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LR-N10-0414

U.S. Nuclear Regulatory Commission
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Salem Nuclear Generating Station, Unit No. 1 and Unit No. 2
Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: Response to NRC Request for Additional Information, dated October 25, 2010, related to Structures Monitoring associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application

Reference: Letter from Ms. Bennett Brady (USNRC) to Mr. Thomas Joyce (PSEG Nuclear, LLC) "REQUEST FOR ADDITIONAL INFORMATION FOR SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION ON STRUCTURES MONITORING (TAC NOS. ME1834 AND ME1836)", dated October 25, 2010

In the referenced letter, the NRC requested additional information regarding the Spent Fuel Building Structure associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application (LRA). Enclosure A contains the response to this request for additional information.

Enclosure B provides an update to the affected portion of the License Renewal Commitment List (LRA Appendix A, Section A.5), as a result of this RAI response. There are no other new or revised regulatory commitments contained in this letter.

This letter is submitted on a time schedule approved by the NRC License Renewal Project Manager. If you have any questions, please contact Mr. Ali Fakhar, PSEG Manager - License Renewal, at 856-339-1646.

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I declare under penalty of perjury that the foregoing is true and correct.

Executed on 12/14/10

Sincerely,

Robert C. Braun
Senior Vice President, Operations
PSEG Nuclear LLC

Enclosures: A. Response to Request for Additional Information
B. Update to License Renewal Commitment List

cc: William M. Dean, Regional Administrator – USNRC Region I
B. Brady, Project Manager, License Renewal – USNRC
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NRC Senior Resident Inspector – Salem
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Howard Berrick, Salem Commitment Tracking Coordinator

Enclosure A

Response to Request for Additional Information regarding the Spent Fuel Building Structure associated with the Salem Nuclear Generating Station, Units 1 and 2 License Renewal Application

RAI B.2.1.33-07

RAI B.2.1.33-07

Background:

The Salem Nuclear Generating Station, Unit 1, spent fuel pool (SFP) has experienced borated water leakage, including leakage through the concrete walls. In response to request for additional information B.2.1.33-05, dated September 1, 2010, the applicant stated: "Presently, there are no indications of active leakage from the SFP through the SFP wall."

Issue:

Although the applicant has stated that there are no indications of active leakage through the accessible SFP wall, the applicant has not confirmed that there is no through-wall leakage from the three inaccessible walls of the SFP.

Request:

Provide information to confirm the claim that there is no active through-wall leakage from the SFP occurring in any of the SFP walls, including the inaccessible walls.

PSEG Response:

This RAI response addresses the following three items:

1. Leakage at the construction joints at the bottom of the Spent Fuel Pool (SFP) walls
2. Ground water monitoring at Salem related to leakage at the Spent Fuel Pool, and
3. The leakage path of the Spent Fuel Pool water.

1. For clarification, there is a small amount of leakage believed to be at the construction joint at the bottom of the Spent Fuel Pool east wall adjacent to the Auxiliary Building. Refer to UFSAR figure 3.6-26 (portion attached) for the plant configuration as it relates to the following discussion.

   - There is a small amount of leakage at the east wall construction joint as evidenced by grab samples at the seismic gap drain, which exhibit short-lived isotopes. This wall is 6' thick. The wall at the seismic gap is not accessible below grade. It is believed that the leakage is along the construction joint at the bottom of the wall (Elevation 89-foot), similar to what was observed at the west wall before the telltale drains were cleared in 2003. The leakage rate from the Unit 1 Spent Fuel Pool at the construction joint at the bottom of the east wall is estimated to be about 1/8 of a gallon per day from the SFP, as evidenced by seismic gap drain leakage and the associated sampling.
   - The west wall of the Fuel Handling Building is accessible below grade, where the telltale drains allow leakage flow to the sump. This wall is 9'-7" thick. No evidence of through-wall leakage has been visually observed since clearing of the telltale drains in 2003 allowed for drainage of water trapped behind the Spent Fuel Pool liner.
   - Leakage through the south wall is considered to be impossible due to the thickness of the wall south of the transfer pool, which is approximately 39' thick. This wall is not accessible below grade.

