

April 24, 2013

Mr. Patrick Daly, Senior Vice-President
and General Manager
ZionSolutions, LLC
101 Shiloh Boulevard
Zion, IL 60099

SUBJECT: NRC INSPECTION REPORT 05000295/2013008(DNMS);
05000304/2013008(DNMS) – ZION NUCLEAR POWER STATION

Dear Mr. Daly:

On March 29, 2013, the U.S. Nuclear Regulatory Commission (NRC) completed onsite inspection activities for the first calendar quarter of 2013 at the permanently shut-down Zion Nuclear Power Station in Zion, Illinois. The inspection continued with in-office review through April 5, 2013. The purpose of the inspection was to determine whether decommissioning activities were conducted safely and in accordance with NRC requirements. The enclosed report presents the results of this inspection, which were discussed during a telephone call with Mr. Patrick Thurman on April 18, 2013.

During the inspection period, the NRC inspector reviewed aspects of the occupational radiation exposure monitoring program; the characterization and manifesting for a radioactive waste (RADWASTE) shipment of irradiated hardware in an NRC approved Type B cask; and implementation of the corrective action program (CAP). The CAP review included an evaluation of a recently identified condenser off-gas system configuration control issue.

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. 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, the inspector did not identify any violations of NRC requirements that were of greater than minor safety significance.

In accordance with Title 10 of the Code of Federal Regulations (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 Web site at <http://www.nrc.gov/reading-rm/adams.html>.

P. Daly

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

Sincerely,

/RA/

Christine Lipa, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

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

Enclosure:
Inspection Report No. 05000295/2013008(DNMS);
05000304/2013008(DNMS)

cc w/encl: Patrick Thurman, *ZionSolutions*
Gary Bouchard, *ZionSolutions*
Alan Parker, Energy Solutions
John Christian, Energy Solutions
Russ Workman, Energy Solutions
Illinois Department of Nuclear Safety
Kent McKenzie, Lake County Emergency Management Agency
Melinda Bush, Illinois General Assembly
JoAnn D. Osmond, Illinois General Assembly
Barry A. Burton, Lake County Administrator
Mark C. Curran, Jr., Lake County Sheriff
Laurie Cvengros, Village Clerk, Village of Beach Park, Illinois
Willard R. Helander, Lake County Clerk
Jana Lee, Village Clerk, Village of Winthrop Harbor, Illinois
Diane Burkamper, City Clerk, City of Zion, Illinois
Irene T. Pierce, Lake County, Illinois

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Kent McKenzie, Lake County Emergency Management Agency
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Letter to Patrick Daly from Christine A. Lipa dated April 24, 2013

SUBJECT: NRC INSPECTION REPORT 05000295/2013008(DNMS);
05000304/2013008(DNMS) – ZION NUCLEAR POWER STATION

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos.: 050-00295; 050-00304

License Nos.: DPR-39; DPR-48

Report Nos.: 05000295/2013008(DNMS)
05000304/2013008(DNMS)

Licensee: Zion*Solutions*, LLC

Facility: Zion Nuclear Power Station
(permanently shut-down)

Location: 101 Shiloh Boulevard
Zion, IL 60099

Dates: Onsite Inspection on March 13 -15 and
March 25 - 29, 2013; in-office review
through April 5, 2013

NRC Inspector: Wayne Slawinski, Senior Health Physicist

Approved by: Christine A. Lipa, 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 05000295/2013008(DNMS); 05000304/2013008(DNMS)

The Zion Nuclear Power Station is a permanently shut-down and defueled power reactor facility that was maintained in a Safe Storage of Spent Fuel (SAFSTOR) condition with spent fuel in wet storage from 1998 through 2010. In 2011, active decommissioning commenced and continued throughout the inspection period. This routine safety inspection reviewed the licensee's execution of the site decommissioning project focusing on aspects of the occupational exposure monitoring program, review of a radioactive waste (RADWASTE) shipment in a U.S. Nuclear Regulatory Commission (NRC) approved cask and implementation of the corrective action program.

Self-Assessments, Audits and Corrective Actions

- Issues were identified at appropriate thresholds by various departments of the licensee's onsite organization, entered into the corrective action program (CAP), and were screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of issues, assessed regulatory reporting and included timely remedial actions in most instances (Section 1.1).

