September 9, 2002

MEMORANDUM TO: Kahtan N. Jabbour, Acting Chief, Section 2
Project Directorate II
Division of Licensing Project Management

FROM: Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II ***/RA/***
Division of Licensing Project Management

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - REGARDING DRAFT QUESTIONS FOR THE UNIT 1 STEAM GENERATOR REPLACEMENT TOPICAL REPORTS AND ASSOCIATED TECHNICAL SPECIFICATION AMENDMENT (TAC NOS. MB5370, MB5371, MB5387, MB5571)

The attached questions were provided to the licensee via e-mail to allow them to prepare for a conference call regarding the questions and any clarifications they may have. Following the call, these questions, as well as any others provided by the other technical sections involved, will be formally transmitted as a request for additional information.

If there are any questions or concerns, please feel free to call Eva Brown at (301) 415-2315.

Docket Nos. 50-327 and 50-328

Attachment: E-mailed Questions

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DATE	09/09/02	09/09/02	09/09/02	09/09/02

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REQUEST FOR ADDITIONAL INFORMATION

STEAM GENERATOR REPLACEMENT

TOPICAL REPORTS AND RELATED TS AMENDMENT

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

References: Letter from the Tennessee Valley Authority (TVA) to the U.S. Nuclear Regulatory Commission (NRC), “Sequoyah Nuclear Plant (SQN) - Steam Generator Replacement Project - Topical Report No. 24370-TR-C-001, “Alternate Rebar Splice - Bar-Lock Mechanical Splices,” March 18, 2002

Letter from the TVA to the U.S. NRC, “Sequoyah Nuclear Plant (SQN) - Steam Generator Replacement Project - Topical Report No. 24370-TR-C-002, ”Rigging and Heavy Load Handling,” April 15, 2002

Letter from the TVA to the U.S. NRC, “Sequoyah Nuclear Plant (SQN) - Steam Generator Replacement Project - Topical Report No. 24370-TR-C-003, “Steam Generator Compartment Roof Modification,” March 28, 2002

Letter from the TVA to the U.S. NRC, “Sequoyah Nuclear Plant (SQN) - Unit 2 - Technical Specification (TS) Change No. 02-03, “Essential Raw Cooling Water (ERCW) Operability During Movement of Heavy Loads - One Time TS Change In Support of the Steam Generator Replacement Project,” July 10, 2002

Topical Report No. 24370-TR-C-001, “Alternate Rebar Splice - Bar-Lock Mechanical Splices”

1. Provide a copy of the Bechtel/INEEL test report for the Bar-Lock Mechanical Splices. The report should include information on who performed the splice tests, their qualifications, and how the tests were performed.

2. Describe TVA’s involvement, if any, in the Bechtel/INEEL test program.

3. Clarify whether TVA has evaluated and determined that the QA programs of the reinforcing bar supplier (Consolidated Power Supply), the reinforcing bar fabricator (Birmingham Steel Corporation), the manufacturer of the Bar-Lock coupler (including lockshear bolt, and serrated rail), and the contractors who performed the tests (Bechtel/INEEL), meet the 10 CFR 50, Appendix B requirements? Provide the results of TVA’s evaluations of theses QA programs.

4. On page 10 the report states that Bechtel has witnessed and verified implementation of Bar-Lock’s manufacturing quality control processes and procedures for compliance with the applicable provisions of American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME) N45.2. Identify and submit for staff’s review the applicable provisions of ANSI/ASME N45.2 that were considered. Discuss how the Bar-

Lock's manufacturing quality control processes and procedures comply with the 10 CFR 50, Appendix B requirements?

5. On page 11 of the report it states that "[s]ince the Bar-Lock couplers will be used in a nuclear safety-related application, they are subject to a commercial grade dedication program." Describe and submit the commercial grade dedication program for staff's review.

6. On page 12 of the report it states that the records of bolt shear test results were examined. Describe how the bolt shear test was conducted and submit a typical bolt shear test result, including the relationship between applied shear force and recorded shear deformation of a test bolt.

