# U.S. NUCLEAR REGULATORY COMMISSION
# REGION I

## INSPECTION REPORT

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| Inspection Nos. | 05000272/2010009, 05000311/2010009, and 07200048/2010001 |
| Docket Nos. | 05000272, 05000311, and 07200048 |
| License Nos. | DPR-70 and DPR-75 |
| Licensee: | PSEG Nuclear LLC |
| Location: | Salem Nuclear Generating Station<br>Hancocks Bridge, New Jersey |
| Inspection Dates: | August 9, 2010 – September 20, 2010 |
| Inspectors: | Stephen Hammann, Senior Health Physicist, Decommissioning Branch, Division of Nuclear Materials Safety<br><br>Mark Roberts, Senior Health Physicist, Decommissioning Branch, Division of Nuclear Materials Safety<br><br>Orysia Masnyk-Bailey, Health Physicist, Decommissioning Branch, Division of Nuclear Materials Safety<br><br>Jim Pearson, Senior Inspector, Spent Fuel Storage and Transportation, Office of Nuclear Material Safety and Safeguards<br><br>Earl Love, Inspector, Spent Fuel Storage and Transportation, Office of Nuclear Material Safety and Safeguards<br><br>Suresh Chaudhary, Senior Reactor Inspector, Materials and Structural Engineering Branch, Division of Reactor Safety |
| Approved By: | Judith A. Joustra, Chief<br>Decommissioning Branch<br>Division of Nuclear Materials Safety |

## EXECUTIVE SUMMARY

Salem Nuclear Generating Station
NRC Inspection Report Nos. 05000272/2010009, 05000311/2010009 and 07200048/201001

This report covered an on-site inspection and in-office review by Nuclear Regulatory Commission (NRC) regional and Office of Nuclear Material Safety and Safeguards (NMSS) based inspectors of activities related to the dry cask storage of spent fuel, including the preparation for, and the initial loading of, spent fuel into the independent spent fuel storage installation (ISFSI). The licensee selected the Holtec International HI-STORM 100 Cask System for storage of spent nuclear fuel at the Salem Nuclear Generating Station. The NRC had certified the HI-STORM 100 Cask System for storage of irradiated fuel under Certificate of Compliance (CoC) No. 1014, Amendment No. 5 on May 31, 2000. The inspectors reviewed the pre-operational loading activities to confirm that the personnel, equipment, and plant programs and procedures were adequate to safely load spent fuel into the ISFSI. The inspectors also observed selected portions of the initial ISFSI loading campaign to confirm that these activities were performed in accordance with the approved procedures, the CoC, and Technical Specification (TS) requirements. The licensee successfully demonstrated pre-operational activities in preparation of the initial loading campaign and successfully completed their first complete canister loading and storage on the ISFSI pad.

Based on the results of this inspection, no findings were identified.

## REPORT DETAILS

### 1.0 Preoperational Test Program

a. Inspection Scope

The CoC for the Holtec International HI-STORM 100 Cask System required that the licensee conduct pre-operartional testing (i.e. dry runs) to demonstrate multipurpose canister (MPC) loading, forced helium dehydration (FHD), transfer cask (HI-TRAC) handling, and MPC insertion into the storage overpack (HI-STORM). The inspection included observation of the activities being performed, interviews with personnel performing the activities, and reviews of selected PSEG Nuclear LLC procedures and documents prepared to support the conduct of these activities.

b. Observations and Findings

Between August 9-12, 2010, and September 7-9, 2010, the inspectors evaluated a dry run demonstration by the licensee that included moving a HI-TRAC with a MPC inside from the decontamination pit into the spent fuel pool; loading of mock fuel assemblies into the MPC; FHD and helium backfill of an MPC; inserting the MPC into the HI-STORM; and transporting the HI-STORM on a portion of the haul path. All activities were performed in a methodical manner. Strict adherence to procedures was followed with each step of each procedure being checked off as it was completed. All workers carried out their activities in a professional manner indicating they were experienced and properly trained.

The licensee conducted pre-job briefings before each work evolution. The briefings covered key aspects of the activities to be performed including, human performance, scope of work, job instructions, industrial safety, radiological concerns, potential hazards and planned responses, personnel safety, and closure items. Full participation of all workers was encouraged and all comments were taken into consideration.