Decommissioning Performance and Status

- Information was adequately exchanged during a heightened level of awareness (HLA) briefing for the movement of the lower reactor vessel internals package. Worker responsibilities were articulated and management involvement was evident during the briefing (Section 2.1).
- Plant material condition was adequate and did not adversely impact safe decommissioning. Radiological barriers and postings satisfied regulatory requirements. Workers followed work plans and were aware of the radiological controls specified in radiation work permits (Section 2.2).

Occupational Radiation Exposure

- External radiological hazards were assessed to determine the appropriate type and positioning of dosimetry to monitor the occupational dose of the site workforce as required by Title 10 of the Code of Federal Regulations (CFR) 20.1502 (Section 3.1).
- Workers were monitored for external radiation exposure to demonstrate compliance with the dose limits of 10 CFR 20.1201, and records of individual monitoring results were maintained as required by 10 CFR 20.2106 and 10 CFR 20.2110 (Section 3.2).
- Personnel dosimeters were supplied and evaluated by a processor holding current National Voluntary Laboratory Accreditation from the National Institute of Standards and Technology for the types and energies of radiation present at the site. Secondary dosimetry devices were calibrated at frequencies and using methods prescribed by industry standards. Quality controls ensured that dosimetry devices were used in a manner that allowed for accurate assessment of occupational worker dose (Section 3.3).

- Plans for neutron monitoring and dose assessment associated with the pending dry cask storage campaign were technically sound and capable of yielding accurate assessment of neutron exposure to occupational workers (Section 3.4).
- Exposure monitoring and control for embryo/fetal dose satisfied the requirements of 10 CFR 20.1208 and 20.2106 (e). However, a violation of minor safety significance was identified for the failure to exchange/process the dosimeter assigned to a declared pregnant woman at the procedure required monthly interval (Section 3.5).

Radioactive Waste Management and Transportation

- A RADWASTE shipment of irradiated hardware on March 20, 2013, was prepared and manifested consistent with the licensee's procedures to meet the requirements of 10 CFR Part 20 and Part 61, and those of the Department of Transportation (DOT) in 49 CFR Parts 170-189 (Section 4.1).

Radioactive Waste Treatment and Effluent Monitoring

- The licensee identified, adequately evaluated and planned to report to the NRC an off-gas system control issue that resulted in small quantities of gaseous effluent to be historically released to the environment unmonitored. The licensee performed evaluations required by 10 CFR 20.1501 to demonstrate compliance with the effluent dose limits of 20.1302 and the ALARA design objectives of 10 CFR 50, Appendix I (Section 5.1).

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-2 reactor vessel internals along with the initiation of Unit-1 internals segmentation. Auxiliary building decommissioning work escalated and included interference removal to support future extraction of the residual heat removal heat exchangers. The RADWASTE packaging and shipment related work continued, as did various preparatory activities associated with the spent fuel dry cask storage campaign.

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

1.1 Identification, Resolution and Prevention of Problems

a. Inspection Scope

The inspector reviewed several recently generated CAP documents 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. Corrective action program documents reviewed by the inspector encompassed a wide range of issues related to effluent monitoring and effluent control, the as-low-as-is-reasonably-achievable (ALARA) program, testing of ventilation filtration systems, and reactor vessel segmentation activities. The CAP documents reviewed by the inspector are listed in the attachment to this report.

b. Observations and Findings

The inspector determined that issues were identified at a reasonably low threshold within various functional areas of the site and entered into the CAP. Issues were effectively screened, prioritized and evaluated commensurate with safety significance in most instances. The scope and depth of evaluations was adequate in that they addressed the significance of issues and assigned a course of corrective action. However, a self revealed issue associated with a structural support problem that occurred during Unit 2 core barrel/thermal shield segmentation was being handled by contractor staff with limited knowledge of the licensee's engineering organization. Inspector dialogue with the licensee several days after the problem occurred prompted additional involvement of the engineering organization. The licensee agreed that its engineering staff should have been more involved since the issue had a potentially significant radiological consequence if structural supports installed as an interim measure failed.

The inspector reviewed the circumstances surrounding a licensee-identified configuration control issue with the condenser off-gas system that resulted in unmonitored effluent paths to the environment. The inspector reviewed the licensee's evaluation and documentation of the issue, the extent of condition evaluation, and plans for resolution. The issue is documented further in Section 5.1 of this report.

