-power, a written agreement was made with the local municipality for the Zion fire department to pressurize the fire protection header with the municipal water supply system.

The inspectors reviewed the last heat-up test of the SFP conducted on September 16, 2013, which demonstrated that the licensee had more than 10 days before the SFP water would begin to boil on a loss of cooling event. Therefore, if SFP cooling were lost for any reason, including a loss of offsite power, the licensee would have adequate time available to implement corrective actions to ensure SFP safety.

The licensee discussed with the inspectors proposed changes to the plant that would reduce the number of make-up sources for the SFP from three to two, and reduce the capability of the fire protection header to be pressurized by alternate means. Specifically, the licensee discussed three potential changes as part of their decommissioning plans. The first is the removal of the Condensate Storage Tanks as a make-up source to the SFP. The second is a change to the fire protection system that eliminates use of the service water system to pressurize the fire protection system. Sections of fire protection piping would be eliminated and water supply for the system would be derived from the municipal water supply, not the Crib House forebay which is fed by Lake Michigan. The licensee would retain the option of pressurizing the remaining fire protection system piping with municipal water through the use of Zion fire department equipment. The third change would involve the replacement of the two service water pumps with a single service water pump that would draw suction from the Crib House forebay. The means for supplying the remaining fire protection piping with water from this service water pump are being evaluated by the licensee.

No findings of significance were identified.

c. Conclusions

The licensee maintained three make-up sources to the SFP in accordance with current design basis, as specified in the DSAR. Adequate time and resources were available to implement actions if SFP cooling systems or power were lost.

5.0 Maintenance and Surveillance (IP 62801)

5.1 Maintenance and Troubleshooting

a. Inspection Scope

The inspectors reviewed troubleshooting efforts and follow-up maintenance for emergent issues that occurred during the inspection period associated with the SFNI cooling system. The review was performed to determine whether the licensee had evaluated the impact of the problem on the operability of the systems including the impact of removing individual components from service, the use of redundant systems and/or the effect on other site components or capabilities. The execution of repairs, post maintenance testing and operability determinations were also reviewed.

b. Observations and Findings

In April 2014, the licensee experienced a SFNI system transient related to the SFNI secondary cooling system (CR-2014-000410). During the weekly routine swap of the SFNI standby pump, suction pressure decreased unexpectedly. Cooling system flow dropped about 12% and discharge pressure about 20% on one of the cooling trains. However, spent fuel pool system flow and pressure was maintained within an acceptable range using the alternate train as redundant pumps and cooling towers are provided which can be aligned in various configurations. Troubleshooting efforts and remedial actions were undertaken by the licensee. Those actions temporarily rectified the immediate issue; however, the problem continued when systems were realigned. The licensee initially suspected that the pressure reductions were caused by debris in the form of calcium scale deposited in the common suction piping and cooling tower strainers.

The inspectors found that the licensee's troubleshooting and repair efforts were timely, appropriate to the circumstances and approved by operations management. Subsequent inspections with a boroscope did not identify the suspected obstructions. During the boroscope inspection, the SFP cooling risk was elevated to a licensee defined 'yellow' risk category but returned to 'green' (normal) risk shortly thereafter. The inspectors determined that the licensee established appropriate performance criteria and monitored the SFNI cooling system consistent with 10 CFR 50.65.

At the time of the inspection the licensee continued to troubleshoot the issue because they had not yet isolated the cause of the cooling pump suction pressure degradation. Throughout the transient, both cooling towers remained operable although one tower was degraded for limited periods of time. The inspectors determined that the licensee maintained adequate cooling capability for the SFP throughout the period of degraded flow. One of two SFNI secondary cooling system trains is sufficient to cool the SFP, and the two trains can be cross-connected providing the licensee greater flexibility for cooling the SFP. In addition, based on the last heat-up test of the SFP, more than 10 days was conservatively available before pool water would begin to boil on a loss of cooling event without makeup water added.

No findings of significance were identified.

c. Conclusions

Troubleshooting and repair efforts for SFNI cooling system transients were timely and appropriate to the circumstances. The licensee established appropriate performance criteria and monitored the SFNI cooling system consistent with 10 CFR 50.65.

6.0 Occupational Radiation Exposure (IP 83750)

6.1 Radiological Surveys and Job Controls

a. Inspection Scope

The inspectors reviewed radiological surveys, radiation work permits (RWPs) and as-low-as-is-reasonably-achievable (ALARA) reviews for selected activities that presented radiological risk to workers. The review was performed to determine whether the licensee developed appropriate measures to identify hazards and means to mitigate potential consequences. During walkdowns, the inspectors observed work activities to assess whether the controls established aligned with those specified in the RWPs and ALARA reviews and were adequate to minimize worker radiation exposure.

