TVA

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

April 27, 1995

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) - DESCRIPTION OF BOILING WATER REACTOR (BWR) SCRAM DISCHARGE VOLUME LONG-TERM MODIFICATIONS AND WITHDRAWAL OF TECHNICAL SPECIFICATION (TS) 312

This letter describes TVA's current plans for compliance with the Generic Safety Evaluation Report (SER), BWR Scram Discharge System, which was included in NRC's December 9, 1980 letter to all BWR licenses. This letter also notifies NRC of the withdrawal of proposed TS 312, which was submitted by TVA letter dated September 30, 1993.

As discussed in proposed TS 312, TVA's previous analysis of the Unit 2 scram discharge system indicated that a successful scram would be achieved without the scram pilot air header low pressure switches, provided that the Control Rod Drive (CRD) stall flow rate and the scram discharge volume water level instrumentation response characteristics remain within acceptable limits. TVA has noted higher CRD stall flow rates during the first part of the operating cycle following a refueling outage. These higher stall flows may preclude long term conformance with these acceptance limits. Therefore, TVA has determined that the most prudent course of action at this time is to maintain the scram pilot air header low pressure trip function and withdraw proposed TS 312.

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The overall reactor protection system design, with the scram pilot air header low pressure switches, still satisfies the criteria contained in the generic SER. Therefore, in accordance with Section 4.3 of the generic SER, pre-implementation review of this design change by the NRC staff is not required. However, in order to correctly reflect TVA's method of compliance with the generic SER, TVA is informing you of these changes.

Enclosure 1 contains a discussion of the background of this issue and details of the increased CRD stall flows. Due to the time constraints associated with Unit 3 restart and the need to maintain similarity between the operating units, a design change will be implemented on Unit 3 to install a qualified scram pilot air header low pressure switch scram function prior to restart. In addition, TVA will also submit a proposed Unit 3 TS amendment that adds the scram pilot air header low pressure switch scram function.

The scram pilot air header low pressure switch scram function performs the same function as the high water level switches in the Scram Discharge Instrument Volume. The scram pilot air header low pressure switch scram function has also recently contributed to decreased plant availability. Therefore, TVA intends to pursue the overall reactor protection system design issue and the long term need for the scram pilot air header low pressure switch scram function. TVA intends to address the scram discharge volume long term modifications for Unit 1 as part of this long term review.

A summary list of commitments contained in this letter is provided as Enclosure 2. If you have any questions, please contact me at (205) 729-2636.

Sincerely,

Pedro Salas
Manager of Site Licensing

Enclosures
cc: see page 3

cc (Enclosures):

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)

DESCRIPTION OF BWR SCRAM DISCHARGE VOLUME LONG-TERM MODIFICATIONS AND WITHDRAWAL OF TECHNICAL SPECIFICATION (TS) 312

I. BACKGROUND

On June 28, 1980, 76 of the 185 control rods failed to fully insert during a routine shutdown at BFN Unit 3. After two additional attempts to manually scram, 47 rods remained partially withdrawn. Following a longer drain of the scram discharge volume (SDV), the remaining rods fully inserted. The elapsed time from the initial scram to the time that all rods were inserted was approximately 15 minutes.

During the investigation of the above event, the following problem scenario was postulated:

> The scram outlet valves open at a slightly higher set point than the scram inlet valves. The control air system typically operates at about 75 PSI. If the pressure decreases to approximately 40 PSI, the scram outlet valves open. The scram inlet valves open at about 30 PSI. If a slow loss of air pressure occurs such that the scram outlet valves remain slightly open while no movement of the control rods take place, the SDV could fill with water before the scram inlet valves open. Similarly, a slow fill event caused by excess Control Rod Drive (CRD) leakage (approximately 10 gpm) could also fill the SDV. These events would allow the SDV to fill with water and prevent a reactor scram, if required.

By Generic Letter to all Boiling Water Reactors (BWRs), dated July 7, 1980, licensees were requested to propose TS changes which included surveillance requirements for SDV vent and drain valves and surveillance requirements for Reactor Protection System and control rod block SDV limit switches. Bulletin 80-17 and its supplements requested licensees to install a system to continuously monitor, record, and alarm water levels in the SDVs and, as a short-term measure, initiate an immediate manual scram when low pressure occurs in the CRD air system.