No findings of significance were identified.

c. Conclusions

Issues were being identified at appropriate thresholds by various departments of the licensee's onsite organization and entered into the CAP. Issues were effectively screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of issues, assessed regulatory reporting and included timely remedial actions in most instances. Actions were being taken to resolve the problems commensurate with their importance to safety and risk.

2.0 Decommissioning Performance and Status Review (IP 71801)

2.1 Control and Conduct of Facility Activities

a. Inspection Scope

The inspector attended the initial HLA pre-job briefing for the placement of the Unit 1 reactor vessel lower internals onto a storage stand in the flooded reactor refueling cavity. The inspector determined if appropriate information was exchanged during the brief, whether worker responsibilities were delineated clearly and if stop work conditions and/or contingencies were discussed. The inspector reviewed the level of supervisory involvement to determine if oversight was appropriate and whether an adequate safety perspective was established.

b. Observations and Findings

The inspector found that worker responsibilities and lines of communication were adequately delineated during the HLA brief. Information was exchanged freely between the work groups and supervisory involvement was evident. Management oversight contributed positively to the briefing as they challenged command and control of the lift, clarified the stop work conditions and how/when those conditions would be determined. Operations staff also added value to the brief as they questioned how prerequisites would be met before the work commenced and challenged the emergency response contingency plan should the lift go awry.

No findings of significance were identified.

c. Conclusions

Information was adequately exchanged during the HLA brief for movement of the lower reactor vessel internals package, worker responsibilities were articulated and management involvement was evident.

2.2 Plant Tours/Walkdowns

a. Inspection Scope

The inspector conducted plant tours throughout the inspection period to observe field conditions, discuss job safety with workers, and to assess the impact of work activities on safe decommissioning. During these walkdowns, the inspector evaluated 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 inspector in areas toured to determine if those areas were controlled properly and posted as prescribed in 10 CFR Part 20. The inspector walked-down the Unit 2 seal table area and discussed with the licensee its plans for future in-core detector removal. The inspectors observed workers perform interference removal in preparation for future residual heat removal (RHR) heat exchanger extraction and assessed the radiological controls and associated job coverage.

b. Observations and Findings

The inspector found that controls associated with Unit-1 & Unit-2 Containment Building and Auxiliary Building work included those required to prevent unauthorized entry into highly contaminated areas and high radiation areas.

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

No findings of significance were identified.

c. Conclusions

Plant material condition was adequate and had not adversely impacted safe decommissioning. Radiological barriers and postings satisfied regulatory requirements. Workers followed work plans and were aware of the radiological controls specified in radiation work permits.

3.0 Occupational Radiation Exposure (IP 83750)

3.1 External Exposure Monitoring

a. Inspection Scope

The inspector reviewed the licensee's procedure and practices for assessing external radiation hazards and monitoring worker dose. In particular, the inspector evaluated how the licensee monitored worker dose in situations that involved radiation gradients that produced non-uniform exposure to the whole body or instances when the shallow dose to an extremity could greatly exceed the deep dose equivalent. The inspector reviewed radiation survey records, radiation work permits (RWP) and ALARA plans along with the use of special dosimetry to determine if workers were properly monitored.

b. Observations and Findings

The inspector found that radiologically risk-significant activities that involved external radiation dose to areas of the body not accurately monitored by standard dosimetry placement were evaluated adequately through the ALARA process. As part of that process, radiation protection staff identified work in areas with known or suspected radiation dose gradients and established radiation level thresholds which dictated the type and location of dosimetry placement for radiation dose monitoring. The inspector

noted that the thresholds established by the licensee for extremity monitoring and for whole body dosimetry placement aligned with industry guidance.

The inspector found that the licensee monitored worker extremities consistent with procedure requirements to demonstrate compliance with the regulatory dose limits. Area radiation survey data, worker exposure records and ALARA reviews collectively showed that the licensee monitored external exposure to the part of the body that received the highest expected dose as required by 10 CFR 20.1201(a) and (c). The inspector also found that alarm setpoint values for electronic dosimetry (ED) were established such that they provided meaningful indications of unexpected conditions based on pre-job work area radiological assessment.