No findings of significance were identified.

c. Conclusions

The licensee demonstrated the ability to move the MPC and HI-TRAC as necessary, load fuel assemblies into the MPC, remove moisture from the MPC and backfill it with helium, transfer a loaded MPC into the HI-STORM, and move the HI-STORM along the haul path leading to the ISFSI pad.

## 2.0 Review of Evaluations

a. Inspection Scope

The inspectors evaluated the licensee's compliance with the requirements of 10 CFR 72.212 and 10 CFR 72.48. The inspection consisted of interviews with cognizant personnel and review of licensee documentation.

b. Observations and Findings

The licensee is required, as specified in 10 CFR 72.212(b)(1)(i), to notify NRC at least 90 days prior to the first storage of spent fuel under this general license. The inspectors verified that the licensee notified the NRC on May 12, 2010, of their intent to use the Holtec International HI-STORM 100 Cask System in accordance with CoC No. 1014. This letter met the requirement of the 90-day notification. The licensee is also required, as specified in 10 CFR 72.212(b)(1)(ii), to register the use of each cask with the NRC no later than 30 days after using the cask to store spent fuel. At the time of the inspection, the licensee had not provided this registration but was aware of the requirement.

The licensee is required to perform written evaluations in accordance with 10 CFR 72.212(b)(2)(i), prior to use of each cask, to establish that the conditions of the CoC have been met. The inspectors determined that the licensee developed its written evaluation, "Salem/Hope Creek Generating Station, Independent Spent Fuel Storage Installation, 10 CFR 72.212 Evaluation Report, NRC Docket 7200048," to document that the ISFSI was within the licensed scope as required. The inspectors reviewed the licensee's written evaluations that confirmed that the conditions set forth in the CoC had been met, the ISFSI pad had been designed to support the stored load of the casks, and the radiological criteria specified in 10 CFR 72.104 had been met. The review of the written evaluations determined that applicable reactor site parameters, such as fire, tornadoes, wind generated missile impacts, lightning, seismic events, flooding, and temperature had been evaluated for acceptability with the bounding values specified in the Holtec International HI-STORM 100 Cask System Final Safety Analysis Report (FSAR) and the NRC Safety Evaluation Report (SER).

The inspectors reviewed the licensee's 10 CFR 50.59 evaluation of the construction and operation of the ISFSI and plant interfaces, and determined that the licensee had demonstrated that changes to plant TS, or a license amendment were not required, and that ISFSI related work activities would not impact safe operation of the plant. Also, all ISFSI related procedures had a 10 CFR 72.48 screening performed to ensure that there had been no changes, tests, or experiments in the facility or spent fuel storage cask design as described in the FSAR.

The inspectors reviewed selected records and procedure changes related to security, emergency preparedness, training, health physics, and quality assurance programs to ensure that the operation of the ISFSI program had been adequately incorporated into these supporting programs.

The inspectors interviewed key personnel in these disciplines to confirm that they were knowledgeable of the impact of ISFSI related activities on the operating facility.

No findings of significance were identified.

c. Conclusions

Overall, the 10 CFR 72.212 evaluation was found to be acceptable. The 10 CFR 72.48 screening evaluations for the ISFSI procedures adequately addressed facility conditions that may have been impacted by implementing the ISFSI program.

## 3.0 Fuel Characterization and Verification

a. Inspection Scope

The CoC for the Holtec International MPC-32 canister specifies the parameters that must be met in order to allow spent fuel to be stored at the ISFSI. The inspectors evaluated the licensee's programs to verify that spent fuel assemblies selected for storage met the applicable requirements of the CoC. The inspection consisted of interviews with cognizant personnel and a review of licensee documentation.

b. Observations and Findings

The inspectors reviewed the licensee's process for selecting and verifying fuel assemblies for placement into dry cask storage. The inspectors reviewed relevant documents associated with the qualification, characterization, and selection of fuel assemblies for storage at the ISFSI.

The CoC TS require that selected fuel assemblies be visually inspected, independently verified, be free of cladding defects, and be within specified limits for such parameters as fuel enrichment, burn-up, and decay heat output. The licensee had developed procedures to ensure the proper characterization of loaded fuel to meet the requirements of the CoC. The inspectors discussed the fuel selection process with cognizant personnel and determined that individuals were knowledgeable of the TS requirements.