- Based upon samples from the monitoring wells in the yard area north and west of the Fuel Handling Building, there is no indication of through-wall leakage from the north wall. This wall is 8'-9" thick, and is not accessible below grade. The monitoring well system and the specific monitoring wells outside of the north west corner of the Fuel Handling Building and at the west end of the Fuel Handling Building do not exhibit any increasing trend of radionuclides (tritium). In addition, the monitoring well closest to the northwest corner of the Spent Fuel Pool exhibits lower levels of tritium than the monitoring well west of the Fuel Handling Building, which would not be the case if there was through-wall leakage at the north wall of the Fuel Handling Building.

As a point of clarification, MPR-2613 report, which was docketed in response to RAI B.2.1.33-1 (PSEG letter LR-N10-0165), stated that all wall leakage at the construction joints has stopped. The statement in MPR-2613 was based on the observations in the Sump Room that noted no evidence of leakage after the telltales were cleared in early 2003. However, as described above, there is approximately 1/8 of a gallon per day believed to be migrating through the construction joint at the bottom of the east wall (Elevation 89-foot). This leakage rate has an insignificant impact on the structural adequacy of the east wall. The construction joint is the interface between two different concrete pours, not a channel for free flow of Spent Fuel Pool leakage. The construction joint is a path for migration of boric acid through the wall because mini-voids or mini-discontinuities between the two pours provide a transport path through the wall. Any degradation of the concrete will be limited to the immediate vicinity of the leakage pathway and will diminish along the pathway as the boric acid reacts with the concrete (i.e., the degradation becomes limited by the availability of boric acid).

Any concrete degradation in the construction joint will be significantly less than that shown in the laboratory testing (Long-Term Test Program, which started in April 2005). The laboratory testing to quantify concrete degradation used a large volume bath in comparison to the exposed concrete surface of the specimens and refreshed the bath periodically to ensure that degradation was not limited by the availability of boric acid (i.e., was not reactant-limited). These testing conditions are much more severe than the existing condition of SFP leakage at the construction joint in the east wall. This can be illustrated by comparing the concrete surface area in the construction joint in the east wall (37 feet long and 6 feet thick) and the approximate leakage rate (1/8 of a gallon per day) to the refresh frequency in the tests which related to the ratio of the bath volume to exposed concrete surface area. This comparison shows that the leakage rate through the east wall provides much less exposure to boric acid than the refreshed bath used during the testing of the concrete. As a result, the minor leakage at the construction joint on the east wall is not structurally significant. In addition, in the same evaluation which included rebar degradation from leakage migration through a wall, the conclusion remains valid for the east wall, that any potential damage to reinforcing steel would not be significant.

The structural assessment of the Fuel Handling Building concluded that migration of Spent Fuel Pool leakage through the construction joint has an insignificant impact on the structural adequacy of the Fuel Handling Building. This conclusion will be further confirmed by additional examinations and testing that PSEG Nuclear will perform in the vicinity of construction joint prior to the period of extended operation. The construction joint in the Sump Room (west wall) previously showed evidence of boric acid migration through the joint. Petrographic examination and compressive strength testing of a core sample will confirm that the concrete is in good condition. In addition, PSEG Nuclear will expose rebar in the vicinity of that construction joint to assess potential rebar corrosion.

This inspection will confirm that the outer rebar, the rebar of interest from a structural standpoint, has not experienced significant corrosion. West wall testing was explained in Salem RAI B.2.1.33-05 response per PSEG letter LR-N10-0321. The concrete examinations in the west wall of the Spent Fuel Pool at the construction joint is judged to also provide a relevant indication of the concrete conditions in the east wall of the Spent Fuel Pool. Additionally, PSEG Nuclear will perform examinations and testing in the vicinity of construction joint on the east wall prior to the period of extended operation. Specifically, PSEG will take a shallow core sample approximately 4 inches deep in the east wall in the vicinity of the construction joint for a petrographic examination to confirm that the concrete is in good condition. The construction of the east and west walls are very similar, and these core samples in the Unit 1 Spent Fuel Pool walls (east and west) will provide information focused at ensuring that inaccessible concrete degradation will be addressed before loss of an intended function.