No work appears to have occurred at the site that warranted use of multi-dosimetry since decommissioning work began in 2011. However, the inspector found that the licensee had not defined the conditions or established procedural thresholds for use of multi-dosimetry should its use be warranted. Based on inspector feedback, the licensee recognized the need to establish thresholds for multi-dosimetry such as jobs with varying whole body dose gradients or instances when worker positioning could impact the optimal monitoring location. Condition Report (CR) No. 2013-000394 was generated to document the issue.

No findings of significance were identified.

c. Conclusions

External radiological hazards were assessed by the licensee to determine the appropriate type and positioning of dosimetry to monitor the occupational dose to the workforce as required by 10 CFR 20.1502.

3.2 External Exposure Control

a. Inspection Scope

The inspector reviewed individual exposure monitoring records for occupational workers at the site for compliance with the requirements of 10 CFR 20.2106 and 20.2110. The licensee's administrative dose limits were reviewed as were the methods, practices and justifications for approving dose extensions. The inspector reviewed the licensee's process for investigating higher than expected exposures or unexpected radiation levels that were self-revealed through ED alarms.

b. Observations and Findings

The licensee maintained records of doses received by individuals for whom monitoring was required as provided by 10 CFR 20.2106. Monitoring records for 2011 and 2012 demonstrated that all monitored workers satisfied the NRC exposure limits of 10 CFR 20.1201. Additionally, administrative dose limits prescribed by the licensee's exposure control program were satisfied. Individuals that were granted dose limit extensions in 2011 and 2012 were approved by licensee management, appropriate justifications were provided and the extensions were documented as specified in the licensee's program.

Based on the licensee's records, the inspector determined that personnel exposure investigations were completed timely and adequately as required by procedure in instances when dosimetry was lost, damaged or EDs malfunctioned or alarmed.

No findings of significance were identified.

c. Conclusions

Workers were monitored as required by 10 CFR 20.1502 to demonstrate compliance with regulatory dose limits. Records of individual monitoring results were maintained as required by 10 CFR 20.2106 and 20.2110.

3.3 Use of External Dosimetry Devices

a. Inspection Scope

The inspector reviewed the licensee's program for the assessment of occupational external radiation dose through the use of personnel dosimeters, including primary dosimeters that require processing and secondary dosimeters used for initial dose determinations and tracking. Dosimetry which required processing to determine the radiation dose was reviewed to determine if the devices were evaluated by a processor holding current dosimetry accreditation thru the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology for the types and energies of radiation present. The licensee's quality control program was also reviewed to determine if adequate measures were used to independently validate the dosimetry vendors processing capabilities.

Additionally, the inspector reviewed the use of EDs, the calibration of that dosimetry and the licensee's assessment of ED response and reliability as a secondary dosimetry system.

b. Observations and Findings

The inspector determined that personnel dosimeters (primary dosimetry) were supplied and evaluated by a processor holding current NVLAP accreditation from the National Institute of Standards and Technology for the types and energies of radiation that currently exist or will exist at the site, including neutron/photon mixtures. Personnel dosimetry performance test data was reviewed for the dosimetry device used by the licensee to validate that no angular dependence or other bias existed in the measurements. Test data demonstrated that the licensee's vendor could accurately process dosimetry for test categories, ranges and tolerances provided in ANSI /HPS N13.11-2009 for photons and for beta emitters. Additionally, the inspector determined that the dosimetry vendor's scope of accreditation included mixtures of neutrons and high energy photons prescribed in ANSI N13.11-2001, even though NVLAP suspended proficiency testing for neutron categories in August 2010. Laboratory Bulletin No. LB-52-2010 issued by NVLAP announced the suspension of proficiency testing pending resolution of industry technical issues.

The inspector found that EDs used by the licensee as secondary dosimetry devices were calibrated by a vendor at frequencies and using methods prescribed by Health Physics Society (HPS) N13.11-1993 and ANSI N323A-1997. The licensee's procedure governing

the use and calibration of electronic dosimetry called for a calibration frequency at an interval that did not align with the industry standard, which the licensee planned to rectify through a procedure revision. The inspector determined that the licensee routinely compared primary to secondary dosimetry response to identify differences and to develop correction factors should secondary dosimetry be used to assign the dose of record. The correction factors were established to ensure that worker exposures would be tracked, conservatively determined and would not exceed administrative limits on a real-time basis. The inspector also found that other dosimetry quality controls were instituted as provided in the licensee's procedure to ensure that dosimetry devices were stored, used and processed in a manner that allowed for accurate assessment of occupational worker dose.