Prior to the initial ISFSI campaign, the inspectors verified that procedures had been developed for the selection and verification of fuel assemblies and that the procedures covered the movement of the fuel assemblies from the spent fuel pool to the MPC. The inspectors verified that the selected fuel assemblies met the requirements of the CoC.

No findings of significance were identified.

c. Conclusions

The licensee developed a program to ensure the proper selection and characterization of fuel assemblies for dry cask storage in accordance with approved procedures. The documentation supported the proper characterization of the first 32 fuel assemblies to be loaded and demonstrated that these fuel assemblies met the design parameters specified in the CoC TS.

## 4.0 Heavy Loads Program

a. Inspection Scope

The licensee was required to demonstrate the adequacy of their heavy loads program pertaining to the movement of the MPC and HI-TRAC from the decontamination pit into the spent fuel pool and the stack-up of the HI-TRAC onto the HI-STORM and subsequent lowering of the MPC into the HI-STORM. The licensee was also required to demonstrate lifting the HI-STORM with the vertical cask transporter (VCT) for transport to the ISFSI pad. The inspection consisted of field observations, interviews with cognizant personnel, and reviews of relevant documentation.

b. Observations and Findings

The crane that was used to move the fuel storage components was installed specifically for use with the ISFSI program at the Salem Nuclear Generating Station. The crane was built by American Cranes and is a 115-ton, single failure proof, bridge crane. The bridge has end-of-travel flip switches to automatically slow down and stop the movement of the bridge.

The crane was used to move the HI-TRAC containing the MPC from the decontamination pit to the spent fuel pool and back again. The crane was also utilized to lift the HI-TRAC and MPC onto the HI-STORM and subsequent lowering of the MPC into the HI-STORM. The inspectors observed personnel performing visual inspections and pre-operational checks of the crane and associated lifting devices in accordance with approved procedures prior, to the heavy load lifts described above. The inspectors observed the VCT transport the HI-STORM along a portion of the ISFSI haul path.

Over the course of the dry run, the inspectors observed all the movement pathways for the MPC and HI-TRAC. Pre-lift job briefings were thorough and emphasized safety aspects of lifting heavy loads. Individual responsibilities were clearly communicated during the pre-job briefings. Crane operators, spotters, and members of the lifting team were knowledgeable of their responsibilities. Movements of heavy loads were performed in a deliberate and safe manner. The inspectors noted that effective communication was maintained between the load director, crane operator, and members of the lifting team while lifts were in progress. Positive controls were established to keep non-essential personnel away from the work area to minimize distractions of the lift team. The inspectors also reviewed the crane acceptance testing that the licensee had performed.

No findings of significance were identified.

c. Conclusions

The licensee developed a heavy loads program and procedures to ensure the proper handling of the required heavy loads involved in an ISFSI. The documentation supported compliance with the CoC and FSAR.

## 5.0 Forced Helium Dehydration and Helium-Backfill Operations

a. Inspection Scope

The CoC required a pre-operational demonstration of moisture removal and helium backfill of the MPC. The inspection consisted of field observations, interviews with cognizant personnel, and a review of licensee documentation.

b. Observations and Findings

The licensee chose the forced helium dehydration (FHD) method of moisture removal as allowed by the CoC. The inspectors determined that appropriate procedures had been developed for the FHD and helium backfill processes. The licensee contracted Holtec International employees to perform the operations. The contract employees were well trained on the equipment and familiar with the procedures required for the operations. The pre-job briefing for the demonstration was thorough and covered all aspects of the activities to be performed. The contractors performed a visual inspection of the equipment, including verification that the helium being used met the purity requirements of the CoC. The inspectors observed the demonstrations and determined that the licensee met the CoC TS requirements for MPC Cavity Drying Limits and MPC Helium Backfill Limits.

No findings of significance were identified.

c. Conclusions

The inspectors concluded that the licensee successfully demonstrated the capability to adequately remove moisture and backfill the MPC with helium to meet the requirements in the CoC TS.