7. The Bar-Lock coupler system relies on the clamping force generated on the rebars between the lockshear bolts and serrated rails. Provide the magnitude of the compressive stress and force on the tip of a lockshear bolt and the strain in the bolt after the bolt installation. Provide the stress relaxation characteristic of the lockshear bolt (relaxation is defined as the loss of its compressive stress under strain for a period of time). Provide evidence that the clamping force generated by the lockshear bolt would not be reduced, as a result of the relaxation phenomenon, to a point that would degrade the proper function of the Bar-Lock coupler system during the life of the plant.

<u>Topical Report No. 24370-TR-C-002, "Rigging and Heavy Load Handling"</u>

8. The topical report discusses the dose consequences of dropping an original steam generator outside the containment. For staff to complete review of your dose consequences analysis, additional information is needed on the referenced calculation (Reference 23 of the topical). Provide the assumptions, inputs and methodologies used to determine the dose consequences of dropping the original steam generator. This should include the source term (isotopes and activities), control room ventilation system operation assumptions and the atmospheric dispersion factors (X/Qs) used in the dose calculation. Additionally, if the X/Qs are newly calculated and have not been reviewed by the staff, provide the inputs (including meteorological data), assumptions (including the location of the drop) and methodologies used to calculate the X/Q values.

9. Describe the attributes of the heavy lift plan for the various loads to be lifted. Specifically identify who is responsible for the development and approval of the lift plan, and are persons responsible for plan development registered professional engineers having specialized knowledge of critical lift operations? Demonstrate that the plan, in part, is based upon the following: (1) the rated capacity and operational limitations specified by the crane's load chart; (2) measured, as opposed to calculated, weights for the materials to be hoisted; (3) thorough studies of wind speed and its effect on crane and hoisted load; and (4) consideration of the effects of ground conditions and all dynamic forces on the crane's stability.

10. Will cranes (outside lift system (OLS) and mobile cranes used to erect the OLS) and work areas be equipped with strategically located instruments to monitor wind velocity (speed and direction) at or near the elevation of hoisted loads? If not, provide a justification for not making the necessary provisions to vigorously measure wind velocity.

If monitoring will be done, describe how and provide the basis for the monitoring scheme chosen.

11. What actions will be taken to ensure the crane is equipped with correctly calibrated instruments to accurately monitor all parameters affecting safe crane operation?

12. Section 5.1 of the topical report states that the rated load for the proposed crane configuration for the Sequoyah steam generator replacement (SGR) ranges from 440.8 tons (400 metric tons) to 517.9 tons (470 metric tons), depending on the lift radius. The OLS does not completely conform to the requirements of ANSI B30.5, “Crawler, Locomotive, and Truck Cranes,” and the load test requirements of B30.5 in Section 5-2.2.2 do not subject the OLS to complete functional testing with and without the load following erection. Provide a response to the following:

    (a) Will a load test of the OLS at 110-percent of the largest postulated load to be carried by the OLS be performed and what is that load and how is it determined? Will full performance tests with 100-percent of the largest postulated lifted load for all speeds and motions for which the system is designed be performed?

    (b) How will verification be performed during and following erection of the OLS, the proper assembly of electrical and structural components?

    (c) How will TVA verify the integrity of all control, operating, and safety systems of the OLS following erection?

    (d) How will TVA demonstrate the ability of the OLS to protect against an overload situation to include the ability of the OLS to withstand a load hang-up.

13. Will lifting devices that are not specially design meet the guidelines of NUREG-0612, Section 5.1.1(5), as set forth in ANSI B30.9,”Safety Standard for Cranes, Derricks, Hoists, Hooks, Jacks, and Slings?” In addition, do the interfacing lift points on the old/new steam generators such as the lifting lugs meet the guidelines of NUREG-0612, Section 5.1.6(3)(a) or (b)?

14. Provide a description of how the OLS is anchored to the platform and describe the critical locations in the load carrying parts of the OLS for the various boom configurations. During a design basis earthquake with or without the largest postulated lifted load to include pendulum and swinging loads, demonstrate that the OLS will remain anchored to the platform and that the platform and OLS will be prevented from overturning.