The inspectors reviewed radiological survey practices and observed the controls for internals segmentation and liner extraction from the flooded reactor cavities. Additionally, the inspectors reviewed the planning, job briefings and observed the initial attempts to extract the partially segmented Unit-2 lower core assembly from the cavity pool.

b. Observations and Findings

The inspectors found that radiologically risk significant activities were evaluated and controls were prescribed as ALARA measures as require by 10 CFR 20.1101. Work in the containment buildings was observed to be controlled adequately to prevent the creation of airborne hazards and to reduce external dose.

The licensee exercised caution when potential rigging issues emerged during attempts to relocate the Unit 2 lower casting assembly into Unit 1. The licensee postponed the work until the task was reevaluated, approved by management and all involved staff were re-briefed.

No findings of significance were identified.

c. Conclusions

Radiological activities in Units 1 & 2 were conducted as provided in RWPs and ALARA reviews. Radiation surveys were performed adequately to identify the hazards present.

7.0 Radiological Environmental Monitoring Program (IP 84750)

7.1 Program Development, Modifications and Adjustments

a. Inspection Scope

The inspectors reviewed the DSAR for information regarding the environmental monitoring program and meteorological monitoring instrumentation. The inspectors reviewed the Offsite Dose Calculation Manual (ODCM) to identify environmental monitoring stations and evaluated the location of these stations and the types of samples collected from each to determine if they were consistent with the ODCM and NRC guidance provided in NUREG-1301, "Offsite Dose Calculation Manual Guidance – Standard Radiological Effluent Controls for Pressurized Water Reactors," Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes, and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light Water Cooled Nuclear Power Plants," Regulatory Guide 4.1, "Radiological Environmental Monitoring for Nuclear Power Plants," and in NRC Radiological Assessment Branch Technical Position, November 1979, "An Acceptable Radiological Environmental Monitoring Program." The inspectors also reviewed licensee self-assessments performed since 2012 related to REMP areas. The inspectors determined if ODCM required detection sensitivities were met for various sample media (i.e., the samples meet required lower limit of detection (LLDs)). The inspectors reviewed the results of the vendor's analytical laboratory quality control program, including the interlaboratory comparison program, to determine the adequacy of the environmental sample analyses provided by the vendor.

The inspectors evaluated changes made by the licensee in response to a non-cited violation (NCV 05000295/2012-07-01; 05000304/2012-07-01). The inspectors reviewed modifications to the ODCM resulting from ongoing facility decommissioning activities, changes to the land use census, changes prompted by updated meteorologically based deposition calculations and socioeconomic impacts to determine if the existing radiological environmental monitoring program (REMP) reflected current site conditions. Overall, the evaluation was conducted to determine whether the licensee performed the reviews required to ensure that changes to the REMP did not affect the ability to monitor the impact of radioactive effluent releases on the environment and thereby validate the capability of the effluent monitoring program.

b. Observations and Findings

As described in the DSAR, the purpose of the REMP is to provide data on measurable levels of radiation and radioactivity in the environment to relate these data to radioactive emissions. The environmental monitoring program implements Section IV.b.2 of Appendix I to 10 CFR 50 and thereby supplements the radiological effluent monitoring program by verifying that measurable concentrations of radioactive material are not higher than expected on the basis of effluent measurements and exposure pathway modeling.

In 2012, the licensee evaluated the REMP in response to NRC identified issues described in Inspection Report No. 05000295/2012-07(DNMS); 05000304/2012-07(DNMS). As a result of that evaluation, in 2013, the licensee reestablished an outer (offsite) ring of thermoluminescent dosimeters (TLDs), added TLD and air sample control stations, and expanded the land use census to include gardens greater than a specified size in each meteorological sector within 5 miles of the site. The inspectors determined that the 2012 evaluation correctly concluded that sampling of broad leaf vegetables was not required because site effluent releases were not from elevated release points. The inspectors also determined that the licensee's evaluation correctly concluded that a supplemental environmental air sampling station in the vicinity of the community having

the highest calculated ground level deposition was bounded by an existing air sample station, identified as location Z-01.