## 6.0 Training and Qualifications

a. Inspection Scope

The licensee's training program was reviewed to verify that appropriate training requirements were identified for ISFSI related activities and that personnel were qualified to perform those activities.

b. Observations and Findings

The inspectors determined that the licensee established a formal site-specific ISFSI training program that addressed the Holtec International design, the applicable CoC conditions, the approved facility fuel loading, HI-TRAC handling, MPC loading and transfer, and abnormal event procedures. The licensee maintained records to demonstrate that personnel conducting ISFSI activities attended the required training and received passing scores on written and practical exams. As part of the process, the licensee established a formal training matrix to assure that personnel selected for ISFSI

activities were fully qualified. Training was provided prior to the start of the loading campaign and refresher training is required every two years. Interviews with personnel and field observations provided evidence that personnel were familiar with the ISFSI activities that they were assigned to perform.

No findings of significance were identified.

c. Conclusions

Appropriate training was developed for the various tasks and licensee personnel were adequately trained to safely conduct ISFSI activities.

## 7.0 Initial Loading of the ISFSI

a. Inspection Scope

The inspectors observed the initial spent fuel loading campaign initiated on September 13, 2010. The inspection consisted of field observations, review of license documentation, and interviews with responsible personnel.

b. Observations and Findings

The inspectors observed the loading of spent fuel into the MPC by the licensee's fuel handlers. The fuel assemblies were properly identified and verified before being moved into the canister. The licensee did a further verification that the correct fuel assemblies had been loaded by making a video recording of the fully-loaded canister and checking the identification numbers of the fuel assemblies. The inspectors also viewed the video recording. The inspectors observed the removal of the HI-TRAC containing the loaded MPC from the spent fuel pool to the decontamination pit and also observed the decontamination of the HI-TRAC. The FHD and helium backfill processes were observed by the inspectors. The inspectors also observed the stack-up of the HI-TRAC and HI-STORM. All ISFSI procedures and procedures for ISFSI-related activities were examined. The personnel involved in the various ISFSI activities were interviewed and found to be knowledgeable and experienced. The pre-job briefings were thorough and covered all aspects of the activity to be performed.

No findings of significance were identified.

c. Conclusions

The licensee successfully performed their first complete canister loading and storage on the ISFSI pad. The licensee has a documented ISFSI program and trained personnel needed to meet the criteria set forth in the CoC, FSAR, and NRC regulations for an ISFSI.

**Exit Meeting Summary**

The inspectors presented the preliminary inspections results to Lou Menoscal, Nuclear Projects Manager, and various staff on September 17, 2010. The inspectors informed the licensee that although they did not plan on returning the following week, the inspection would remain open until the first canister was successfully stored on the ISFSI pad. This occurred on September 20, 2010. The final exit meeting was held via telephone with Tom Wallender, ISFSI Project Manager, on September 20, 2010.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. Some proprietary items were reviewed during the inspection, but no proprietary information is presented in this report.

**ATTACHMENT: SUPPLEMENTAL INFORMATION**

## SUPPLEMENTAL INFORMATION

## PARTIAL LIST OF PERSONS CONTACTED

Licensee

Bill Eckman, DCS Project
Ed Eilolz, Salem Plant Manager
Sarah Elkhiamy, Reactor Engineer
Andrew Fecht, Holtec Project Manager
Bob Gary, RP Manager
Bill Guthrie, Manager Security Operations
Jim Lewis, Superintendent Reactor Services
Paul Lippie, Reactor Engineer
Pete Maconni, Outage Specialist
Paul Martitz, Radiation Protection Supervisor
Lou Menoscal, Nuclear Projects Manager
Enrique Villar, Regulatory Compliance
Tom Wallender, ISFSI Project Manager
Mike Walsh, Reactor Services

## INSPECTION PROCEDURES USED

60854 Preoperational Testing of an Independent Spent Fuel Storage Installation
60855 Operation of an Independent Spent Fuel Storage Installation
60856 Review of 10 CFR 72.212(b) Evaluations
60857 Review of 10 CFR 72.48 Evaluations