Enhancement 5 associated with the Structures Monitoring Program is revised as part of the response to this RAI, as shown below. This revision updates LRA Appendix A, Section A.2.1.33 (the UFSAR Supplement) and Appendix B, Section B.2.1.33 (the Structures Monitoring Program description) as follows. Note that Enhancement 5 is found in the original LRA within Appendix A on pages A-26 and A-27, and within Appendix B on page B-153.

This Structures Monitoring Program enhancement is changed to read as follows:
(Original text is shown in normal font, additions are shown in ***bold italics*** and deletions are shown with strikethroughs)

5. Require the following actions related to the spent fuel pool liner:

    a. Perform periodic structural examination of the Fuel Handling Building per ACI 349.3R to ensure structural condition is in agreement with the analysis.

    b. Monitor telltale leakage and inspect the leak chase system to ensure no blockage.

    c. Test water drained from the ***telltales and*** seismic gap for boron, chloride, and sulfate concentrations; and pH. ***Acceptance criteria will assess any degradation from the borated water. Sample readings outside the acceptance criteria will be entered into and evaluated in the corrective action program.***

    d. Perform ~~a~~ ***one*** shallow core sample in ***each of*** the Unit 1 Spent Fuel Pool ***walls (east and west)*** ~~where previous inspections~~ ***that*** have shown ingress of borated water through the concrete. The core sample***s*** will be examined for degradation from borated water.

    e. Perform a structural examination per ACI 349.3R every 18 months of the Unit 1 Spent Fuel Pool wall in the sump room where previous inspections have shown ingress of borated water through the concrete.

The License Renewal Commitment List, LRA Appendix A, Section A.5 is also updated to reflect this revision to Enhancement 5. See Enclosure B of this letter for the Commitment List updates.

2. The seismic gap drain was installed in the Salem Unit 1 Auxiliary Building in 2004 at approximately 9 feet below the construction joint in the Fuel Handling Building, adjacent to the bottom of the east wall of the Spent Fuel Pool. The seismic gap drain was installed to remove water from the seismic gap between the Fuel Handling Building and the adjacent Auxiliary Building, providing a path for any water entering the gap to be captured by the plant radioactive waste system. Thus, the seismic gap drain prevents release of radioactivity to the environment. The leakage of Spent Fuel Pool water into the Fuel Handling Building seismic gap drain is addressed in the Environmental portion of the LRA in Section 2.3. The seismic gap drain is continuously open to maintain a hydraulic gradient flowing into the Auxiliary Building and prevent any environmental release. The water samples from the seismic gap drains have detected some short-lived radionuclides. Monitoring wells installed in the Groundwater Recovery System are routinely monitored to develop trends in tritium concentration and verify no new source materials are released to the environment. Refer to the attached figure for a cross section through the Fuel Handling Building, which provides relative elevations.

   The following is an excerpt taken from the Salem LRA, Appendix E, Environmental Report, Section 2.3, Groundwater. It is repeated here to facilitate understanding of the discovery of Spent Fuel Pool leakage into shallow ground water, its remediation and its lack of impact upon the environment. Note that the figures referred to in the following discussion may be found in the Salem Environmental Report:

   Ground-Water Tritium

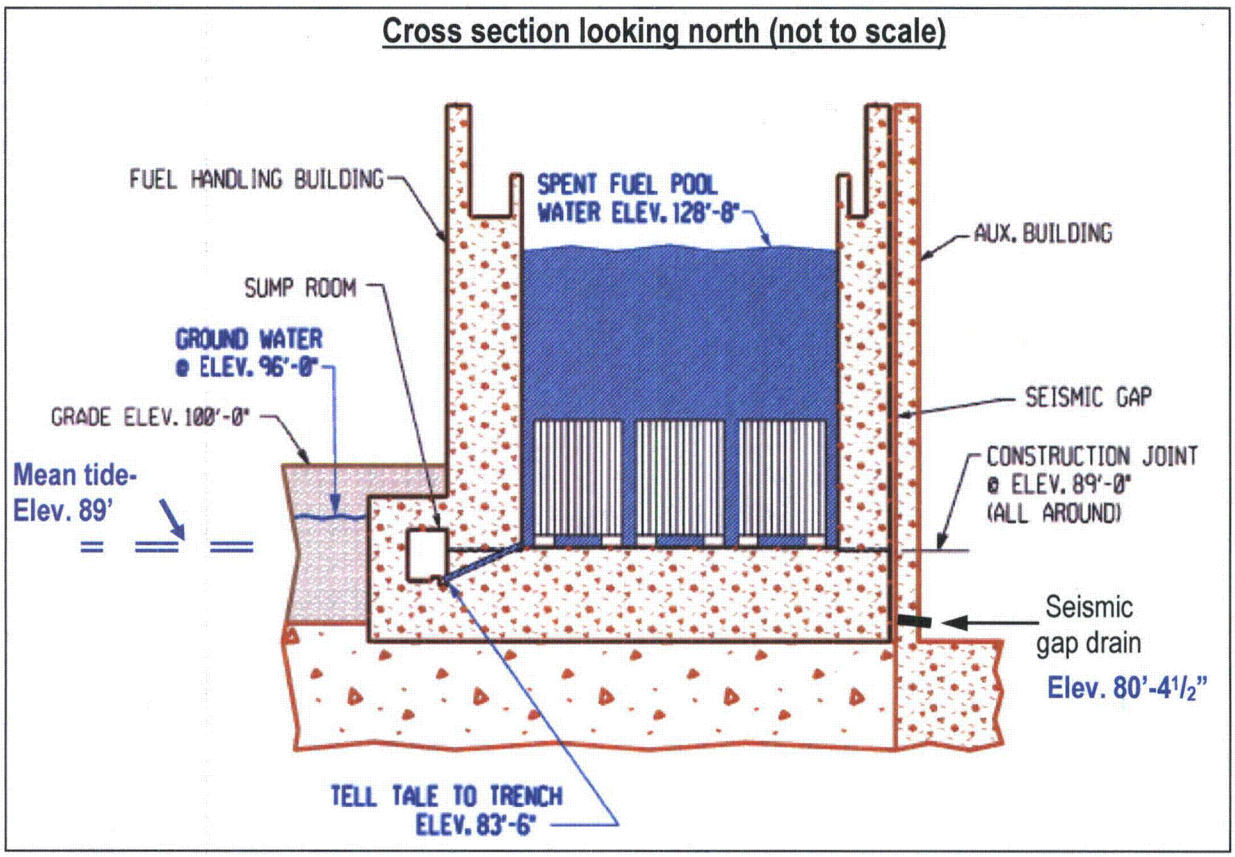
   In 2003, PSEG identified tritium in ground water from onsite sampling wells near the Salem Unit 1 Fuel Handling Building (FHB). The sampling locations were within the Salem protected area (i.e., the access-controlled site area encompassed by physical barriers). Other locations of tritium contamination in the general vicinity of the Unit 1 FHB and within the protected area were also identified. In April 2004, a Remedial Investigation Report (RIR) was submitted to the NJDEP Bureau of Nuclear Engineering (NJDEP-BNE) presenting details and results of ground-water investigation activities. The RIR indicated that the source of tritium detected in ground water was the Salem Unit 1 Spent Fuel Pool, the tritium release to the environment had been stopped, and tritium concentrations above the New Jersey Ground Water Quality Criterion had not migrated to the property boundary. Neither strontium nor plant-related gamma emitters were detected in any ground-water well. These results were used to develop a remedial action strategy designed to hydraulically contain further migration of tritium in the ground water and to remove tritium from the ground water in accordance with a Remedial Action Work Plan. The NJDEP-BNE approved the strategy in November 2004, and by September 2005 a full-scale ground-water recovery system (GRS) had been installed and was operational to contain the elevated tritium concentrations in the ground water directly under the Salem units. The ground-water recovery system reverses the ground-water flow gradient so that ground water in the recovery system's radius of influence is pulled toward the recovery system and away from the site boundary, thus ensuring that any tritium is contained and will not leave the Salem site. A total of 36 wells are included in the GRS monitoring and recovery network (Figure 2.3-1). All tritium removed from the ground water is processed in accordance with NRC requirements and station procedures.