No findings of significance were identified.

c. Conclusions

Personnel dosimeters were supplied and evaluated by a processor holding current NVLAP accreditation from the National Institute of Standards and Technology for the types and energies of radiation present. Secondary dosimetry devices were calibrated by a vendor at frequencies and using methods prescribed by industry standards. Quality controls ensured that dosimetry devices were used in a manner that allowed for accurate assessment of occupational worker dose.

3.4 Assessment of Neutron Exposure

a. Inspection Scope

The inspector reviewed the licensee's current capabilities and future plans for neutron monitoring and worker dose assessment, which will be implemented for the dry cask storage campaign slated to begin later this year. Proposed survey plans, personnel monitoring device capabilities as well as neutron survey instrumentation were reviewed to determine whether the licensee's neutron monitoring and assessment will be sufficient to meet 10 CFR 20.1201 and 20.1501(c).

b. Observations and Findings

The licensee uses personnel monitoring devices that are supplied and processed by a vendor that maintains NVLAP accreditation for neutron monitoring prescribed in ANSI N13.11-2001, for a moderated californium (Cf-252) source. The licensee determined that neutron energies associated with loading spent fuel assemblies during the dry cask storage campaign will range from thermal energies up to approximately 11 million electron volts (Mev), with the vast majority of neutrons less than 5 Mev. As a result, the Cf-252 energy spectrum reasonably equates to the actual spectrum that will be present during the loading campaign. Consequently, the vendor supplied dosimetry is expected to yield accurate results.

During cask loading, the licensee plans to calculate and track neutron dose real-time based on the ratio of measured gamma to neutron dose rates established using portable survey instruments. The ratio will be determined by measuring gamma and neutron dose rates in the cask loading and preparation areas, then multiplying that ratio by the secondary dosimeter (ED) reading to establish the real-time neutron dose estimate. The

licensee plans to validate the measured ratios monthly throughout the cask loading campaign.

The inspector determined that portable neutron survey instrumentation planned to be used by the licensee had a near flat response to neutron energies in the range of interest; consequently, the instrumentation should provide accurate dose rate information. The licensee also plans to compare neutron instrument calibration data and the dosimetry processor's neutron algorithm to establish correction factors, if applicable. Additionally, once the campaign begins, dosimetry vendor processing results will be compared to the licensee's real-time measured results as a means to further validate the accuracy of neutron dose assessment.

No findings of significance were identified.

c. Conclusions

The licensee's plans for neutron monitoring and dose assessment associated with the pending dry cask storage campaign are reasonable, technically sound and allow for accurate assessment of neutron exposure.

3.5 Monitoring of Declared Pregnant Workers

a. Inspection Scope

The inspector reviewed the adequacy of the licensee's methods for informing workers of the risks of radiation exposure to the embryo/fetus. The inspector reviewed the licensee's monitoring methods and procedures, radiation exposure controls, and the training and information provided to declared pregnant women to determine if an adequate program was established to limit embryo/fetal dose.

b. Observations and Findings

The licensee established a procedure for informing individuals of the regulatory options to monitor and control radiation exposure for declared pregnant or nursing women. The inspector found that the procedure provided adequate instruction for workers and supervisors regarding the declaration of pregnancy process, including the declaration to become pregnant and for newborn or infant child nursing. However, the inspector determined that instructions provided through the licensee's Nuclear General Employee Training (NGET) did not include supplemental information relevant to prenatal radiation exposure recommended in Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure." In particular, the instruction provided by the licensee did not include information about the health risks from radiation exposure, the potential impact of declaration on job status and other information recommended in the questions/answers listed in the appendix of the regulatory guide.

According to the licensee, one individual declared pregnancy since site decommissioning activities commenced in 2011. The inspector determined that the individual completed the procedural specified declaration form and the licensee accurately determined the individual's radiation dose from the estimated date of conception. However, the inspector identified that the primary dosimeter issued to the individual was not exchanged and processed by the licensee monthly during the pregnancy monitoring period, as required

by step 5.3.9 of procedure ZS-RP-102-003-002, Revision 0, "Expected or Declared Pregnant or Nursing Woman Exposure Control." Instead, the dosimetry issued to the individual remained on a routine quarterly exchange frequency. Additionally, the licensee failed to document postpartum dose information on the Declaration of Pregnancy Form as intended by procedure ZS-RP-102-003-002. The inspector verified that the pregnancy declaration and the associated radiation dose to the embryo/fetus during the gestation period satisfied the requirements of 10 CFR 20.1208 and 20.2106 (e).