## LIST OF DOCUMENTS REVIEWED

Acceptance Standards For Welds, Base Materials, And Cladding, Rev. 4
Ad-AA-101-1002-F1, Procedure approval Form, Rev. 2
Emergency Cooridinates Quarterly Practical Exercise – 2nd Quarter 2010
Emergency Plan Qualification Guides for Shift Manager, Radiological Assessment Coordinator and Performance Training Guideline for Radiation Protection Technicians
EP-AA-120-1003, Emergency Preparedness Document Processing, Rev. 1
Exelon Labs, Certificate of Calibration
HC.MD-FR.DCS-0001(Q), HI-STORM System Receipt Inspection
HC.OP-AB.MISC-0004, ISFSI – SFSC Heat Removal System, Rev.2
HC.OP-AR.DCS-0001, Dry Cask Storage System Thermal Monitoring System Alarm Response Procedure
HC.OP-DL.ZZ-0026(Q), Quality Assurance Topical Report
LS-AA-104-1002, 50.59 Applicability Review Form
LS-AA-105-1001, 72.48 Review Coversheet Form
LS-AA-105-1003, 72.48 Screening Form

MM-AA-716-021, Rigging and Lifting Program
MSLT-DSC-HOLTEC, Helium Mass Spectrometer Leak Test Procedure
NC.MD-FR.DCS-0013(Q), Dry Cask Storage Special Lifting Device Inspection
NF-AA-330, SNM Transfer to Dry Storage
NF-AA-330, SNM Physical Inventories
NF-AA-390, Spent Fuel Material Control
PCI Energy Services, GQP-9.0, Training, Qualification, Examination, AND Certification OF NDE, Inspection And Testing Personnel In Accordance With SNT-TC-1A and CP-189, Rev. 10
PCI Energy Services, GQP-9.2, High Temperature Liquid Penetrant Examination And
PCI Energy Services, GQP-9.7, Solvent Removable Liquid Penetrant Examination And Acceptance Standards For Welds, Base Materials, And Cladding, Rev. 13
PSEG Nuclear LLC – Emergency Plan
RP-SA-303, HI-TRAC Radiation Survey
RP-AA-304, HI-STORM Radiation Survey
RP-HC-305, ISFSI Radiation Survey, Rev. 1
Salem Generating Station – Event Classification Guide
Salem Generating Station – EAL Technical Basis
SC.MD-EU.CRN-0012(Q), Cask Handling Crane Daily Use Inspection, Rev.5
SC.MD-FR.DCS-0002(Q), Offloading and Receiving Dry Storage Components, Rev. 2
SC.MD-FR.DCS-0003(Q), Transport Loaded and Unloaded HI-STORM and HI-TRAC
SC.MD-FR.DCS-0004(Q), MPC Preparation for Loading
SC.MD-FR.DCS-0005(Q), Handling and Loading MPC
SC.MD-FR.DCS-0006(Q), Sealing, Drying and Backfilling of a Loaded MPC
SC.MD-FR.DCS-0007(Q), Stack-Up and Transfer of a Loaded MPC
SC.MD-FR.DCS-0008(Q) Transporting and Transferring a Loaded MPC for Unloading
SC.MD-FR.DCS-0009(Q), Unloading a Loaded MPC
SC.MD-AB.DCS-0008(Q), Responding to Emergency Conditions
SC.RE-FR.DCS-0001, Dry Cask Storage Fuel Characterization
SC.RE-FR.DCS-0002, Dry Cask Storage Fuel Selection for Cask Loading
SC.RE-FR.DCS-0003, Holtec MPC Fuel Spacer Matrix, Rev. 1
SC.RE-FR.ZZ-0001, Special Nuclear Material Control and Accounting
SC.RE-FR-ZZ-0005, Spent Fuel Assembly Inspection, Rev. 7
SC.RE-FR.ZZ-0007, Verification of Fuel Location in DRY Casks

## LIST OF ACRONYMS USED

| | |
|---|---|
| ADAMS | Agencywide Document Access and Management System |
| CoC | Certificate of Compliance |
| CFR | Code of Federal Regulations |
| FHD | Forced Helium Dehydration |
| FSAR | Final Safety Analysis Report |
| ISFSI | Independent Spent Fuel Storage Installation |
| MPC | Multipurpose Canister |
| NMSS | Nuclear Material Safety and Safeguards |
| NRC | Nuclear Regulatory Commission |
| SER | Safety Evaluation Report |
| TS | Technical Specifications |
| VCT | Vertical Cask Transporter |