1101 Market Street, Chattanooga, Tennessee 37402

CNL-15-171

September 11, 2015

10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: Application to Revise Technical Specification 6.8.4.h, "Containment Leakage Rate Testing Program," (SQN-TS-14-03) (TAC Nos. MF5366 and MF5367), Response to Request for Additional Information

References:

1. Letter from TVA to NRC, CNL-14-176, "Application to Revise Technical Specification 6.8.4.h, "Containment Leakage Rate Testing Program," (SQN-TS-14-03)," dated December 2, 2014 (ADAMS Accession No. ML14339A539)

2. Nuclear Energy Institute 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 2012 (ADAMS Accession No. ML12221A202)

3. Electronic mail from Andrew Hon (NRC) to Joseph W. Shea (TVA), "Sequoyah Nuclear Station, Unit 1 & 2 - Request for Additional Information Related to LAR to Revise Containment Leakage Rate Testing Program," dated August 6, 2015

By letter dated December 2, 2014 (Reference 1), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for Sequoyah Nuclear Plant (SQN), Units 1 and 2, revising the SQN, Units 1 and 2, Technical Specifications (TS) 6.8.4.h, "Containment Leakage Rate Testing Program," by adopting Nuclear Energy Institute (NEI) 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," (Reference 2) as the implementation document for the performance-based Option B of 10 CFR Part 50, Appendix J. The proposed changes permanently extend the Type A containment integrated leak rate testing (ILRT) interval from 10 years to 15 years and the Type C local leakage rate testing intervals from 60 months to 75 months.

By electronic mail dated August 6, 2015 (Reference 3), the Nuclear Regulatory Commission (NRC) requested additional information to support the review of the LAR. The response to the request for additional information (RAI) is due September 8, 2015. During a telephone conversation with the NRC Project Manager on September 2, 2015, the due date for the response to the RAI was extended to September 10, 2015.

Enclosure 1 to this letter provides TVA's RAI responses. There are no changes required to the LAR as submitted in the Reference 1 letter as a result of this additional information. Enclosure 2 to this letter provides a list of regulatory commitments containing one new regulatory commitment.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50.92(c), TVA has determined that the additional information, as provided in this letter, does not affect the no significant hazards consideration associated with the proposed application previously provided in Reference 1.

Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosure to the Tennessee Department of Environment and Conservation.

There is one new regulatory commitment contained in this submittal. Please address any questions regarding this request to Mr. Edward D. Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 11th day of September 2015.

Respectfully,

J.W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. Response to Request for Additional Information
2. List of Regulatory Commitments

Enclosures

cc (Enclosures):

NRC Regional Administrator - Region II
NRC Resident Inspector – Sequoyah Nuclear Plant
NRC Project Manager – Sequoyah Nuclear Plant
Director, Division of Radiological Health - Tennessee State Department of Environment and Conservation

ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
UNITS 1 AND 2

Response to Request for Additional Information

Request for Additional Information (RAI) RAI 1

Section 4.4.1 of the LAR indicates that SQN, Units 1 and 2, have completed requirements of the first period, second 10-year interval containment IWE in-service inspection and no detrimental flaws have been observed to date. A table has been provided in Section 4.4 of the LAR which indicates that a general visual examination of accessible interior surface of the Unit 1 containment vessel was planned for April 2015. Considering that the LAR may not include the latest inspection results, please discuss the highlights of those inspections and corrective actions (if any) performed subsequent to the submittal of the LAR that relate to the structural integrity and leak-tightness of the SQN Units 1 and 2 primary containments.

TVA Response

Since the License Amendment Request (LAR) was submitted on December 2, 2014, only the Sequoyah Nuclear Plant (SQN), Unit 1 containment has been examined. Examinations of the moisture barrier, thermal barrier, Steel Containment Vessel (SCV) inboard and outboard surfaces, and penetration X-129E were completed for the SQN, Unit 1 containment in April and May of 2015 during refueling outage U1R20. The results of these examinations are summarized as follows.

Moisture Barrier
The General Visual Examination of the moisture barrier found five areas with indications of loss of adhesion. The areas were excavated after the initial examination. Excavated areas were examined and found to be acceptable. Following excavation and examination, the sealant was reapplied and the areas were reexamined. The resealed areas were found to be acceptable.

Thermal Barrier
All loose seams in the Thermal Barrier were caulked.