The inspectors found that existing environmental air sample stations provided measurements of radioactive material in the exposure pathways with the highest radiation exposure to individuals given potential occupancy; therefore, compliance with regulatory standards was achieved. The inspectors questioned why no air sampler station was positioned in the meteorological sector with the highest calculated deposition that could potentially be occupied by the public on a limited basis. Specifically, the inspectors challenged the licensee about a small portion of sector "C" that was land-based beachfront and potentially accessible to the public. Following additional review, the inspectors concluded that access to the small beachfront area was controlled by the licensee to preclude occupancy; therefore, air sampling in that location was not necessary to achieve regulatory compliance. Since batch liquid effluent discharges to Lake Michigan commenced in June 2014 after several years of inactivity, the licensee planned to reestablish sampling of root/tuberous vegetables. Broad leaf vegetable sampling was also being considered by the licensee as a conservative measure. The licensee generated CR 2014-000708 to capture the planned enhancements to the REMP.

No findings of significance were identified.

c. Conclusions

The REMP was adequately developed consistent with industry and regulatory standards. The licensee planned to reestablish food product sampling to conservatively address potential receptor dose from alternate pathways.

7.2 Review of Annual Radiological Environmental Operating Reports

a. Inspection Scope

The inspectors reviewed the 2011, 2012 and 2013 Annual Radiological Environmental Operating Reports (AREORs), and discussed environmental monitoring results for 2014 to determine if the REMP was implemented as required by technical specification and the ODCM. The inspectors reviewed the environmental reports for changes to the ODCM with respect to environmental monitoring, commitments in terms of sampling locations, monitoring and measurement frequencies, land use census, interlaboratory comparison program, and analysis of radiological environmental sample data.

The inspectors reviewed each situation documented in these reports which involved a missed sample, inoperable sampler, lost TLD, or anomalous measurement for the cause and corrective actions. Additionally, the inspectors reviewed the licensee's assessment of sample results that did not meet lower-limit-of-detection thresholds to determine the cause and plans to correct. The inspectors reviewed the associated radioactive effluent release data that was the likely source of any positive sample result, if applicable.

b. Observations and Findings

The inspectors determined that the AREORs were submitted to the NRC in a timely manner and that the informational content satisfied regulatory criteria. The reports included summaries, interpretations and analyses of results and trends including

comparisons with prior reports and historical data. The analyses data demonstrated that decommissioning operations had not impacted the environment as the results were not discernible from preoperational environmental data.

The inspectors found that the licensee continued to experience problems to achieve industry acknowledged LLDs for certain short-lived fission products in water samples. Specifically, almost 50 % of the water samples collected were not analyzed timely, which impacted laboratory detection capabilities for Barium-140/Lanthanum-140 (short lived nuclides). To address this issue, the licensee planned to revise the REMP to eliminate analyses for nuclides which are not generated at the Zion Station. The inspectors identified other minor administrative deficiencies in the AREORs that were not compliance based, but which indicated that additional attention to detail was necessary to ensure annual reports were accurate and information was consistently conveyed. Condition Report No. CR 2014-000708 was generated to document and address the issues identified.

No findings of significance were identified.

c. Conclusions

Annual Radiological Environmental Operating Reports were submitted timely and satisfied NRC required informational content with minor exceptions.

7.3 Program Implementation, Maintenance, and Oversight

a. Inspection Scope

The inspectors walked down all of the licensee's environmental air sampling stations plus several of the TLD monitoring stations to determine whether they were located as described in the ODCM and to determine the material condition of the equipment. Each station walked down was also examined to assess monitoring station orientation relative to plant effluent release locations, to assess equipment configuration, and to determine whether vegetation growth control allowed for the collection of representative samples. The inspectors evaluated the environmental drinking water sampling locations to determine the suitability of each in complying with REMP requirements.

The inspectors accompanied the licensee's contractor sampling technician and evaluated the methods used to collect drinking water samples, to change-out air particulate samples and to observe use of the field rotometer used to measure air sample pump flow. At each location, the inspectors determined whether environmental sampling was representative of the release pathways as specified in the ODCM and that sampling techniques were consistent with the vendors sampling procedures manual.

The inspectors also walked-down the licensee's meteorological tower and reviewed meteorological instrument availability and positioning, maintenance and instrument calibration data for the two year period that preceded the inspection. The review was performed to determine if meteorological instruments were maintained in accordance with the DSAR, and as provided in Regulatory Guide 1.23, Safety Guide 23, "Onsite Meteorological Programs." Additionally, the inspectors reviewed air sample pump field test and preventative maintenance records for 2012, 2013 and through April 2014, as well as field and master rotometer calibration data to determine if that equipment was

maintained consistent with the contractor's sampling procedures manual.

