TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

September 8, 1992

TVA-SQN-TS-92-01 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - RESPONSE TO QUESTIONS ON REQUEST FOR LICENSE AMENDMENT TO TECHNICAL SPECIFICATION (TS) - SPENT FUEL POOL STORAGE CAPACITY INCREASE

The enclosed pages respond to your questions concerning the subject submittal. We received the questions from you on July 23, 1992. A followup discussion for purposes of clarification was held by members of your staff and TVA on July 28, 1992.

Please direct questions concerning this issue to C. R. Davis at (615) 751-7509.

Sincerely,

Mark J. Burzynski

Mark J. Burzynski
Manager
Nuclear Licensing and Regulatory Affairs

Enclosures
cc: See page 2

A033 /1

cc (Enclosures):

Mr. D. E. LaBarge, Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852

Mr. Michael H. Mobley, Director (w/o Enclosures)
Division of Radiological Health
T.E.R.R.A. Building
150 9th Avenue, N
Nashville, Tennessee 37203

NRC Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

Mr. B. A. Wilson, Project Chief
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE

A. Control of Heavy Loads

Questions

1. The licensee has committed to comply with the general guidance of Section 5.1.1 of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," as documented in Table 2.4.1 of the licensing report. However, Section 5.1.2 of NUREG-0612 is also applicable to the rerack operation. Provide documentation clearly describing how compliance with Section 5.1.2 of NUREG-0612 will be achieved for all phases of the rerack operation. Control of the movement of the impact shield should be specifically addressed.

2. Show that postulated load drops during the reracking operation will not damage the fuel pool liner and structure to such an extent that the stored fuel may become uncovered.

Responses:

Section 5.1.2 of NUREG-0612 was not considered an applicable commitment for the rerack operation because Generic Letter 85-11 cancelled the Phase II requirements of Generic Letter 81-07. However, in response to the question, it is noted that Option (4) of Section 5.1.2 of NUREG-0612 calls for satisfaction of the evaluation criteria of Section 5.1 and evaluation of the consequences of a postulated heavy load drop in conformance with the guidelines of Appendix A to that document. Based on the projected outage schedule for the Sequoyah reactor units, all fuel stored in the pool is expected to have undergone 90 days of decay at the time the heavy load movements are begun and is certain to have decayed for at least 54 days, because the Unit 2 end-of-cycle 6 refueling outage duration is projected to be 65 days. Almost all the radioiodine and short-lived xenon and krypton will have decayed to very low levels. The gaseous radionuclide remaining is Kr-85 which makes a minor contribution to any offsite dose. This limits releases of radioactive material that may result from damage to spent fuel. Also, as indicated in Table 1.1.1 of the submitted report, "Spent Fuel Pool Modification for Increased Storage Capacity," a total of approximately 900 fuel assemblies will be stored in the pool at the time of reracking. Ninety percent of these will have decay times which significantly exceed 90 days. This further limits the potential for radioactive material release. Accordingly, based on a comparison of this information and specific rerack calculations performed for a Sequoyah fuel handling accident with NUREG-0612 Tables 2.1-1 and 2.1-2, the accidental dropping of a postulated heavy load will produce doses that are well within (less than one-fourth) 10 CFR Part 100 limits.

Section 2.2.6 of NUREG-0612 concludes that there appears to be no potential for a criticality situation due to a heavy load drop in a PWR spent fuel pool which contains only totally spent fuel. No fresh fuel and very little, if any, partially burned fuel is expected to be stored in Sequoyah's pool during installation of the new racks. The racks contain large amounts of Boral neutron poison and structural steel. Section 2.2.6 further concludes that there is low potential for criticality if PWR spent fuel racks containing non-spent fuel are crushed. Section 4.1 of Appendix A to NUREG-0612 allows boron credit for load drop accidents under certain conditions. Sequoyah's technical specifications will satisfy these conditions in that boron concentration must be determined by chemical analysis to be greater than or equal to 2000 parts per million (ppm) at least once per 72 hours during fuel movement. Such fuel movement or shuffling will be required on a continuing basis as the new racks are installed. Section 4.1 of Appendix A further states that the largest array of non-spent fuel a licensee should have to consider is that of an offload core, and Section 4.2.2(2) states an estimated maximum reactivity insertion due to crushing is 0.05 δk. By comparison the reactivity value of 2000 ppm boron for Sequoyah's new and existing racks is between 0.15 and 0.20. Therefore, the accidental dropping of a heavy load will not result in a fuel configuration such that k_{eff} is larger than 0.95.

Appendix A of NUREG-0612 mandates that the structural analysis of the load be predicated on the following bases/limitations.

(i) The load drop orientation is the most adverse which would result in the most severe consequences.

(ii) The fuel has decayed for at least 100 hours.

(iii) The true stress-strain relationship of the deforming structure is employed.