Steel Containment Vessel
The General Visual Examination of the SCV found signs of distress and rust at penetration X-155. There were previously reported indications of coating/paint flaking at various locations on the SCV inboard surface. The SCV outboard surface had scratches and scrapes with light to medium rust, but no recordable indications were found.

None of the indications are greater than 10% of the SCV thickness. There is no effect to the structural integrity of the SCV. There is no indication that an adverse condition exists. The indications were determined to be acceptable for continued service. Successive examinations will be performed next inspection period as prescribed in IWE 2420(b).

Penetration X-129E
The American Society of Mechanical Engineers (ASME) Section XI VT-2 Visual Examination found no recordable indications.

RAI 2

Section 4.4.2 of the LAR states that the Class CC equivalent components at SQN (i.e., the structural base slab and metal liner) are exempt from examination based on the exemptions of IWL-1220(b) and IWE-1220(b). The structural base slab and metal liner are covered with concrete, which forms the reactor building floor and results in these components being inaccessible for examination.

Please provide the timing, frequency, and the extent of inspections for monitoring the aging effects of the reinforced concrete components in accessible areas performed as part of the SQN in-service inspection program and structures monitoring program. Also, provide discussion and demonstrate that there is reasonable assurance that the containment vessel reinforced concrete foundation mat is adequately monitored for its performance or condition in a manner that allows for timely identification and correction of degraded conditions. The response to this request for additional information should also include the results of recent inspections of the SQN Units 1 and 2 shield buildings.

TVA Response

A General Examination of containment surfaces is performed in accordance with Section XI, IWE-2412-1 and Table IWE-2500-1 during each inspection period. This is an examination of exposed accessible interior and exterior surfaces of the SCV to verify that no evidence of structural deterioration exists which may affect either the containment structural integrity or leak tightness. In accordance with site procedures special emphasis is placed on the liner to concrete interface areas inside the Annulus and Raceway.

A structures monitoring inspection is performed on a 5-year frequency that includes all structures in the scope of the SQN 10 CFR 50.65 Maintenance Rule Program. During this inspection, a walkdown of the containment is performed looking for obvious degradation or the presence of aging mechanisms on visible/accessible portions of the Shield Building, containment interior concrete, and the SCV.

Inspections of the shield building interior and exterior are also performed under a preventative maintenance surveillance for Shield Building integrity verification. These inspections are performed on a 10-year frequency, and also serve to identify concrete aging mechanisms or degradation.

The Structures Monitoring Program addresses detection of aging effects for inaccessible and below-grade concrete structures in accordance with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated December 2010. The acceptability of inaccessible areas are evaluated when conditions exist in accessible areas that could indicate presence of, or result in, degradation to such inaccessible areas. Also, representative samples of the exposed portions of the below grade concrete are examined when excavated for any reason. TVA committed to revise the SQN Structures Monitoring Program Procedures prior to the Period of Extended Operation (PEO) to include: “Opportunistic inspections when normally inaccessible areas (e.g., high radiation areas, below grade concrete walls or foundations, buried or submerged structures) become accessible due to required plant activities. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant degradation is occurring," as stated in TVA Letter dated August 21, 2014, Enclosure 2, commitment number 31.” There has been no abnormal degradation of the SQN Units 1 and 2 Shield Buildings/containment concrete detected by the above inspections that would indicate the potential for significant concrete degradation in inaccessible areas. The most recent inspections of the Shield Buildings were performed under

the maintenance rule structures inspection program during U1R18 and U2R18, for SQN Unit 1 and Unit 2, respectively.

RAI 3

Section 4.4.1 of the LAR provided information regarding the operating experience and examination of the moisture barrier at the junction of the containment vessel wall and the concrete floor. It is stated that (1) examinations were conducted in 2000, 2003, 2006, 2011, and 2014 for SQN, Unit 2, and in 2000, 2004, 2006, and 2012 for SQN, Unit 1; and (2) in each of the examinations, areas were noted where the moisture barrier was not completely adhered to the concrete interface. The moisture barrier was removed and reapplied in the subject areas. Please provide the following:

a. *TVA's evaluation of the cause of degradation and specific details on TVA's corrective action(s) to demonstrate effective management of this identified degradation. The response should include details regarding (1) how the lack of bond between the moisture barrier and the respective surfaces at the junction of the concrete floor and the containment vessel wall was resolved; and (2) the effectiveness of the corrective action(s) considering that in each examination since 2000, areas were noted where the moisture barrier was not completely adhered to the concrete interface.*