The inspectors reviewed the licensee's assessment of any unexpected analysis results, biased or anomalous data and the overall effect on the REMP, to determine the level of licensee engagement in the environmental sampling program.

b. Observations and Findings

The inspectors found that the environmental air sampling stations were located as described in the ODCM and were oriented in a manner to provide appropriate sampling of plant airborne effluents. The inspectors found that the environmental air sample pumps were properly maintained and in working order. The inspectors found that vegetation growth around air sampling stations was controlled as specified in the vendor's sampling procedures manual. Also, the inspectors noted that the sample technician followed air sample filter change-out and water sampling protocols, and had corrected previous NRC inspection issues documented in Inspection Report No 05000295/2012-007(DNMS); 05000304/2012-007(DNMS). The inspectors also found that licensee oversight of contractor activities had improved since the previous inspection.

The inspectors determined that the meteorological tower was properly sited and associated measuring instruments were operable, calibrated, and maintained in accordance with NRC Safety Guide 23. The inspectors verified that the meteorological data readout and recording instruments in the control room were functional. The inspectors compared readout data (i.e., wind speed, wind direction, and delta temperature) in the control room and at the meteorological tower and discussed with the licensee the recording system capabilities to conclude that data was sampled and compiled consistent with the aforementioned safety guide.

The inspectors verified that the appropriate detection sensitivities were utilized for counting samples and lower-limits-of-detection were achieved other than as specified in Section 7.2. Review of the REMP sample vendor's quality control program and interlaboratory comparison results demonstrated the adequacy of the vendor's program including a corrective action program to address identified deficiencies and to prevent recurrence.

No findings of significance were identified.

c. Conclusions

Environmental air sampling, TLDs, drinking water and other sample media were collected and analyzed as required by the ODCM. Sample collection, preparation and analyses techniques assured that viable results were obtained and lower-limits of detection were achieved for all nuclides except certain short-lived materials no longer generated at the site.

7.4 Hydrogeologic Evaluations and Groundwater Monitoring

a. Inspection Scope

The inspectors determined if the licensee performed a characterization of site geology and hydrology to identify the predominant ground water gradients and potential pathways

for groundwater migration from onsite locations to offsite locations. The inspectors also determined if an onsite radiological ground water monitoring program had been implemented to monitor for potential radioactive leakage into groundwater. The inspectors selected components and structures that presented a mechanism for licensed material to potentially reach groundwater, and determined whether the licensee had implemented an adequate means to detect the impact on groundwater from these components and structures as future site remediation occurs.

b. Observations and Findings

In 2006, the license holder for the Zion Station completed an evaluation of the hydrogeologic characteristics of the site and assessed the impact of historical station operations on the groundwater through a network of monitoring wells installed for that purpose. The initial hydrogeologic investigation report was issued in 2006, and was reevaluated by the licensee in 2011. The reevaluation was conducted based, in part, on groundwater quality and groundwater level data accumulated since the 2006 study, supplemented by five years of radiological monitoring results.

The inspectors reviewed the monitoring well locations, depths, current sampling frequency and associated analysis results and determined that the licensee had implemented an adequate radiological groundwater monitoring program. Inspector walk-downs showed that all well sampling heads were in good physical condition, demarcated and properly controlled to prevent potential tampering or inadvertent damage. Methods for sample collection were found to be adequate and provided for representative results. Inspector identified issues documented in Inspection Report 05000295/2012-007(DNMS); 05000304/2012-007(DNMS) were addressed through procedure modifications. However, the inspectors noted that current site personnel did not have a thorough understanding of the radiological groundwater protection program due to site reorganization and unanticipated staffing changes. As a result, program oversight diminished which caused certain radiological analyses to be initially missed, but subsequently licensee identified and performed.

No findings of significance were identified.

c. Conclusions

Hydrogeologic features of the site were adequately evaluated to establish site characteristics. The radiological impact to the groundwater from historic site operations was assessed and continues to be monitored consistent with operating reactor industry initiatives and licensee procedures.

8.0 Solid Radwaste Treatment and Transportation (IP 86750)

8.1 Packaging and Characterization of Irradiated Hardware

a. Inspection Scope

The inspectors selectively reviewed the licensee's supporting documentation associated with a Class C radioactive waste (radwaste) shipment of irradiated hardware in a Type B(U) cask to assess compliance with the requirements of 10 CFR Part 20 and Part 71, and the applicable Certificate of Compliance (CoC No. 9168) for the cask. The shipment

consisted of activated metals from the Unit-2 reactor vessel internals. An associated authorization (special authorization) for the licensee's use of the cask issued March 8, 2014 by the NRC Division of Spent Fuel Storage and Transportation was also reviewed to determine whether use of the cask conformed to NRC limitations.

b. Observations and Findings

Shipment Packaging

The inspectors determined that the licensee complied with 10 CFR 71.3 and 71.17, and the NRC special authorization dated March 18, 2014, for the June 21, 2014 shipment of activated metals using the Model No. 8-120B package, with one exception. The exception is described below.