One violation was identified for failure to follow procedure ZS-RP-102-003-002, which is required to be implemented by Technical Specification 5.5. The Technical Specification requires that procedures be established and implemented consistent with Regulatory Guide 1.33, Revision 2. That regulatory guide requires radiation protection procedures for personnel monitoring, which is provided by procedure ZS-RP-102-003-002 for monitoring of declared pregnant women.

The procedural violation was determined to be of minor safety significance because: (1) the declared individual was prohibited from entry into high radiation areas and was administratively limited to 100 mrem; (2) the individual's work assignment rarely involved entry into radiation areas; and (3) the actual radiation exposure for the gestation period was well below the administrative limit. The licensee generated CR No. 2013-0000392 to document the procedure compliance issue and the enhancements planned to expand the instruction provided in NGET training. Therefore, the issue does not warrant enforcement action.

No findings of significance were identified.

c. Conclusions

Exposure monitoring and control for embryo/fetal dose satisfied the requirements of 10 CFR 20.1208 and 20.2106 (e). However, a violation of minor safety significance was identified for the failure to exchange/process the dosimeter assigned to a declared pregnant women at the procedure required monthly interval.

4.0 Solid Radioactive Waste Management and Transportation (IP 86750)

4.1 Waste Classification, Characterization and Manifesting

a. Inspection Scope

The inspector reviewed the licensee's method to classify and characterize an irradiated hardware waste shipment to determine if the radionuclide mix and content was accurately calculated. The use of scaling factors was reviewed to determine if hard-to-detect radioactive materials (e.g., pure alpha or beta emitting radionuclides) were included in the characterization. These reviews were conducted to determine whether the licensee characterized and classified the RADWASTE shipment in compliance with 10 CFR 61.55 and 10 CFR 61.66, as required by Appendix G of 10 CFR Part 20 so as to meet low-level waste burial site criteria.

The inspector selectively reviewed the documentation of shipment packaging, package/vehicle radiation surveys and placarding, package labeling and marking, carrier instruction and the licensee's manifesting for the above noted shipment. For this

shipment, the inspector determined if the requirements of 10 CFR Parts 20 and 61 and those of the Department of Transportation in 49 CFR 170-189 were met.

b. Observations and Findings

The inspector found that the licensee's method for determining the radionuclide content of a March 20, 2013, shipment of segmented Unit-2 reactor internals was appropriate as it was based on neutron activation analyses and verified for conformity with expected dose rate information. Characterization assumptions and the activation analysis results were reviewed by the inspector to verify the licensee's characterization and waste classification results.

For the March 20, 2013, shipment, the inspector determined that the requirements of 10 CFR Part 20 and Part 61 and those of the Department of Transportation (DOT) were met. The inspector determined that the package was labeled and marked properly, that package and transport vehicle surveys were performed with appropriate instrumentation and that results satisfied DOT criteria. The inspector also determined that the shipment manifest was completed in accordance with NRC and DOT requirements and included the required emergency response information. The inspectors determined that the March 20, 2013, shipment satisfied NRC and DOT requirements including the conditions of the Certificate of Compliance for the shipping cask.

No findings of significance were identified.

c. Conclusions

A RADWASTE shipment of irradiated hardware on March 20, 2013, was prepared and manifested consistent with the licensee's procedures to meet the requirements of 10 CFR Part 20 and Part 61, and those of the DOT in 49 CFR Parts 170-189.