By Generic Letter, dated October 1, 1980, NRC asked if BWR licensees intended to reevaluate their present scram system and modify it, as necessary, to meet the additional design and performance criteria being developed by the BWR Owners Group (BWROG). TVA declined to commit to the BWROG criteria in its October 27, 1980 response. The generic Safety Evaluation Report (SER) regarding BWR scram discharge systems was issued by Generic Letter, dated December 9, 1980. At that time, all licensees, except TVA, had agreed with the NRC approved BWROG criteria for establishing permanent long term modifications.

One of the deficiencies identified in the generic SER was a specific failure mode of the control air system, which could cause an inability to scram the control rods. As previously mentioned, Supplement 3 of Bulletin 80-17 required an immediate manual scram when low pressure occurs in the CRD air system or when other indications occur. However, only a short time could be available for the operator to successfully initiate a reactor scram. Since a human factors evaluation determined that this manual scram could not be assured, the NRC staff issued orders to provide prompt added protection for credible degraded air conditions in the BWR control air supply system. These orders required an automatic system initiate control rod insertion if the air pressure decreased below a prescribed value. By NRC letter to TVA, dated January 9, 1981, BFN was ordered to install an automatic system to accomplish this scram.

By letter dated October 6, 1982, TVA provided a description of the long term modifications that were being performed on Unit 2 and would be performed during the subsequent Units 1 and 3 outages:

1. Piping Modifications - Each SDV would have an independent but closely coupled scram discharge instrument volume (SDIV). The vent lines would be cross-tied and contain vacuum breakers.

2. Valving Modifications - The vent and drain lines would have two isolation valves in series and the installed relief valve on the drain piping would be removed.

3. Instrumentation Modifications - Each SDIV would have two main control room alarms (3-5 gallons not drained and the 24 gallons CRD withdrawal inhibit). Each SDIV would have one out of two taken twice logic to scram with the accumulation of 50 gallons of water in the SDIV. Magnetrol float switches and diverse Rosemount sealed delta-pressure transmitters and electronic switches would be installed to accomplish the scram function.

Interim commitments, such as the Continuous Monitoring System, the automatic scram on low CRD air pressure, and the functional testing of the SDIV instrumentation following a scram, were withdrawn. TVA also stated in this letter that the committed modifications were in accordance with the generic SER. In accordance with Section 4.3 of the generic SER, since TVA met the acceptance criteria contained in the compliance section, no staff pre-implementation approval was required.

NRC issued an Order to TVA on June 24, 1983, to require the installation of the long term modifications during the Cycle 5 outage for Units 1 and 3 (these modifications had previously been performed on Unit 2). The Order stated that:

> The licensee shall install the long term BWR scram discharge system modifications in conformance with the staff's Generic SER, which incorporates the BWR Owners Subgroup criteria, before reactor operation in Cycle 6 or, in the alternative, the licensee shall place and maintain the facility in a cold shutdown or refueling mode of operation until such modifications are made.

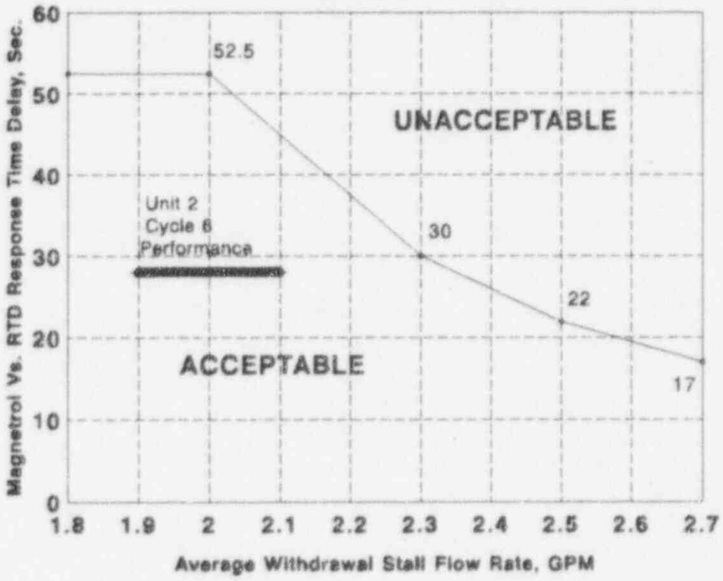
By letter dated June 27, 1984, TVA informed NRC of changes in the design of the long term modifications. The submittal stated that a 2-inch vent pipe would be installed between the SDV and the SDIV to reduce air binding between the volumes. In addition, although the delta-pressure transmitters provided acceptable results with the scram pilot air header low pressure switches installed, the final configuration would have instrumentation with a more reasonable actuation time. Consequently, the design was changed to replace the delta-pressure transmitters with heated reference resistive temperature devices (RTDs). The letter also stated that since BFN had no experience with the RTDs and the post-modification tests were not conclusive for validating the modeling of the fast fill event, the scram pilot air header low pressure switches were left installed to provide an additional degree of safety.