10 CFR 71.3, "Requirements for License," states, in part, that except as authorized in a general license, no licensee may deliver licensed material to a carrier for transport. 10 CFR 71.17, "General License NRC-approved Package," grants the licensee a general license to transport, or deliver to a carrier for transport, NRC licensed material in a package for which a CoC or other approval has been issued by the NRC. 10 CFR 71.17 requires, in part, that the general licensee register with the NRC as a user of the package and comply with the terms and conditions of the CoC or other approval. Additionally, the licensee is required to maintain:

- a quality assurance program approved by the Commission as satisfying the provisions of subpart H of Part 71;
- a copy of the CoC or other approval of the package; and
- the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging, and actions to be taken before shipment.

The inspectors determined that the licensee satisfied 10 CFR 71.17 except for the requirement related to drawings referenced in the CoC because the licensee did not maintain current cask drawings. The licensee subsequently obtained the revised drawings from the CoC holder and generated CR 2014-000694 to document the compliance issue. The failure to maintain the correct revision of the CoC-referenced drawings is categorized as a violation of minor safety significance that is not subject to formal enforcement action as provided in Section 2.3 of the Enforcement Policy. The issue did not affect the licensee's ability to safely complete shipments using the cask.

The CoC states that the package be used and prepared for shipment in accordance with Chapter 7 of the application, as supplemented. The inspectors found that the operating instructions for package loading contained in the current revision of the Safety Analysis Report (SAR), Consolidated Revision 7 dated November 2013, aligned with the licensee's implementing procedure (TR-OP-035) for the cask. The inspector also found that the CoC holders "Cask Book" for the 8-120B package and the licensee's procedure contained the applicable steps from the cask SAR along with more detailed instructions related to operation and handling of the package.

Shipment Characterization

The licensee classified the June 21, 2014 radwaste shipment as Class C using appropriate methodologies consisting of neutron activation analyses, dose rate

information in combination with dose-to-curie derivations from Microshield modeling, and 10 CFR 61 analysis data. The inspectors found that the licensee's method to quantify the removable contamination on the surfaces of the activated metals was acceptable to demonstrate that the removable contamination limits specified in the March 18, 2014 special authorization were met. The licensee applied removable contamination data from reactor coolant system piping which demonstrated that contamination levels of shipment hardware were well below the limits prescribed by the special authorization. Although the licensee used average concentration values for each radionuclide rather than the highest values, the inspectors determined through independent calculations that requirements were met had the most conservative values been used instead. Overall, the inspectors determined the waste shipment was adequately characterized and classified as required.

The inspectors verified that the maximum weight of the contents including shoring and secondary containers met the limit in the 8-120B cask CoC. The inspectors found that the licensee's determination of the weights of each activated metal piece loaded into the cask and the total weight of the contents plus liner was less than the maximum specified in the CoC. The inspectors performed independent calculations to verify the accuracy of the licensee's results. Since the total weight of the contents was close to the maximum weight requirement, the inspectors validated load cell calibration as an alternate means to demonstrate that the weight of the shipment was within prescribed limits.

The special authorization required that the radwaste contents consist, in part, of curved core barrel plate sections. In addition, it required that the payloads either be "self-nesting" or stabilized using cribbing to minimize shifting of items during shipment. The inspectors determined through review of selected drawings and shipment survey documents, supplemented by discussions with licensee staff, that the shipment contained core barrel sections that were secured in a liner with adequate cribbing to minimize movement of the plates.

The CoC for the 8-120B cask required radioactive material in the form of activated metals be contained within "secondary containers" that be verified closed using two independent physical verifications. To satisfy this requirement, a metal liner, liner overpack and an engineered bag collectively comprised the secondary container system. Hardware was contained within the metal liner with a bolted top lid, while bottom of the liner contained holes with a mesh screen to allow water to drain from it as the contents were loaded underwater. The lid bolts were physically independently verified to be tight by two workers. The bolted liner was inserted into an overpack with a lid that is closed with spring clips. A combination fiber/plastic engineered bag surrounded the liner and overpack in the shipping cask. The bag was zippered closed and verified to be sealed by two independent workers. The inspectors noted that the basis for the secondary container stated in the cask SAR and NRC Safety Evaluation Report was to prevent the escape of discrete radioactive particles from the secondary container system and potentially reach the annular gap between the primary shipping cask lid and cask bolting flange. The inspectors determined that the licensee's secondary container system was adequate to prevent particle migration.