Additionally, drains were installed in the Salem Auxiliary Buildings adjacent to the seismic gap, which provide continuous draining of the seismic gap and prevent contaminated water from the Spent Fuel Pool from migrating into the environment. Ongoing ground-water monitoring results are reported quarterly to the NJDEP-BNE, and thus far they indicate that, in addition to containing tritium migration, the ground-water recovery system is accomplishing significant decreases in ground-water tritium concentrations. Figure 2.3-2 shows the extent and concentrations of tritium in the initial tritium plume as of March 2004. Figure 2.3-3 shows the extent and concentrations of tritium in the plume as of December 2008. Together, these figures demonstrate the success of the GRS at maintaining hydraulic containment of tritium, preventing off-site release, and reducing the concentration of tritium in the shallow ground water. The Spent Fuel Pool leakage was reported to the NRC and is the subject of NRC Information Notice 2004-05, "Spent Fuel Pool Leakage to Onsite Groundwater."

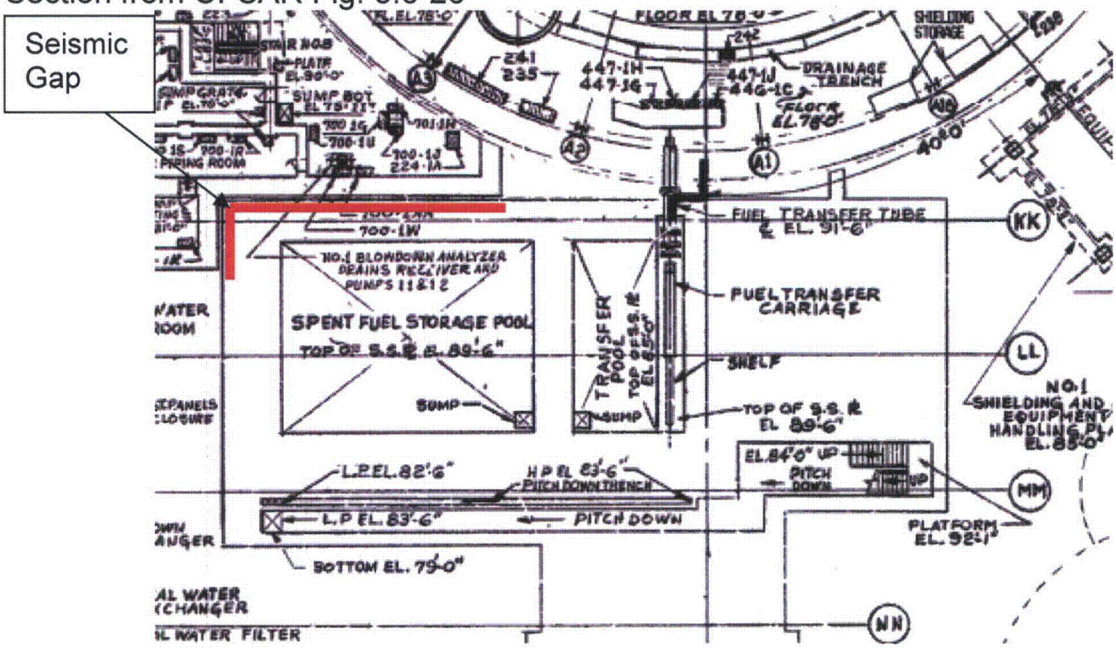
The Quarterly Remedial Action Progress Report for Salem for the fourth Quarter of 2007 indicates that the concentrations of tritium in ground water has continued to drop since the initiation of remediation and termination of the release to the environment. All tritium concentrations have been reduced to below 100,000 picoCuries per liter (pCi/L) from an initial maximum of approximately 15,000,000 pCi/L. Most of the ground-water concentrations are below 20,000 pCi/L. No station-related gamma emitting radionuclides or strontium has been detected in ground-water samples. Tritium concentrations exceeding NJDEP Ground Water Quality Criterion have not migrated to the property boundary or to geologic formations deeper than the shallow water-bearing unit beneath Salem. There is no complete exposure pathway to humans or biota resulting from the release.