5.0 Radioactive Waste Treatment and Effluent Monitoring (IP 84750)

5.1 Followup of Gaseous Effluent Configuration Control Issue

a. Inspection Scope

The inspector reviewed the circumstances surrounding a licensee identified configuration control issue involving the plant condenser off-gas system that caused small quantities of gaseous effluent to be historically released to the environment unmonitored. The inspector reviewed the licensee's identification of the issue, the licensee's cause and extent of condition evaluation and the associated corrective actions. The inspector determined whether the licensee performed the evaluations required by 10 CFR 20.1501 to demonstrate compliance with the effluent dose limits of 20.1302, and the ALARA design objectives of 10 CFR 50, Appendix I.

b. Observations and Findings

In February 2013, licensee walkdowns identified small unmonitored pathways into the turbine building upstream of the Unit 1 and Unit 2 auxiliary building vent stack effluent radiation monitors from condenser off-gas system drain lines. Small portions of the air flow thru the auxiliary building ventilation system backflowed into the off-gas system and

entered the turbine building because the drain lines were not isolated. The off-gas air that escaped into the turbine building eventually leaked into the environment unmonitored.

According to the licensee, the problem was likely caused by historical configuration control issues that initiated during station operations prior to permanent shutdown of the plant dating back to at least 1998. The licensee identified two condenser off-gas system pathways into the turbine building from the Unit 1 off-gas system and one similar pathway from Unit 2. Specifically, non-isolated one-inch diameter gland steam condenser off-gas drain lines allowed small quantities of gaseous effluent to backflow into the turbine building and subsequently leak into the environment. According to the licensee, the unmonitored pathways may have been created in Unit 1 as part of an off-gas system alteration in the 1990s. That alteration routed gland steam condenser discharge piping drain lines into the turbine building without the capability to isolate the lines. For Unit 2, the licensee speculated that existing valves for the discharge header between the 2A and 2B gland steam condenser drain line may have been left open when the system was drained/isolated following permanent shutdown of Unit 2 in 1998. Consequently, during periods when the condenser off-gas system was not operational since at least the 1990s, very small quantities of gaseous effluent were introduced into the turbine building and bypassed the auxiliary building vent stack monitors.

The inspector reviewed the licensee's bounding calculation and associated radiological assessment of these abnormal discharges to determine if the isotopic concentrations and volumes released to the environment were accurately determined since 2010, when the NRC license for the Zion Station was transferred to ZionSolutions. The inspector verified that the environmental impact of the unmonitored releases was small compared to regulatory limits, representing a fraction of one percent of the regulatory limit. The inspector determined that the licensee's evaluations for 2010 and 2011 satisfied the requirements of 10 CFR 20.1501, and that plans to report the issue aligned with regulatory guidance.

The licensee plans to submit errata reports to the 2010 and 2011 Radioactive Effluent Release Reports, concurrent with the 2012 effluent report which is required to be submitted to the NRC no later than May 1, 2013. According to the licensee, affected years prior to 2010 are being evaluated with the assistance of the former license holder (Exelon Nuclear). The licensee plans to submit errata reports to the NRC for other affected years along with the 2013 annual effluent report. The abnormal discharges are being documented by the licensee as 'small errors' consistent with Regulatory Guide 1.21, "Measuring, Evaluating and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste." The inspector determined that the licensee's extent of condition assessment and the actions in-place to prevent possible recurrence of a similar problem caused by decommissioning activities were adequate. Condition Report Nos. 2013-000267, 2013-000165 and 2013-000381 were generated to document the issues and track resolution.

No findings of significance were identified.

c. Conclusions

The licensee identified, adequately evaluated and plans to report to the NRC a configuration control problem that involved the plant off-gas system and caused small

quantities of gaseous effluent to be historically released to the environment unmonitored. The licensee performed the evaluations required by 10 CFR 20.1501 to demonstrate compliance with the effluent dose limits of 20.1302 and the ALARA design objectives of 10 CFR 50, Appendix I.

6.0 Exit Meeting

The inspector presented the results of the inspection to Mr. Thurman during a telephone conversation on April 18, 2013. The licensee acknowledged the results presented and did not identify any of the documents reviewed by the inspector as proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

G. Bouchard, Vice President, Engineering, Operations & Nuclear Security
S. Chris Baker, Vice President, Environmental Health & Safety
*P. Thurman, Vice President, Regulatory Affairs
D. Brown, Vice President, D&D and Construction
T. Bejma, Director, Quality Assurance
R. C. Keene, Director, Radiation Protection
M. Wiskerchen, Waste Operations Manager
D. Adams, Dosimetry Specialist

*Participated in exit meeting telephone call on April 18, 2013.