One violation of minor significance was identified.

c. Conclusions

The licensee properly packaged, characterized and classified a June 21, 2014 radwaste shipment to satisfy applicable regulatory, CoC, and special authorization requirements with one exception, resulting in a violation of minor safety significance.

8.2 Shipment of Irradiated Hardware

a. Inspection Scope

The inspectors observed shipment preparations and loading activities for the shipment of radwaste made on June 21, 2014. The inspectors determined if the shipment was made in accordance with: (1) 10 CFR Part 71; (2) the cask CoC and associated special authorization approved by the NRC; and (3) approved site procedures. The inspectors interviewed licensee personnel performing activities related to this shipment to determine their understanding of the requirements and adherence to procedures.

b. Observations and Findings

The inspectors observed various shipping activities conducted for the shipment of radwaste on June 21, 2014. Specifically, the inspectors observed the pre-job brief, cask receipt surveys, cask readiness surveillances, liner insertion, cask closure and final surveys of the shipping cask to verify that the shipping activities were conducted as required.

The licensee conducted cask preparatory work using procedure TR-OP-035, the licensee's approved handling procedure for the shipping cask. However, as the cask was being closed, the inspectors identified that the cask impact limiter was not surveyed for removable contamination as required in step 5.1.2.7.1 of procedure TP-OP-035. The licensee agreed that a radiation survey had not been performed, so the impact limiter was removed and a survey was performed of the interior surfaces as required. No contamination was detected. The failure to satisfy cask procedure TR-OP-035 loading criteria constituted a violation of minor significance that is not subject to formal enforcement action as provided in Section 2.3 of the Enforcement Policy. The licensee documented the issue in the corrective action program as CR 2014-000700. The inspectors determined that the compliance issue was of minor significance as there were no actual consequences subsequently determined through radiation surveys before shipment departure. The inspectors found that licensee staff was not aware of the requirement to survey the inner surfaces of the impact limiter. Moreover, the inspectors noted that licensee staff had an inconsistent understanding of the requirements in the cask handling procedure.

One violation of minor significance was identified.

c. Conclusions

The June 21, 2014 radioactive waste shipment was prepared and shipped in accordance with procedure to meet the requirements of 10 CFR Part 71, the applicable CoC and an associated special authorization with one exception, resulting in a violation of minor safety significance.

9.0 Exit Meeting

The inspectors presented the results of the inspection to various license managers and other licensee staff during an onsite meeting on July 24, 2014. The licensee acknowledged the results presented and did not identify any of the documents reviewed by the inspectors as proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

*T. Orawiec, Decommissioning Plant Manager, Vice President Operations & Nuclear Security
G. Myers, Projects Manager
*D. Hillyer, Fuels Manager
*D. (Nick) Williams, Vice President, Radiological and Environmental Controls
*G. Van Noordennen, Vice President, Regulatory Affairs
D. Roth, Director, Engineering
*R. C. Keene, Director, Radiation Protection
M. (Shawn) Miller, Manager, Fuel Transfer Operations
M. Wiskerchen, Manager, Waste Operations
*A. Bejma, Manager, Quality Assurance
R. Williams, Manager, Fuel Engineering
*S. Wholers, Regulatory Affairs
H. Morgan, ISFSI Weld Supervisor
J. Smith, ODCM Coordinator

*Participated in exit meeting on July 24, 2014.

INSPECTION PROCEDURES (IPs) USED

IP 60855.1	Operation of an Independent Spent Fuel Storage Installation
IP 40801	Self-Assessment, Auditing and Corrective Action
IP 71801	Decommissioning Performance and Status Review
IP 60801	Spent Fuel Pool Safety
IP 62801	Maintenance and Surveillance
IP 83750	Occupational Radiation Exposure
IP 84750	Radioactive Waste Treatment, Effluent and Environmental Monitoring
IP 86750	Solid Radwaste and Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened & Closed	Type	Summary
05000295/14-08-01 05000304/14-08-01	NCV	SFP area radiation monitor alarms do not allow for timely initiation of safety actions due to audibility