Postulating accidental drop of a rack along with its lifting attachment from the maximum possible height, and further postulating the most adverse physically admissible drop profile, results in a primary impact of the rack with the pool slab. Recognizing that the pool slab is located over a rock subgrade and buttressed with approximately 20 feet of reinforced concrete, the postulated rack drop is incapable of actuating a gross structural failure. This conclusion is substantiated by prior analyses performed for recent rerack licensing submittals such as the one for Three Mile Island Unit 1. The physical integrity of the pool and its function as a container of cooling and shielding water is, therefore, unimpaired. While localized damage to the liner can be hypothesized, the associated leakage will be minor and contained within the relatively small volume of the leak chase system, and therefore, strictly speaking, does not constitute loss of water from the spent fuel pool system. Also the leak rate will be small compared to available installed makeup capacity from the Refueling Water Storage Tank (RWST). Each reactor unit has an RWST with a volume of 370,000 gallons and a boron concentration maintained between 2500 and

2700 ppm as required by technical specifications. Borated water may be supplied from the RWST via a refueling water purification pump, which has a 200 gpm design flow. Two such pumps are available. Alternatively, a temporary line can be run from the boric acid blender, located in the Chemical and Volume Control System, directly into the spent fuel pool. In summary, the cooling and shielding of spent fuel in the pool would remain unaffected by a postulated heavy load accident during the rerack operation.

With respect to the movement and placement of the impact shield, we note the following items:

1. The weight of the impact shield is approximately 3-1/2 tons. This is less than the weight of the heaviest rack so that movement of the shield over the designated heavy load path outside of the pool area is not a bounding case.

2. The impact shield is not moved over any portion of the main pool, but is moved into its final position by moving directly over the cask pit. The impact shield geometry is such that during this movement, the shield supports will be over the cask pit concrete walls, the shield itself will be parallel with the horizontal plane, and the height of travel of the shield above the top of the cask pit surrounding walls will be minimized. Because of these factors, there is no credible scenario by which the impact shield could drop into the cask pit, rather, any accident during movement would simply bring the shield supports onto the top of the supporting walls.

3. Spent fuel stored in the cask pit area will always have aged at least one year.

In summary, fuel stored in the cask pit is not placed in jeopardy by any uncontrolled vertical movement of the impact shield during its installation or removal.

B. Thermal-Hydraulic Considerations:

<u>Question</u>

1. The discharge scenarios of Section 5.4 of the licensing report assume fuel transfer begins after 280 hours of decay in the reactor vessel. However, Section 3/4.9.3 of the Sequoyah Technical Specifications permits movement of irradiated fuel after only 100 hours of decay. Evaluate the impact of the shorter decay time on spent fuel pool design limits.

<u>Response</u>:

Additional thermal-hydraulic analyses were performed assuming that the transfer to the spent fuel pool begins after 100 hours of decay. The discharge modes denoted as Cases 1a and 1b were reanalyzed.

Case 1b had previously yielded the maximum pool bulk temperature as shown in Table 5.5.1 of the submitted report "Spent Fuel Pool Modification for Increased Storage Capacity." The transfer of fuel to the pool was assumed to begin after 100 hours of decay and be completed within 12 days of reactor shutdown. The following results were obtained.

Case	T_{max} (Maximum Pool Water Temperature) (°F)	Coincident Time After Reactor Shutdown (hrs)
1a (revised - 2 cooling trains	139.5	291
1b (revised - 1 cooling trains	177.2	293

It is noted that these temperatures are well within the range of typical norms for PWR fuel pools. The corresponding temperatures for Cases 1a and 1b in Table 5.5.1 are 138.0°F and 174.9°F, respectively. The spent fuel pool design limits are not exceeded.

Question

2. Describe the degree of redundancy in spent fuel pool cooling trains provided by the backup spent fuel pit pump with regard to single active failures. Potential single failures in support systems such as the electrical distribution system and the component cooling water system should be considered.

Response:

There are three spent fuel pool cooling pumps in the spent fuel pool cooling system. Pumps A-A and B-B are trained. The third pump C-S can be aligned to either train and can be powered from either train. Each power source to the backup C-S pump is an independent Class 1E electrical supply. A mechanical interlock is provided on the power supply transfer panel to prevent the C-S pump from being powered from both trains. Normally, one SFP pump and one heat exchanger is required to handle the existing heat load, but there are times when two pumps and two heat exchangers (both trains) are used. In the event of failure of one spent fuel pump, the backup pump (C-S) would be aligned and operated. In the event of failure of one heat exchanger, cooling would be done with the other train. The systems can be shut down for limited periods of time for maintenance or replacement of malfunctioning components.

The Component Cooling Water System (CCS) is designed such that no single active failure will interrupt cooling water to both A and B safeguard trains. The system consists of five CCS pumps and three pairs of heat exchangers serving both units. The heat exchangers are designated as Heat Exchangers 1A1/1A2, 2A1/2A2, and 0B1/0B2.

Cooler 1A1/1A2 serves train A loads in Unit 1, Cooler 2A1/2A2 serves train A loads in Unit 2, and Cooler 0B1/0B2 serves train B loads in both units. During full power operation, with spent fuel pool maximum cooling required, two CCS pumps and one heat exchanger pair may be used for the unit carrying the spent fuel pool heat load. The other unit requires only one CCS pump and one heat exchanger pair. A CCS pump capable of supporting either unit is aligned to the third heat exchanger pair to serve either unit's train B safeguard equipment. The fifth pump may be used as backup for either unit by transferring the spent fuel pool load to the unit aligned with that pump.