15. What are the minimum wind conditions for operation of the OLS, how was the minimum wind condition determined, and what is its basis? If these conditions are encountered during heavy load lifts what actions will be taken to secure the load and place it in a safe condition? How long will it take considering side loads effects could cause the OLS to tip over?

16. The submittal indicates that the mobile (lattice boom and/or truck) cranes used in the assembly/disassembly of the OLS will have a current certification and will be load tested during production. However, the licensee did not indicate if the mobile cranes will be

"proof tested" to ensure proper operation. Demonstrate the operability of the mobile cranes prior to assembly of the OLS by testing in accordance with B30.5. Will a 110-percent static load test be completed and will full performance tests with 100-percent of the largest postulated lifted load for all speeds and motions for which the system is designed be conducted prior to heavy lift operations?

17. The submittal states that restrictions on the use of these cranes (mobile cranes-lattice boom and/or truck) will be imposed to specify the weather conditions under which they may be operated and how and when to secure the mobile cranes in case of inclement weather; and the restrictions are designed to preclude adverse interactions with safety-related SSCs." With respect to the use of the mobile cranes for assembly and disassembly of the OLS, provide a response to the following:

    (a) Describe the restrictions for use of the mobile cranes during assembly/disassembly of the OLS.

    (b) What are the minimum wind conditions for operation of the mobile cranes? How was the minimum wind condition for operation determined and what is its basis (e.g., dead weight of the boom with maximum postulated lifted load)?

    (c) Describe the safety-related systems, structures and components (SSCs) that could potentially be affected by a dropped load during assembly/disassembly of the OLS. What effects could a load drop, during assembly/disassembly, have on Unit 1/Unit 2 operations?

    (d) Describe how an operator, to include those responsible for operations, will be notified of the minimum wind conditions for operation. What actions will be taken if it is determine that winds near or at the limiting conditions for operations have been reached? How long will it take to perform these actions?

    (e) Since the mobile cranes have the potential to interact with safety-related SSCs during assembly/disassembly describe the safe load paths for these cranes. What processes or procedures will be used to ensure mobile crane operator remain within the safe load paths?

    (f) Describe whether or not the mobile cranes during assembly/disassembly, with its largest postulated load, will fail and potentially impact safety-related SSCs.

18. The submittal in Section 4.2(2) states that crane operations will be conducted by highly trained and qualified personnel. Also section 4.2(3) references sections 5.1 and 5.2 as providing the details of operator qualifications that conform to ANSI B30.5. With respect to operator qualifications provide a response to the following:

    (a) Describe how qualification program satisfy the requirements in Section 5-3 of ANSIB30.5.

    (b) ANSI B30.5 in Section 5-3 states that only designated operators shall operate the crane. However, designated operators are selected or assigned by the employer or the employer's representative as being qualified to perform specific duties. If operators are not employed by SQN or are employed by SQN what requirements/criteria are used to designate operators as being qualified (e.g., physical faculties and fitness, deviations from physical qualifications, grounds for disqualifications, required safety instruction, written examination, and performance test, as well as specific crane written examination and experience requirements)?

19. NUREG-0612, Control of Heavy Loads at Nuclear Plants, provides guidelines in Section 5.1.1(7) for crane designs which rely on criteria within ANSI B30.2 and CMAA specification number 70. Section 2-1 of B30.2 provides criteria for construction and installation and CMAA 70 specifies design stresses, service classification, and structural design, mechanical design, electrical and electrical equipment. However, B30.5 provides no criteria for crane design. What are the critical load bearing parts, load controlling parts, and operational safety devices of the OLS and how do the operational safety devices work together to ensure safe load handling (i.e., interlocks, upper hoist limit switch, lower hoist limit switch, rotate limit switch, emergency stop switches, locking devices, overload indicators, radius indicator, and overspeed, pressure, and temperature devices with shutdown capability if any)?