PARTIAL LIST OF DOCUMENTS REVIEWED

ZS-FT-401; TSC Loading Operations; Revision 5

ZS-FT-402; TSC Closure Operations; Revision 11

ZS-FT-403; VCC Loading Operations; Revision 6

ZS-FT-404; Site Transportation; Revision 3

ZS-FT-405; FTO Contingency Plans; Revision 6

ZS-FT-409; Fuel Transfer Operations Lift Plans; Revision 3

ZS-FT-411; Annulus Circulating Water System Operation; Revision 7

ZS-FT-412; Vertical Concrete Cask Pre-Use Inspections; Revision 0

AOP-6.2, Spent Fuel Pool/Transfer Canal Uncontrolled Loss of Level, Current Revision

AOP-6.4, Loss of Spent Fuel Pit Cooling, Current Revision

AOP-8.6, SFNI Loss of Power, Current Revision

CR-2014-000410, Low Suction Pressure on B SFNI Cooling Pump Required Pump Shutdown, dated April 16, 2014

NF-AA-309, Special Nuclear Material & Core Component Move Sheet Development, Revision 6

NF-ZN-310-2000, Special Nuclear Material and Core Component Movement Requirements for Zion Station, Revision 3

PT-0 App. D, Operator Surveillance Check Sheet Defueled, Revision 76

SOI-75, Spent Fuel Pool Operations, Revision 7

SOI-75 App. A, Spent Fuel Pit Cooling Valve Lineup, Revision 7

SOI-75 App. B, SFP Skimmer Valve Lineup, Revision 4

SOI-75 Appendix C, Spent Fuel Nuclear Island Cooling Tower Electrical and Valve Lineup, Revision 6

SOI-75BB, SFNI Cooling System Operation, Revision 6

SOI-75CC, Spent Fuel Pool Cooling System Operation, Revision 2

SOI-75D, Spent Fuel Pit Makeup, Revision 28

SOI-75DD, Spent Fuel Pool Filtration System Operation, Revision 1

SOI-75EE, SFNI DAS Computer, Revision 3

SOI-75V, SFNI Applied Water Technologies Operation, Revision 2

SOI-75W, SFNI Boric Acid Batching and Transfer, Revision 4

Standing Order No. 2013-003, Administrative Protocol During Spent Fuel Dry Cask Storage Campaign, dated October 14, 2013

TSS 15.6.83, Spent Fuel Storage Rack Surveillance, Revision 6

Technical Review Letter TR-010-2013, “Spent Fuel Pool” Boral Coupon Surveillance Schedule Revision,” dated February 25, 2013 & 50.59 Screening for Rack Surveillance Revision, dated February 21, 2013

TSS 15.6.104, Determination of Spent Fuel Pit Liner and Transfer Canal Liner Leakage, Current Revision

TSS 15.6.179 Rev. 3, DAS Alarm System Functional Test, Revision 3

WO 01359724, DAS Alarm System Function Test – TSS 15.6.179, dated June 22, 2011

WO 01565325, Perform Heat Up Test For Fuel Pool, OSP-01-002, Spent Fuel Pool Heat Up Data Collection Procedure, Revision 1, dated September 17, 2013

ZAP 0300-21, Zion Administrative Procedure Station Blackout, Revision 3

ZAP-0400-21, Foreign Material Exclusion Program, Revision 4

ZAP 110-02, Procedure Process Control, Revision 22

ZAP-1200-09, Spent Fuel Pool Risk Management Program, Revision 10

ZAP 300-04, ZNPS Special Nuclear Material Program, Revision 20

ZAP 310-03, Standing Orders, Revision 4

ZAP 900-03, Fire Prevention for Transient Fire Loads, Revision 4

Zion Drawing No. M-1500, P & ID Spent Fuel Pool Cooling Towers System Spent Fuel Nuclear Island, Revision A dated October 20, 2000 (and changes dated 2006)

Zion Drawing No. M-63, Diagram of Spent Fuel Pit Cooling & Cleanup Piping Zion Station Unit-1 & 2, Revision AE dated September 1996 (and changes dated 2013)

Zion Drawing No. M-69, Demineralized Water System, changes dated July 2013

Zion Nuclear Power Station Permanently Defueled Technical Specifications, Amendment Nos. 180 and 167

Zion Station Defueled Safety Analysis Report (DSAR), dated October 2010 (including DSAR Change Log dated May 8, 2014)

Zion Station Fire Protection Report, Amendment 13 (dated July 2013)

Zion Station DSAR Figure 3-39A, Spent Fuel Pool Secondary Loop Cooling System, October 2000

Zion Station DSAR Figure 3-45A, Spent Fuel Nuclear Island Offsite Power Supply, October 2000