TVA Response

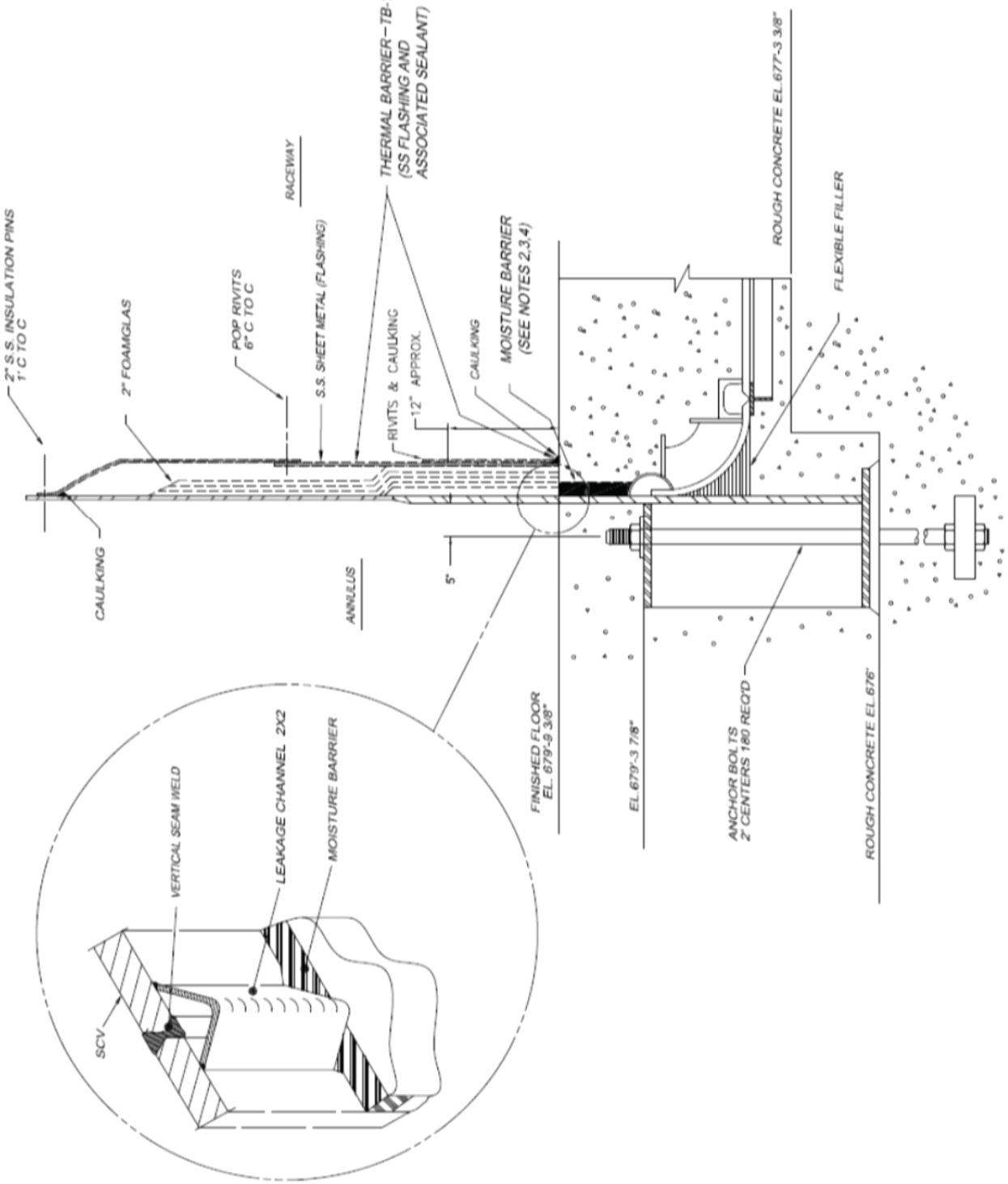
Examinations of the moisture barrier have identified areas with lack of bonding of the sealant. When these areas are identified, the sealant is excavated to allow inspection of the SCV under the moisture barrier and the condition is entered in the Corrective Action Program for evaluation. Examinations have identified no instances of suspect areas or detrimental flaws that would affect the structural integrity of leak tightness of the SCV. After examination of the excavated areas, the sealant is reapplied and reexamined prior to the end of the outage. Because no instances of suspect areas or detrimental flaws have been identified, other corrective actions were not required as a result of these examinations.