In addition, another problem with the instrumentation was discovered. Based upon analyses of scrams on Units 1 and 2 since the modifications, TVA determined that under scram conditions, the Magnetrol float switches had a response time delay of approximately 20 seconds compared to the RTDs. TVA believed that the RTDs provided a more realistic representation of SDIV water level based upon previous scram data and analyses. Assuming a time delay for the normal leakage events, the response time remained

acceptable. However, for the fast fill event, the scram pilot air header low pressure switches were left installed due to concerns regarding the SDV fill up rate versus the response time delay in the float switches.

The Class 1E scram pilot air header low pressure switches were proposed for inclusion in the Unit 2 TSs as part of Supplement 3 to TS No. 199, dated April 29, 1986. NRC approved TS 199 as part of Amendment No. 125, dated August 19, 1986.

During the recovery effort for Unit 3, TVA reevaluated the necessity of the scram pilot air header low pressure switches scram function. TVA determined that the scram pilot air header low pressure switch scram function is not necessary to ensure the proper functioning of the reactor protection system provided that the CRD stall flow rate and the SDV water level instrumentation response characteristics remain within the acceptable limits shown below:



Definitions:

The Magnetrol Versus RTD Response Time Delay is the maximum allowable response time delay between the RTD and Magnetrol level switches as measured following a reactor scram.

The Average Withdrawal Stall Flow Rate is the CRD stall flow rate averaged over all fully withdrawn rods.

By letter dated August 17, 1993, TVA informed NRC that a design change would be implemented on Units 1 and 3 to remove the scram pilot air header low pressure switch

scram function prior to the restart of each unit. TVA also submitted proposed TS 312 on September 30, 1993, to reflect the removal of the scram pilot air header low pressure trip switches scram function on Unit 2.

II. INCREASED CRD STALL FLOWS

As shown on the above figure, during Unit 2 Cycle 6, the average stall flow leakage was 1.9 to 2.1 gpm per CRD. The maximum response time delay between the RTD and Magnetrol level switches for either SDIV was less than 28 seconds. This combination of stall flow rate and instrument delay is well within the acceptable region. Similar acceptable performance was also noted during Unit 2 Cycle 7.

TVA has noted higher CRD stall flow rates during the first part of the operating cycle following a refueling outage. These higher stall flows may preclude conformance with the acceptance criteria discussed above. A review of data from the previous two operating cycles indicates that the average stall flow rate is significantly higher at the first quarterly collection of data following a refueling outage and then returns to a lower value during the remainder of the cycle. It is hypothesized that crud is dislodged from reactor vessel internal surfaces during refueling operations and that some of the crud settles into the CRD guide tubes. Subsequent reactor scrams or individual rod scram time testing during power ascension causes some of this material to be ingested into the drive. This crud material can become trapped between sealing surfaces in the drive, which results in the increased seal leakage measured during stall flow testing. The crud material tends to be purged from the drive over time due to drive operation and the stall flows trend back to normal as the operating cycle continues.

Therefore, TVA has determined that the most prudent course of action at this time is to maintain the scram pilot air header low pressure trip function and withdraw proposed TS 312. A design change will be implemented on Unit 3 to install a qualified scram pilot air header low pressure switch scram function prior to restart. In addition, TVA will also submit a proposed Unit 3 TS amendment that adds the scram pilot air header low pressure switch scram function.

The scram pilot air header low pressure switch scram function performs the same function as the high water level switches in the Scram Discharge Instrument Volume. The scram pilot air header low pressure switch scram function has also recently contributed to decreased plant availability. Therefore, TVA intends to pursue the overall reactor protection system design issue and the

long term need for the scram pilot air header low pressure switch scram function. TVA intends to address the scram discharge volume long term modifications for Unit 1 as part of this long term review.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)

DESCRIPTION OF BWR SCRAM DISCHARGE VOLUME
LONG-TERM MODIFICATIONS AND WITHDRAWAL OF
TECHNICAL SPECIFICATION (TS) NO. 312

SUMMARY OF COMMITMENTS

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1. A design change will be implemented on Unit 3 to install a qualified scram pilot air header low pressure switch scram function prior to restart.

2. Prior to the restart of Unit 3, TVA will submit a proposed TS amendment that adds the scram pilot air header low pressure switch scram function.