August 2, 2000

Mr. J. A. Scalice
President, TVA Nuclear and
Chief Nuclear Officer
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION ON THE INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS (TAC NOS. M83674 AND M83675)

Dear Mr. Scalice:

The Tennessee Valley Authority (TVA) submitted the Individual Plant Examination for External Events (IPEEE) for the Sequoyah Nuclear Plant (SQN), Units 1 and 2, to the U.S. Nuclear Regulatory Commission (NRC) on June 29,1995, in response to Supplement 4 to NRC Generic Letter 88-20. After review of the submittal, an initial Request for Additional Information (RAI) was issued on December 1, 1995. TVA responded with additional information on March 29, 1996. Additional NRC staff questions, during a subsequent conference call, resulted in TVA submitting a revised fire IPEEE on September 1, 1999. The NRC staff and it's contractors have concluded that, at this point in time, the information provided by these submittals and RAI responses do not provide sufficient information to allow the staff to complete its IPEEE review. Therefore, we have developed the enclosed RAI related to the seismic and fire analyses in the IPEEE. The RAIs were developed by our contractor, Energy Research Incorporated, and reviewed by both the seismic and fire "Senior Review Boards" (SRBs) at an SRB meeting on May 30, 2000. The SRB is comprised of NRC staff and Sandia National Laboratory (NRC consultants) personnel who have probabilistic risk assessment expertise in external events.

As discussed during a conference call on July 20, 2000, the NRC staff requires TVA's response to the enclosed RAI to complete its review. Mr. James D. Smith of the SQN Licensing Staff stated that TVA would respond to this request by December 15, 2000.

Please have your staff contact me at (301) 415-2010 if there are any questions regarding the enclosed request.

Sincerely,

/RA by Richard P. Correia for/
Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosure: Request for Additional Information

cc w/enclosure: See next page

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SUPPLEMENTAL REQUEST FOR ADDITIONAL INFORMATION

INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS (IPEEE) SUBMITTAL

SEQUOYAH NUCLEAR PLANT (SQN), UNITS 1 AND 2

DOCKET NOS. 50-327 and 50-328

Seismic Events

1. In the SQN IPEEE, the review level earthquake (RLE) was characterized in a manner inconsistent with the intent of NUREG-1407. The intent of NUREG-1407 is that the RLE control motion for SQN (which is predominantly a rock site) should be specified at rock outcrop as the NUREG/CR-0098 median 5% damped spectral shape for rock, anchored to a peak ground acceleration (PGA) of 0.30g at rock outcrop. The SQN IPEEE appropriately specified the RLE spectral shape as the NUREG/CR-0098 median rock spectrum at rock outcrop, but inappropriately specified the RLE PGA of 0.30g as occurring at the soil surface. Since this split approach of specifying the control motion has resulted in a rock outcrop PGA of about 0.19g, rather than 0.30g, the RLE seismic demands may have been considerably underestimated. The correct RLE demands may potentially be a factor of 1.58 (i.e., the ratio of 0.30 to 0.19) times those determined in the SQN IPEEE. Stated differently, actual component capacities may be only about 0.63 (i.e., the ratio of 0.19 to 0.30) times the capacities computed in the SQN IPEEE. Hence, components having computed high confidence of low probability of failure (HCLPF) capacities as high as 0.47g in the SQN IPEEE may have actual HCLPF capacities less than 0.30g.

   In addition to the residual heat removal heat exchangers and essential raw cooling water 480V motor control centers that were found in the SQN IPEEE to have HCLPF capacities less than 0.3g, Table 3.1.4-1 of the SQN IPEEE submittal identified 14 items having HCLPF capacities less than 0.40g, and 43 additional items that were not screened out. These findings were based on the RLE demands as discussed above. If appropriate RLE seismic demands were applied, it is expected that additional components would not be screened out, the unscreened components would be assessed as having lower capacities, and several additional components would be identified as not meeting the RLE. For example, the following seven components were found from Table 3.1.4-1 of the SQN IPEEE submittal to have (or potentially have) an HCLPF capacity only slightly greater than the RLE:

   - 480V Shutdown Boards (HCLPF=0.33g)
   - 6.9kV Shutdown Boards (HCLPF=0.33g)
   - 480V Shutdown Transformer (HCLPF=0.32g)
   - 125V DC Vital Battery Chargers (HCLPF=0.32g)
   - Main Control Room Air Handling Units (HCLPF=0.31g)
   - Ice Condensers (HCLPF=0.31g)
   - Auxiliary Building Roof Diaphragm (HCLPF>0.30g)

   For at least these essential safe shutdown components, it is expected that HCLPF capacities would be much lower than 0.30g if correct RLE demands were applied.

Enclosure

(a) Please discuss the importance of these components in achieving safe shutdown for seismically-induced transient and small LOCA events involving loss of offsite power. Indicate and discuss what alternate paths for successful shutdown may exist that do not rely on these components. Please also discuss and identify safe shutdown components and human actions that would be affected by failure of the auxiliary building roof diaphragm.