b. *The LAR does not have specific details to determine whether the inspections covered both interior and exterior moisture barriers at the interface of the containment vessel wall and concrete.*

TVA Response

The moisture barrier is intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete to metal interfaces that are not seal welded. The moisture barrier is the sealant between the concrete to metal containment interface in the raceway behind the metal flashing. The raceway is an area inboard of the SCV between the Polar Crane Wall and the SCV on the bottom elevation of containment used for access to the accumulator rooms, fan rooms, and inside the polar crane wall. An examination of the moisture barrier is performed each inspection period. The flashing covering the moisture barrier is removed to allow access for examination.

The SCV to concrete interface is visible in the Annulus. The annulus is the area in the reactor building between the SCV and the concrete shield building. No moisture barrier covers the SCV to concrete interface in the Annulus. The metal to concrete interface is examined in the Annulus each inspection period. The following detail provides a representation of the internal and external SCV to concrete interface.


2" S.S. INSULATION PINS 1' C TO C
2" FOAMGLAS
POP RIVITS 6" C TO C
RACEWAY
S.S. SHEET METAL (FLASHING)
THERMAL BARRIER - TB-1 (SS FLASHING AND ASSOCIATED SEALANT)
RIVITS & CAULKING 12" APPROX.
CAULKING
MOISTURE BARRIER (SEE NOTES 2,3,4)
ROUGH CONCRETE EL 677'-3 3/8"
FLEXIBLE FILLER
CAULKING
ANNULUS
5"
FINISHED FLOOR EL 679'-9 3/8"
EL 679'-3 7/8"
ANCHOR BOLTS 2" CENTERS 180 REQ'D
ROUGH CONCRETE EL 676"
VERTICAL SEAM WELD
LEAKAGE CHANNEL 2X2
MOISTURE BARRIER
SCV

RAI 4

As stated in the LAR, the SQN in-service inspection program contains requirements to evaluate the acceptability of the inaccessible areas, if such conditions were identified, in accordance with 10 CFR 50.55a(b)(2)(ix)(A).

Please discuss areas, other than moisture barrier, of the SQN Units 1 and 2 containment vessels that are inaccessible and susceptible to degradation and provide information of instances where existence of or potential for degraded conditions in inaccessible areas were identified and evaluated based on conditions found in accessible areas, as required by 10 CFR 50.55a(b)(2)(ix)(A). As a minimum, the response should discuss the operating experience (1) where stainless steel sheet metal thermal barrier is covering approximately 5 feet of the bottom of the containment vessel wall, as depicted in Section A-A of Figure 3.8.2-7 of the SQN final safety analysis report; and (2) of the areas of the containment vessel that are inaccessible due to the ice condenser system configuration.

TVA Response

The areas around inaccessible areas, including those inaccessible due to the ice condenser configuration, are examined and, to date, no areas have been identified that would indicate there is an issue that would adversely affect structural integrity or leak tightness of the SCV in inaccessible areas. Remote visual techniques are used, if possible, to eliminate inaccessibility. A section of the stainless steel sheet metal thermal barrier is removed during moisture barrier examinations to allow access, and the accessible areas beneath the thermal barrier are examined. No problems have been identified during those examinations.

RAI 5

NRC Information Notice 2004-09 stated that:

> *Localized water ponding at the clogged drain, in the annulus area, had come in contact with a section of the steel containment vessel (SCV), causing deterioration of the SCV coatings and rusting of the SCV. This area of the SCV is restricted for access due to the close proximity between the SCV and the emergency gas treatment system (EGTS) duct work.*
>
> *These [Corrective] actions consisted of the removal of the EGTS duct work on both Unit 1 and Unit 2 to allow the SCV area behind the EGTS duct work to be cleaned and recoated. Also the licensee has identified this SCV area behind the EGTS duct work for periodic visual examination.*

Please provide information regarding the results of periodic examinations of this SCV area since discovery of the above referenced degradation.

TVA Response

The examinations behind the EGTS duct work are performed every inspection period during the outboard SCV inspection in the Annulus. No new indications have been identified during these examinations since NRC Information Notice 2004-09 was issued.

