TVA

Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609

August 15, 1996

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

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - RESPONSE TO SPENT FUEL STORAGE POOL ACTION PLAN ISSUES

This letter provides TVA'S perspectives on the NRC staff recently completed review and evaluation of design features related to the spent fuel storage pool at operating reactors. Mr. J. M. Taylor's July 26, 1996, memorandum to Chairman Jackson and Commissioners Rogers and Dicus identified a concern with BFN spent fuel pool cooling. The stated concern was that spent fuel pool cooling at BFN was more reliant on infrequently operated backup cooling systems than other similar plants apparently because of the absence of an onsite power supply for the primary spent fuel pool cooling system or a low relative capacity of the primary cooling system.

As described in the enclosure to this letter, TVA considers that the offsite power system for BFN is highly reliable and diverse. In addition, both the Fuel Pool Cooling and Cleanup system and the Residual Heat Removal (RHR) system in supplemental fuel pool cooling mode can be powered in accordance with operating procedures by the onsite emergency AC power system, which consists of eight diesel generators that support the two currently operating units. Taken together, these systems ensure adequate capability and capacity to remove the maximum possible heat load in the spent fuel pool for anticipated conditions.

To provide added assurance that adequate makeup can be provided under off normal conditions (i.e., fuel pool water boil off), the RHR/RHR Service Water crosstie provides a permanently installed seismically qualified makeup water source for the spent fuel pool. This provides added assurance that irradiated fuel is maintained submerged in water and that reestablishment of normal fuel pool water level is possible under every anticipated condition. Two additional sources of spent fuel pool water makeup are also provided via standpipe and hose connections on each of the two Emergency Equipment Cooling Water headers.

There are no new commitments contained in this letter. If you have any questions, please contact me at (205) 729-2636.

Sincerely,

Pedro Salas
Manager of Site Licensing

Enclosure
cc (Enclosure):

Mr. Mark S. Lesser, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

NRC Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611

Mr. J. F. Williams, Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3

RESPONSE TO SPENT FUEL STORAGE POOL ACTION PLAN ISSUES

BACKGROUND

Details of the staff's review and evaluation of the reliability of spent fuel pool decay heat removal and the maintenance of an adequate spent fuel coolant inventory in the spent fuel pool were presented in Mr. J. M. Taylor's July 26, 1996, memorandum to Chairman Jackson and Commissioners Rogers and Dicus. The NRC Staff noted that design features addressing each of these areas for spent fuel storage have been reviewed and approved by the staff. [Specifically for BFN, the Technical Specification amendment that authorized TVA to increase the storage capacity of each of the BFN spent fuel pools was reviewed and approved by the NRC Staff on September 21, 1978.]

To specifically address concerns with the reliability and capability of the spent fuel pool cooling systems, the NRC Staff stated that it would conduct evaluations and regulatory analyses at selected categories of operating reactors. BFN Units 2 and 3 were identified in one category. The stated concern was that the plants in this category were more reliant on infrequently operated backup cooling systems than other similar plants apparently because of the absence of an onsite power supply for the primary spent fuel pool cooling system or low relative capacity of the primary cooling system.

FUEL POOL HEAT REMOVAL SYSTEM DESCRIPTIONS AND COOLING CAPACITY

As described in Sections 4.8.5 and 10.5.5 of the BFN Updated Final Safety Analysis Report, both the Fuel Pool Cooling and Cleanup system and the Residual Heat Removal (RHR) system in supplemental fuel pool cooling mode are used at BFN to remove decay heat from each unit's spent fuel pool. The Fuel Pool Cooling and Cleanup system cools the fuel pool by transferring the spent fuel decay heat through heat exchangers to the Reactor Building Closed Cooling Water system. The heat exchangers are designed to remove the decay heat load of the normal discharge batch of spent fuel. The system for each unit's fuel pool consists of two circulating pumps connected in parallel, two heat exchangers, one common filter demineralizer subsystem, two skimmer surge tanks, and the required piping, valves, and instrumentation. Each pump has a design capacity equal to, or greater than, the system design flow. The pumps circulate the

pool water in a closed loop, taking suction from the surge tanks, circulating the water through the heat exchangers and filter demineralizer, and discharging it through diffusers at the bottom of the fuel pool and reactor well. There are no connections to a fuel storage pool which could allow the fuel pool to be drained below the pool gate between the reactor well and the fuel pool. A check valve with a siphon breaking vent is provided in each pipe outside the pool to limit siphoning of fuel pool water to no more than six inches below normal water level. The fuel pool concrete structure and metal liner are designed to withstand earthquake loads as a Class I system.

The major equipment of the RHR system consists of four heat exchangers and four main system pumps for each unit, and twelve RHR service water pumps for the plant. Permanent connections with normally closed valves are provided on the shutdown cooling piping circuit for supplying cooling water to the Fuel Pool Cooling and Cleanup system. This permits the RHR system heat exchangers to be used to assist fuel pool cooling when a larger than normal amount of fuel is stored in the pool. RHR equipment is designed in accordance with Class I seismic criteria.