INSPECTION PROCEDURES (IPs) USED

IP 40801	Self-Assessment, Auditing and Corrective Action at Permanently Shutdown Reactors
IP 71801	Decommissioning Performance and Status Review at Permanently Shutdown Reactors
IP 83750	Occupational Radiation Exposure
IP 86750	Solid Radioactive Waste Management and Transportation of Radioactive Materials
IP 84750	Radioactive Waste Treatment and Effluent Monitoring

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened & Closed

None

PARTIAL LIST OF DOCUMENTS REVIEWED

Shipment Manifest and Waste Characterization Information, Radiological Surveys and Associated Documentation for Shipment No. RW-13-001; Shipment of Activated Metal in Type B(U) Package; shipped March 20, 2013

DW James Consulting Document No. DAC-0087; Final Packaging Plan for Liner 8-120B (Unit 2); Revision 1

RWP 2013-1-1003, Revision 1 and ALARA Review 12-0017, Revision 1; Remove Unit 1 Reactor Internals Package

Siempelkamp Nuclear Services, Inc., Work Instruction for the Segmentation of Zion Generating Station's Unit 1 Reactor Vessel Internals; Revision 2

Attachment

ZS-RP-102-002-002; Special Dosimetry; Revision 1
ZS-RP-102-004-003; Personnel External Exposure Investigations; Revision 0

ZS-RP-102-000-000; Site Radiological Access and Personnel Monitoring Program; Revision 3

Mirion Technologies Inc. Occupational Radiation Exposure Reports for 2011 and 2012

ZS-RP-102-003-001; Dose Limit Extensions; Revision 4

CR-2013-000282; Unit 2 Temporary Support for Thermal Shield; dated March 16, 2013

CR-2013-000245; Truck Monitor Alarm; dated March 5, 2013

CR-2013-000120; Individual received a Dose Rate Alarm; dated January 29, 2013

CR-2012-001326; Radiological Concern; dated December 12, 2012

CR-2013-000212; Waste Intermodal does not Meet Shipping Criteria; dated February 21, 2013

ZS-RP-108-002-002; Operation and Use of the MGP DMC 2000S Electronic Dosimeter;
Revision 0

Primary to Secondary Dosimetry Comparison Data for 2011 and 2012

Radiation Safety and Control Services, Inc; Standard Operating Procedure for Calibration of
Electronic Dosimeters; Revision 01

NVLAP Accreditation for Mirion Technologies, Inc; Certificate of Accreditation to ISO/IEC
17025:2005; Effective July 1, 2012 – June 30, 2013

Personnel Dosimetry Performance Testing for Mirion Technologies, Inc; Conducted at Pacific
Northwest National Laboratory; dated November 7, 2011

CR-2012-001325; ANI Information Bulletin 11-02 Neutron Monitoring; dated December 11, 2012

Technical Support Document No. 13-001; Neutron Exposure Monitoring and Dose Assignment;
Revision 00

ZRP-5822-03; Use of Neutron Detecting Instruments for Measuring Personnel Exposure;
Revision 0

ZS-RP-102-002-001; Dosimetry Issue, Change Out and Processing; Revision 3

ZS-RP-102-003-002; Expected or Declared Pregnant or Nursing Woman Exposure Control;
Revision 0

CR-2013-000165; Potential Unmonitored Effluent Path from Off-Gas System; dated February 7,
2013

CR-2013-000267; Missing Closure Information for CR-2013-000165; dated March 7, 2013

CR-2013-000381; Condenser Off-Gas Release Path Extent of Condition Review; dated April 16, 2013

CR-2013-000059; Three of Six Auxiliary Building Ventilation System HEPA Filters Failed Test; dated January 15, 2013

CR-2013-000238; Potential Inadvertent Reduction of Assumed Dilution Rates; dated February 28, 2013

LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access and Management System
ALARA	As-Low-As-Is-Reasonably-Achievable
Cf-252	Californium-252
CFR	Code of Federal Regulations
CAP	Corrective Action Program
CR	Condition Report
DNMS	Division of Nuclear Materials Safety
DOT	Department of Transportation
ED	Electronic Dosimetry
HLA	Heightened Level of Awareness
HPS	Health Physics Society
Mev	million electron volt
mrem	millirem
NGET	Nuclear General Employee Training
NRC	U.S. Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
RADWASTE	Radioactive Waste
RHR	residual heat removal
RWP	Radiation Work Permit
SAFSTOR	Safe Storage of Spent Fuel