20. The topical report provides no information on the haul route from the transport location identified on figure 5-2 and whether the potential to interact with safety-related SSCs exists along the haul route, and whether those SSCs could either withstand the impact of a dropped SG or will be protected to preclude them from damage. What is the distance between the lay down area and the old and new SG storage area and what is the method used to load test the haul route (civil/structural)? What are the safety-related components that are located along the haul route that could be impacted by a dropped SG? What safety functions/systems would be impacted? What measures are to be taken to preclude a SG drop along the haul route and preclude the identified components from being damaged if a SG drop occurred?

21. In accordance with recommendations provided in NUREG-0612, Section 5.1, discuss the potential for accidental dropping of the steam generator inside the reactor containment building. Discuss the potential consequences that could result from dropping the steam generator , any compensatory measures that could be implemented to minimize and mange the damage from the drop. Provide rationale for choosing a clearance of 20 feet (ft) above the dome for lifting the steam generators when its been analytically determined that at 12.75 ft or greater a dropped SG would perforate the dome and steel containment vessel.

22. Explain what is meant by discharge piping (e.g., is it the discharge to the ultimate heat sink or is it the flow of cooling water to safety and non-safety related loads)? If discharge is to the safety and non-safety related loads describe the effects of an ERCW Train A discharge piping failure for both units on plant operations from a heavy load drop from the maximum postulated lifted load. What safety related SSCs will be affected and what compensatory measures will be implemented to minimize and manage the damage from the drop?

23. The topical report in Section 8.3 for the Unit 2 ERCW supply piping determined the peak particle velocity from a drop load using reference 14. However, reference 14 indicated that criteria for underground utilities are not available, which includes pipelines. Moreover, reference 14 indicated that criteria should be based on available controlled

tests and not on evaluations. The load used in reference 14 was a two-ton ball dropped from 40 feet which is a few orders of magnitude lower than the largest postulated load that can be potentially dropped at SQN (400-500 tons). What assumptions were made, such as soil type, soil compaction, depth of piping, vulnerability of supply piping during the lift (length of time during lift that makes this situation plausible), difference in loads evaluated in reference 14, and height of lifted load above surface? How were uncertainties accounted for in the calculation considering that the reference provides no criteria to evaluate peak particle velocities in soil for underground utilities? What was the calculated peak particle velocity and pressure 63 feet away from the drop and what design pressure is the piping designed to withstand? Does the compacted soil around the piping act as a missile shield to protect the ERCW supply line piping and if so how was this factored into the evaluation?

24. Section 8.3 of the topical indicated that the ERCW duct banks would be negatively impacted from an old steam generator/ replacement steam generator (OSG/RSG) drop. What safety-related equipment/functions would be impacted from a dropped OSG/RSG? What is the depth of the duct banks below the surface and what is the maximum pressure the duct banks can withstand without risk of failure? What were the assumptions in the analysis and what were the soil pressures 1 foot above, at the duct bank surface, and 1 to 3 feet below the duct banks as a result of dropping an OSG/RSG? What is the depth of soil to be added to account for a potential load drop? Specify what soil type, total area to be covered, and compaction requirements for the additional fill, and provide a drawing indicating the locations where fill will be added.

25. What impact will the closing of valves 1-26-575 and 1-26-653 have on the operability of the HPFP? What compensatory measures are going to be implemented during the periods of valve closure? For mobile cranes operating during assembly/disassembly of the OLS is there adequate depth of cover for fire protection piping to prevent mechanical injury?

26. Although safe load paths have been identified on figure 5-2 of the rigging and heavy load handling topical report the staff believes that it will be difficult for the operator to stay within the safe load path during the various lifts. Describe the communications plan, administrative controls , crane operator actions, and crane automatic actions used to control the lift within the safe load path identified in figure 5-2 of the topical report.