RAI 6

Section 4.0 of the LAR, in response to Condition 4 in Section 4.1 of the NRC safety evaluation (SE) for Topical Report NEI 94-01, Revision 2, dated June 25, 2008 (ADAMS Accession No. ML081140105), stated that SQN Units 1 and 2 have already replaced the steam generators and the design change process addressed the testing requirements.

In Section 4.1 of the LAR, it is noted that (1) the SQN Units 1 and 2 steam generators required temporary construction openings which were restored by reinstalling the removed steel sections and rewelding them using full penetration welds; and (2) the integrity of the restored vessel was verified by non-destructive examination (NDE) and leak testing of the welds.

In reference to Section 3.1.4 of the NRC safety evaluation for NEI 94-01, Revision 2, dated June 25, 2008, and to adequately address Condition 4 in Section 4.1 of the NRC safety evaluation, please provide the following:

a) *The statement in the LAR regarding the integrity of the restored vessel being verified by NDE and leak testing of the welds is brief and gives the appearance that only a local leak rate test was performed. Please provide further information and confirm that all testing committed by TVA for alternative to the testing requirements in paragraph IWE-5221, Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code regarding post-repair pressure testing following SQN Units 1 and 2 steam generator replacements, as described in the NRC safety evaluations dated May 9, 2003 (ADAMS Accession No. ML031320320) and December 22, 2011 (ADAMS Accession No. ML11313A165) for SQN Units 1 and 2, respectively, were completed and all required acceptance criteria were satisfied.*

TVA Response

SQN, Unit 1

The NRC Safety Evaluation dated May 9, 2003, described the following testing.

- Magnetic particle test of the back gouge of the root pass
- 100 percent radiography on the pressure boundary containment SCV final repair welds
- Local leakage/pressure test of the SCV repair welds by pressurizing the containment vessel to the required test pressure of at least accident pressure (P_a) (per the SQN, Unit 1 Technical Specifications (TS) P_a is 12.0 pounds per square inch gauge (psig)) and performing a bubble test of the repair welds

TVA confirms that the required testing was completed prior to returning the SQN, Unit 1 SCV to service and that the applicable acceptance criteria were met.

SQN, Unit 2

The NRC Safety Evaluation dated December 22, 2011, described the following testing.

- Magnetic particle testing of the weld preparation area before performing the weld repair
- 100 percent radiography of the final repair weld
- General visual examination of the SCV pressure boundary welds
- VT-3 examination of the SCV pressure boundary welds
- A detailed visual VT-1 examination of the SCV pressure boundary welds
    - Weld leak test by pressurizing the containment to a test pressure, P_a, of at least 12 psig for a minimum of 10 minutes and performing a bubble test of the repair welds

TVA confirms that the required testing was completed prior to returning the SQN, Unit 2 SCV to service and that the applicable acceptance criteria were met.

b) Information regarding examination of the new containment vessel dome welds that are currently implemented as part of the SQN containment in-service inspection.

TVA Response

Two SCV cutouts were removed and replaced in each SQN Unit's SCV to allow access to the Steam Generators during the replacement outages.

Grid locations for Ultrasonic Testing (UT) thickness examinations have been selected. Each grid is 12 inches wide and 24 inches long, and they are spaced equally along the cut lines. Areas with less than the calculated T minimum thickness will be evaluated. These exams are performed every other outage. The last performance of this examination on SQN, Unit 1 was in 2013 during refueling outage U1R19. No thickness readings were less than the T minimum thickness. The last performance of this examination for Unit 2 was in 2014 during refueling outage U2R19. One grid was found to be less than the T minimum thickness, and that grid was evaluated and found to be acceptable.

c) Confirmation that TVA will implement the staff position with regard to any future post-repair pressure testing following major and minor containment repairs and modifications, as explained in Section 3.1.4 of the NRC staff SE for NEI 94-01, Revision 2.

TVA Response

TVA will implement the staff position with regard to any future post-repair pressure testing following major and minor SQN, Unit 1 and 2 containment repairs and modifications, as explained in Section 3.1.4 of the NRC staff SE for NEI 94-01, Revision 2. Specifically, TVA commits to revise NEDP-14, "Containment Leak Rate Programs," to incorporate the requirements of NEI 94-01, Revision 2, Section 3.1.4 for future post-repair pressure testing following major and minor SQN, Unit 1 and 2 containment repairs and modifications within 60 days of NRC approval of the License Amendment Request submitted December 2, 2014.