ZS-FT-401 Attachment 2, Boron Sampling, Revision 5

NEI 07-07 Update, Hydrogeologic Investigation Report - AMO Environmental Decisions, Inc.; September 2011

EN-ZN-407, Response to Inadvertent Releases of Licensed Materials to Groundwater, Surface Water or Soil; Revision 3

EN-ZN-408, Radiological Groundwater Protection Program; Revision 2

ZCP-352, Onsite Groundwater Monitoring; Revision 4

EN-ZN-408-4160, Groundwater Protection Program Scheduling and Notification; Revision 4

EN-ZN-408-4000, Radiological Groundwater Protection Program Implementation; Revision 4 and Revision 5

HP Consulting, LLC - REMP Evaluation; dated June 13, 2012

CR 2013-000134, Environmental Air Sample Filter Damaged; dated December 12, 2012

CR 2013-0000178, Radioactive Material Control Issues; dated February 7, 2013

CR 2013-000385, Offsite Laboratory Reported Error in MDC Reported Results; dated April 17, 2013

Murray and Trettel, Inc. – Annual Report on the Meteorological Monitoring Program at the Zion Nuclear Power Station for 2012 and 2013

Murray and Trettel, Inc. – Monthly Reports on the Meteorological Monitoring Program at the Zion Nuclear Power Station; January, February and March 2014

Certificate of Compliance Number 9168, Issued to Energy*Solutions*, Revision 20

Safety Analysis Report for Model 8-120B Type B Shipping Package, Consolidated Revision 7

Measurement Systems International, Certificate of Quality & Calibration; MSI-7300RF 5000 Lb Final; dated April 21, 2014

Measurement Systems International, Certificate of Quality & Calibration; MSI8000 RF Remote Display; dated April 21, 2014

Bishop Lifting Products, Inc., Certificate of Calibration; RadioLink Plus Model RLP50TU; dated August 12, 2013

CR-2014-000700; Smear of Cask Impact Limiter Not Perform; dated June 21, 2014

CR-2014-000694; Site did not have 8-120B Cask Drawings; dated June 19, 2014
Drawing No. U2 8-120B (34b); Zion RVI Segmentation Packaging Plan; Revision 4

Letter from Michelle Sampson, NRC to Steven Sisley, Energy*Solutions*; Authorization for

Shipment of Activated Metals Using the Model No. 8-120B Package; dated March 18, 2014

QA-QI-005; "Quality Assurance Cask Inspection," Cask Periodic Inspection Report for Cask Serial/ID #: 2S; dated February 24, 2014

ZS-WM-119, Attachment 8; Packaging Inspection Checklist – Cask (Type B), Shipment Number RW-14-042; Revision 4

TR-OP-035; Handling Procedure for Transport Cask Model 8-120B Certificate of Compliance Number 9168; Revision 26

TR-TP-002; Air Pressure Drop Test For Model 8-120B Cask Certificate of Compliance 9168; Revision 21

ZS-WM-149; Movement of Class B/C Waste Liners; Revision 2

DAC-0234; Final Packaging Plan for Unit 2 Liner 625624-24; Revision 1

DAC-0036; Zion Decommissioning Project Packaging Plan (Unit 2); Revision 5

Teledyne Brown Engineering, Inc.; Report of Analysis/Certificate of Conformance, LIMS #: L48320; dated November 8, 2011

Certificate of Calibration for Environmental Inc. Midwest Laboratory Rotometers (No. 6316685-1/2), dated June 6, 2013 and February 1, 2014

Environmental Inc. Midwest Laboratory Sampling Procedures Manual, Revision 0

ZS-RP-109-001-003, REMP Air Sampling Station and Meteorological Monitoring Program Surveillances, various periods in 2012 – March 2014

Annual Radiological Environmental Operating Report for 2011 (dated May 14, 2012), 2012 (dated May 8, 2013), and 2013 (dated May 12, 2014)

PT-201, Monthly Check for Fire Suppression Water System, various dates in 2013 – April 2014

TSS 15.6.104, Surveillance of Spent Fuel Pit Liner and Transfer Canal Liner Leakage, dated April 7, 2014

TSS 15.6.179, Data Acquisition System Alarm Functional Test, various dates in 2013

ZAP-0400-21, Foreign Material Exclusion Program, Revision 4

ANSI/ANS-58.9-1981, Single Failure Criteria for Light Water Reactor Safety Related Fluid Systems

CR 2014-000398; Fire Hydrant Pipe Break; dated April 12, 2014

CR 2014-000410; Low Suction Pressure on 'B' SFNI Cooling Pump; dated April 16, 2014