3. Leakage from the spent fuel pool comes from very small cracks in the Spent Fuel Pool liner. The water enters the liner leak chase channels, where the majority flows into the Fuel Handling Building sump through the leak chase drains. As explained in Salem RAI B.2.1.33-01 response per PSEG letter LR-N10-0165, the leakage in the Spent Fuel Pool liner is through multiple small cracks in liner seam welds and/or plug welds. This leakage enters the channels behind the liner either directly from cracks in seam welds or indirectly by migrating over concrete from cracks in plug welds, which are not backed by leak chase channels. The leakage in the channels travels through the tell tale drains as the path of least resistance for migration of the borated water. A portion of the plug weld leakage migrates over the slab to an open leakage channel and flows out the telltales, and, as described above, there is approximately 1/8 of a gallon per day believed to be flowing through the construction joint at the bottom of the east wall. See item 1 above for a description of additional examinations of a core sample in the east wall.

Fuel Handling Building (Cross-Section at Spent Fuel Pool):



Section from UFSAR Fig. 3.6-26



A.5 License Renewal Commitment List

The following table identifies revisions made to license renewal commitment 33 as a result of this RAI. Pre-existing text, from the LRA or previous RAI packages, is formatted in normal font; new text is bold and italicized; deleted text is indicated with strikethroughs. Pre-existing text has been repeated here to provide context for the changes. Any other actions described in this submittal represent intended or planned actions. The intended or planned actions are described for the information of the NRC and are not regulatory commitments.

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
33	Structures Monitoring Program	Structures Monitoring is an existing program that will be enhanced to include: 5. Require the following actions related to the spent fuel pool liner: a. Perform periodic structural examination of the Fuel Handling Building per ACI 349.3R to ensure structural condition is in agreement with the analysis. b. Monitor telltale leakage and inspect the leak chase system to ensure no blockage. ***c.*** Test water drained from the ***telltales and*** seismic gap for boron, chloride, and sulfate concentrations; and pH. ***Acceptance criteria will assess any degradation from the borated water. Sample readings outside the acceptance criteria will be entered into and evaluated in the corrective action program.*** d. Perform ~~a~~ ***one*** shallow core sample in ***each of*** the Unit 1 Spent Fuel Pool ***walls (east and west)*** ~~where previous inspections~~ ***that*** have shown ingress	A.2.1.33	Program to be enhanced prior to the period of extended operation.	Section B.2.1.33 Salem letter LR-N10-0165 RAI B.2.1.33-1 Salem letter LR-N10-0321 RAI B.2.1.33-05 ***Salem letter LR-N10-0414 RAI B.2.1.33-07***

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		of borated water through the concrete. The core sample**s** will be examined for degradation from borated water. e. Perform a structural examination per ACI 349.3R every 18 months of the Unit 1 Spent Fuel Pool wall in the sump room where previous inspections have shown ingress of borated water through the concrete.			