(b) For all components that are relied upon for safe shutdown in two success paths, please develop the appropriate RLE seismic demands for SQN in accordance with the intent of NUREG-1407 as clarified above. Please perform a screening assessment of the components based on the new seismic demands, and then evaluate the corrected component HCLPF capacities for all components that do not screen out. Please report the results of this reevaluation, including component and plant HCLPF assessments, and any overall conclusions on the seismic IPEEE that may have changed as a result of this reanalysis.

Fire Events

1. In Step 3 of Phase II (please refer to Section 5 of the SQN fire IPEEE summary report), the submittal has introduced a “severity factor” to compute the conditional probability of damage to safe shutdown cables and equipment in a compartment. This “severity factor” is then multiplied by the failure probabilities of automatic and manual suppression. As discussed in Reference 1, severity factors should not be multiplied by non-suppression probabilities, since the two probabilities are based on a common pool of event data. That is, the potential for a large fire is dependent upon failure of fire suppression; therefore, the methodology employed in IPEEE fire analysis effectively results in double counting suppression efforts.

   For each case that the automatic fire suppression was credited in conjunction with the fire severity factors, please explain why such credit does not constitute double counting for suppression. Please note that a re-analysis should be provided if the multiplication of the severity factors and the non-suppression probabilities cannot be adequately justified.

2. Human error probabilities have not been discussed in the fire IPEEE submittal. However, based on the revised IPEEE submittal it is not clear if the licensee has properly modified the individual plant examination (IPE) human error probabilities (HEPs) to reflect the special conditions imposed by the occurrence of a fire. It is important that the HEPs properly reflect the potential effects of fire (e.g., smoke, heat, loss of lighting, etc.), even if these effects do not directly cause damage to equipment in the scenarios being analyzed. If the influence of fire environment on quantifying the various HEPs is not properly considered, there is a potential for assigning optimistic HEP values. Note that HEPs which are conservative with respect to an internal events analysis could be non-conservative with respect to a fire risk analysis.

Please provide:

(a) A list of compartments which were screened-out from further analysis in Steps 2 and 3 of Phase II, whose quantification involved one or more HEPs;

(b) The description and numerical values of HEPs for each of these compartments; and

(c) The procedure used to quantify the impact of postulated fires on the various HEPs.

Please note that a re-analysis should be provided if the influences of fire (i.e., smoke, loss of lighting, poor communication, etc.) were not taken into account, where relevant, in establishing the performance shaping factors (PSFs).

3. Related to the request for additional information (RAI) number 2 above, the human error probabilities used in computing the conditional core damage probabilities (CCDPs) for bleed and feed appear to be optimistic. The core damage frequency (CDF) of several fire scenarios (e.g., Essential Raw Cooling Water Intake Pumping Station rooms 704.0-E01 and 720.0-E01, Auxiliary Building rooms 714.0-A03, 714.0-A05, 714.0-A05', 714.0-A09, 734.0-A13, 734.0-A28, 749.0-A01, 749.0-A04, 759.0-A01, etc.) were reduced by several orders of magnitude in the final screening step. Since bleed and feed mode of core cooling requires manual operator actions, the estimated small CCDP implies the use of very small HEPs or multiplication of several HEPs without taking into consideration the possibility of dependencies among various human actions.

   For scenarios where feed and bleed was credited, please provide the basis for obtaining small CCDPs, including the basis for those HEPs that have the largest impact on the calculated CCDPs. If HEPs are multiplied, please provide the basis for assuming independence among the various human actions. Please note that a re-analysis should be provided if the technical basis for various HEPs and their independence cannot be adequately justified.

4. Based on the information provided in the IPEEE submittal, it can be inferred that smoke from several compartments can enter the Main Control Room. For example, on page 89 of Reference 2 it is stated that room 749.0-A15 includes the Main Control Room air handlers. It may be inferred that a fire in those compartments may lead to smoke in the Main Control Room. The submittal does not provide an explicit discussion of the impact of smoke due to sources in other compartments on the Main Control Room.

   Please provide a description of the analysis conducted to justify the IPEEE exclusion of the potential for smoke ingress into the Main Control Room. Please note that a re-analysis should be provided, if such an analysis was not conducted, which includes prevention of smoke ingress into the main control room or the abandonment of the main control room, as appropriate.

5. Based on the information provided in the IPEEE submittal, it can be inferred that in addition to the Main Control Room and the cable spreading room, there are several other areas in the plant where components and cables from both units are

co-located (shared compartments). A list of the shared compartments between the two units is not provided in the IPEEE submittal.

Please provide:
(a) a list of shared compartments, and
(b) a discussion of the results of an analysis of the contributions to the estimated fire core damage frequency (for both units) from core damage scenarios where fires are initiated in compartments with components for both units.

References

1. "Guidance for Development of Response to Generic Request for Additional Information on Fire Individual Plant Examination for External Events (IPEEE)," Prepared by Data Systems and Solutions, LLC for Electrical Power Research Institute, May 1999.

2. Sequoyah Nuclear Plant, "IPEEE Fire-Induced Vulnerability Evaluation (FIVE) - Determination of Fire Scenario Safe Shutdown Path Unavailability," Report SQN-IPEEE-003, May 1999.

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SEQUOYAH NUCLEAR PLANT

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