The maximum design normal heat load of spent fuel stored in the pool is the sum of the decay heat released by the average spent fuel batch discharged from the equilibrium fuel cycle (at the time the last assembly enters the pool, as calculated from the equilibrium refueling time estimate), plus the heat being released by the batch discharged at the previous refueling. The maximum possible heat load is the decay heat of the full core load of spent fuel at the end of the fuel cycle plus the remaining decay heat of the spent fuel discharged at the two previous refuelings. This maximum possible heat load value is approximately 29 million BTU/Hr.

The Fuel Pool Cooling and Cleanup system can maintain the fuel pool water temperature below 125°F when removing the maximum normal heat load from the pool with the maximum Reactor Building closed cooling water temperature. The heat removal capacity of this system is 8.8 million BTU/Hr (at 125°F). The fuel pool water temperature may be permitted to rise to approximately 150°F when larger than normal batches of spent fuel are stored in the pool. The RHR system is then operated in parallel with the Fuel Pool Cooling and Cleanup system to remove this heat load. A water temperature below 150°F is maintained for the benefit of the personnel working in the vicinity of the pool. When it is determined that the fuel pool temperature will exceed 125°F, the Fuel Pool Cooling and Cleanup system is normally connected by manual operator action to the RHR system. These actions are proceduralized and this alignment was used during the last refueling outage on Unit 2 (Cycle 9, Spring 1996). The heat removal capacity of the RHR system in supplemental fuel pool cooling mode is 18.8 million BTU/Hr (at 150°F). The combined

capacity of the Fuel Pool Cooling and Cleanup system and the RHR system in supplemental fuel pool cooling mode is 32.2 million BTU/Hr at 138°F.

It should also be noted that the fuel pool boil-off rate at maximum possible heat load has been calculated to be approximately 60 gpm. Approximately 47 hours are available to provide a make-up water supply to the pool prior to reaching the minimum shielding height of 8.5 feet. To assure adequate makeup under off normal conditions (i.e. fuel pool water boil off), the RHR/RHR Service Water crosstie provides a permanently installed seismically qualified makeup water source for the spent fuel pool. This ensures that irradiated fuel is maintained submerged in water and that reestablishment of normal fuel pool water level is possible under all anticipated conditions. Two additional sources of spent fuel pool water makeup are provided via standpipe and hose connections on each of the two Emergency Equipment Cooling Water headers.

ELECTRICAL POWER SYSTEM DESCRIPTION AND SPENT FUEL POOL COOLING EMERGENCY AC POWER CAPABILITY

Normal station power is from the unit station service transformers connected between the generator breaker and main transformer of each unit. Auxiliary power is available through the two common station service transformers, which are fed from two 161-kV lines supplying the 161-kV switchyard, one line each from the Athens and Trinity substations. Historically, this has proven a very reliable source of power. Table 3.1.1-1 of the BFN Individual Plant Examination (IPE) reflected this low annual loss of offsite power initiating event frequency (3.52×10^{-2}).

As described in Section 8.5.3 of the BFN Updated Final Safety Analysis Report, the standby AC supply and distribution system for Units 1 and 2 consists of four diesel generators, four 4.16-kV shutdown boards, four 480-V shutdown boards and other supporting equipment. The standby AC supply and distribution system for Unit 3 is separate from that of Units 1 and 2. The Unit 3 system consists of four diesel generators (3A, 3B, 3C, and 3D), four 4.16-kV shutdown boards, two 480-V shutdown boards and other supporting equipment.

There are three possible 4-kV supplies to each of the four Unit 1/2 4-kV shutdown boards following a loss of offsite power. The first alternate is from the other shutdown bus. The second alternate is from the diesel generator and the third alternate is to manually align the Unit 3 diesel generator via a Unit 3 shutdown board. There are similarly three possible 4-kV supplies to each of the four Unit 3 4-kV shutdown boards following a loss of offsite power. The first alternate is from the diesel generator and the second alternate is to manually align the

Unit 1/2 diesel generators via a Unit 1/2 shutdown board. The third alternate is to power the Unit 3 4-kV shutdown boards from either shutdown Bus 1 or 2 via the 4-kV bus tie board.

The circulating pump motors for the Fuel Pool Cooling and Cleanup system are powered from their corresponding unit 480-V shutdown boards. The RHR pumps are powered directly from their 4-kV shutdown boards. All these boards receive power from the diesel generators on loss of normal auxiliary power. The circulating pump motors are considered nonessential loads and will be operated only as required under accident conditions. Restoration of power to these boards during a station blackout is addressed in the plants' operating instructions. As discussed above, ample time is available for restoration of these loads.

CONCLUSION

The offsite power system for BFN is highly reliable and diverse. In addition, both the Fuel Pool Cooling and Cleanup system and the Residual Heat Removal system in supplemental fuel pool cooling mode can be powered in accordance with operating procedures by the onsite emergency AC power system, which consists of eight diesel generators that support the two currently operating units. Taken together, these systems ensure adequate capability and capacity to remove the maximum possible heat load in the spent fuel pool for all anticipated conditions.

To provide added assurance that adequate makeup can be provided under off normal conditions (i.e., fuel pool water boil off), the RHR/RHR Service Water crosstie provides a permanently installed seismically qualified makeup water source for the spent fuel pool. This ensures that irradiated fuel is maintained submerged in water and that reestablishment of normal fuel pool water level is possible under every anticipated condition. Two additional sources of spent fuel pool water makeup are also provided via standpipe and hose connections on each of the two Emergency Equipment Cooling Water headers.