RAI 7

In Section 4.2, Integrated Leak Rate Test History, page E1-8 of 27, of the submittal, there is a failure of the 4/28/92 as found leakage. The submittal states:

> *"A single penetration (X-47A) in the ice condenser glycol system was responsible for this failure. Corrective action was implemented to reduce the chance of recurrence."*

Please explain how TVA met the criteria of NEI 94-01, Revision 3-A, Section 9.2.3 for two successful consecutive tests in order to be granted a Type A extension. What was the as-left leakage? What type of penetration is X-47A classified?

TVA Response

Prior to the start of the April 28, 1992, Type A test, the valves associated with a single penetration (i.e., X-47A) in the ice condenser glycol system failed their as-found local leak rate tests (LLRTs). During the April 1, 1992, performance of the as-found Type C LLRTs of outboard containment barrier isolation valve FCV-61-191 and the associated inboard containment barriers FCV-61-192 and thermal relief check valve VLV-61-533, TVA discovered that both FCV-61-191 and FCV-61-192 (air operated diaphragm valves) failed to fully close. The FCV-61-191 leak rate was determined to be approximately 526.66 SCFH and the FCV-61-192/VLV-61-533 leak rate was determined to be approximately 211.19 SCFH. The resulting as-found minimum path leak rate was calculated as approximately 211.19 SCFH. The FCVs were repaired and retested on April 2, 1992, with as-left results determined to be 0.00 SCFH for each valve.

At the time of the 1992 Type A test, the minimum path leakage savings (i.e., the difference between the as-found and the as-left leak rates) for all Type B and C tests was added to the Containment Integrated Leak Rate Test (CILRT) results, as described in NRC Information Notice 85-71, "Containment Integrated Leak Rate Tests," dated August 22, 1985. The 1992 Type A test was considered a failure due to addition of the leakage savings from penetration X-47A. In fact, the as-found minimum path leak rate for penetration X-47A of 211.1943 SCFH was greater than the CILRT acceptance criteria of 168.75 SCFH.

NEI 94-01, Revision 3-A, Section 5.0 defines the performance leakage rate as the sum of the Type A upper confidence limit (UCL) and as–left minimum pathway leakage rate (MNPLR) leakage rate for all Type B and Type C pathways that were in service, isolated, or not lined up in their test position (i.e., drained and vented to containment atmosphere) prior to performing the Type A test. In addition, leakage pathways that were isolated during performance of the test because of excessive leakage must be factored into the performance determination. The performance criterion for Type A tests is a performance leak rate of less than 1.0 La.
NEI 94-01, Revision 3-A, Section 9.1.1 also states that the allowable performance leakage rate is calculated as the sum of the Type A UCL and as–left MNPLR leakage rate for all Type B and Type C pathways that were in service, isolated, or not lined up in their test position (i.e., drained and vented to containment atmosphere) prior to performing the Type A test. In addition, leakage pathways that were isolated during performance of the test because of excessive leakage must be factored into the performance determination. If the leakage can be determined by a local leakage rate test, the as– left MNPLR for that leakage path must also be added to the Type A UCL. If the pathway leakage cannot be determined by local leakage rate testing, the performance criteria are not met.

The 1992 Type A test as-found Total Time Leak Rate (TTLR) without the leakage savings from X-47A was calculated at 0.15073%/ day and the as-found Mass Leak Rate (MLR) was

calculated at 0.05773%/ day which is less than 1.0 La (0.25%/day). Therefore, had the NEI 94-01, Revision 3 guidance been in place at the time of the April 28, 1992, Type A test, the test would not have been counted as a failure.

NEI 94-01, Revision 3-A, Section 9.2.3 defines acceptable performance history as successful completion of two consecutive periodic Type A tests where the calculated performance leakage rate was less than 1.0 La. Because the NEI 94-01, Revision 3-A, Section 9.1.1 method for calculating performance leakage rate does not require addition of leakage savings, the 1992 Type A test performance may be counted as one of the two successful consecutive tests to grant a frequency extension in accordance with NEI 94-01, Revision 3, Section 9.2.3.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
UNITS 1 AND 2

List of Regulatory Commitments

Revise NEDP-14, "Containment Leak Rate Programs," to incorporate the requirements of NEI 94-01, Revision 2, Section 3.1.4 for future post-repair pressure testing following major and minor SQN, Unit 1 and 2 containment repairs and modifications within 60 days of NRC approval of the License Amendment Request submitted December 2, 2014.