27. How much time will expire during the movement of an old steam generator along the load path (from the containment to the transporter) where interaction with safety-related SSCs could occur? How much time will expire during the movement of the replacement steam generators along the load path (from the transporter to containment) where interaction with safety-related SSCs could occur? What is the total time to move the OSGs and RSGs between the transporter and inside containment? What is the total time the SGs will be in a position to drop and cause damage to the safety-related SSCs (consider SSCs that may be impacted along the haul route from the transporter location to the storage facility)?

28. An OSG/RSG drop over Unit 1 ERCW would require realignment of the component cooling water system from Unit 2 to provide spent fuel pool cooling. With Unit 1 defueled (full core off load to the spent fuel pool) how long will it take to reach the limiting temperature for the spent fuel pool? The licensee has committed to realigned

the component cooling water system from Unit 1 to Unit 2 to provide spent fuel pool cooling in the event of a load drop. What actions are necessary (automatic and manual) and how long will it take to complete the realignment?

29. The licensee has committed to develop and issue plant procedures to delineate specific actions required in case of a heavy load drop. What will be the principle attributes of the plant procedures? When will the procedures be completed, who will require training on these procedures, and how far in advance will training be completed relative to heavy lift operations?

30. The licensee has committed to isolate shared systems with Unit 2 or verify that they are capable of being isolated following a load drop, prior to handling a load over the containment with the outside lift system. What systems are shared between Unit 1 and Unit 2 that could be impacted from a load drop over/in the vicinity of the containment? What Unit 2 safety-related functions could be impacted from such a load drop? How much time do the plant operators have to isolate these systems and how long will it take to perform the isolation functions?

31. What compensatory measures will be taken to minimize leakage through the temporary Unit 1 pipe tunnel wall from affecting safety-related equipment in the auxiliary building?

32. What components are included in the weight of the lifted loads? List the loads to be lifted and whether the lifted loads are calculated or estimated. What means will be used to verify the weight of the lifted loads in the field?

33. In Appendix A there is an item to "...develop and issue plant procedure(s) to delineate specific actions required in case of a heavy load drop." How will this condition, drop of the load, be communicated to the nuclear plant operators or site personnel?

<u>Topical Report No. 24370-TR-C-003, "Steam Generator Compartment Roof Modification"</u>

33. On page 25 the report states, that "[m]ost of the connections consist of two splice plates, one at the top side and the other at the bottom side of the roof slab. The splice plates clamp the two roof slab sections together by means of a single threaded rod (with a nut and washer at the two ends running vertically through the plates and slab thickness in the core-bore holes." Since the words "most of the connections" were used instead of "all of the connections," describe other types of connections that are used for connecting the cut out portion of concrete compartment roof to the remaining portion of the concrete compartment roof. Also, since only one single threaded rod is used to connect the two roof slab sections, there is a reliance on a friction force between the steel plates and concrete, generated by the clamping force as a result of the post-tensioned threaded rod, to tie the two sections together. The staff finds that the friction force should not be relied upon for a positive connection. Discuss the rationale to address the staff's concern in this regard.

34. On page 25 the report states that the bolt holes and annular space between the cut out portion of the concrete compartment roof to the remaining portion of the concrete compartment roof would be sealed by non-shrink grout, and that "conservative estimates (Reference 8) of the flow path through these micro-cracks yield values that are 1.6 percent of the total design bypass leakage flow area of five square feet

discussed in Updated Final Safety Analysis Report Section 6.2.1.3.5."   Reference 8 is TVA Calculation SCG-1S-609, Evaluation of Steam Generator Compartment Modification - Finite Element Analysis Results, Revision 0. Clarify how the calculated leakage was obtained from the finite element analysis results. Describe how the micro-cracks of the grout were mathematically modeled and the amount of leakage was calculated.

35. After reattaching the cut out portion of the concrete compartment roof to the remaining portion of the concrete compartment roof, what type of tests will be performed to verify that the leakage is within the allowable limit?

36. On page 27 the report states that "[t]he nodes at the cut-line along which the splice-plate connections are located were realistically modeled to transmit vertical forces and in-plane compression only." Was a zero force assumed in the vertical direction to be taken by the grout? If not, provide the justification on the amount of force in the vertical direction to be attributed to the grout.