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SUBJECT: Describes TVA current plans for compliance w/Generic SER,BWR scram discharge sys,included in NRC 801209 ltr.Discussion of background of issue,which includes description of long-term mods previously implemented on Unit 2 encl.

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O. J. "Ike" Zeringue
Vice President, Browns Ferry Nuclear Plant

AUG 17 1993

U.S. Nuclear Regulatory Commission
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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) - BWR SCRAM DISCHARGE VOLUME - LONG-TERM MODIFICATIONS

References: 1) NRC letter to All BWR Licensees, dated December 9, 1980, BWR Scram Discharge System

2) TVA letter to NRC, dated October 6, 1982

3) NRC letter to TVA, dated June 24, 1983

4) TVA letter to NRC, dated June 27, 1984

This letter describes TVA's current plans for compliance with the Generic Safety Evaluation Report (SER), BWR Scram Discharge System, which was included in Reference 1. In References 2 and 4, TVA submitted a description of the long-term scram discharge volume modifications to be performed at BFN. As stated in those letters, TVA's review indicated that its proposed modifications were in accordance with the criteria contained in the generic SER. In Reference 3, TVA received Confirmatory Orders that required modifications be completed, which conform with the generic SER, on Units 1 and 3 prior to their operation during the next cycle. The modifications were completed on BFN Unit 2 prior to the issuance of the Orders on Units 1 and 3.

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During the recovery effort for Unit 3, TVA reevaluated the necessity of the scram air header pressure switches scram function. TVA has determined that the scram air header pressure switches scram function is not necessary to ensure the proper functioning of the scram system. In addition, the overall scram system design, without the scram air header 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 our method of compliance with the generic SER, we are informing you of these changes.

Enclosure 1 contains a discussion of the background of this issue, which includes a description of the long-term modifications previously implemented on Unit 2 and a review of the reanalysis performed. A design change will be implemented on Units 1 and 3 to remove the scram air header pressure switches scram function prior to the restart of each unit. TVA also intends to submit a Technical Specification Amendment, to request deletion of the Class 1E scram air header pressure switches scram function from the Unit 2 Technical Specifications, to allow this design change to be implemented on Unit 2.

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

Sincerely,

O. J. Zeringue

Enclosures
cc: See page 3

U.S. Nuclear Regulatory Commission

AUG 17 1993

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ENCLOSURE 1

Tennessee Valley Authority

Browns Ferry Nuclear Plant (BFN)

Scram Discharge Volume Lont-Term Modifications

BACKGROUND:

On June 28, 1980, 76 of the 185 control rods failed to fully insert during a routine shutdown at Browns Ferry 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 BWR's, dated July 7, 1980, and through Bulletin 80-17 and its supplements, Licensees were requested to propose Technical Specification changes that included surveillance requirements for SDV vent and drain valves, LCO surveillance requirements for RPS and control rod block SDV level switches, and required the installation of a system to continuously monitor, record, and alarm water levels in the SDVs. Specifically, Bulletin 80-17, Supplement 3, dated August 22, 1980, required, as a short-term measure, an immediate <u>manual</u> scram when low pressure occurs in the CRD air system or when other indications occurred, such as multiple rod drift alarms or a marked change in the number of control rods at high temperature.

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). In our October 27, 1980 response, TVA declined to commit to the BWROG criteria. 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 December 1, 1980 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 <u>automatic</u> 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 1 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 ΔP transmitters and electronic switches would be installed.

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 December 9, 1980 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 ΔP transmitters provided acceptable results with the scram air header pressure switches installed, the final configuration would have instrumentation with a more reasonable actuation time. Consequently, the design was changed to replace the ΔP 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 air header 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, it was determined that under scram conditions, the Magnetrol float switched 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 air header pressure switches were left installed due to concerns regarding the SDV fill up rate versus the response time delay in the float switches.

The inclusion of the Class 1E scram air header pressure switches were proposed for inclusion in the Unit 2 Technical Specifications as part of Supplement 3 to Technical Specification No. 199, dated April 29, 1986. Their inclusion in the Unit 2 Technical Specification was approved as part of Amendment No. 125, dated August 19, 1986.

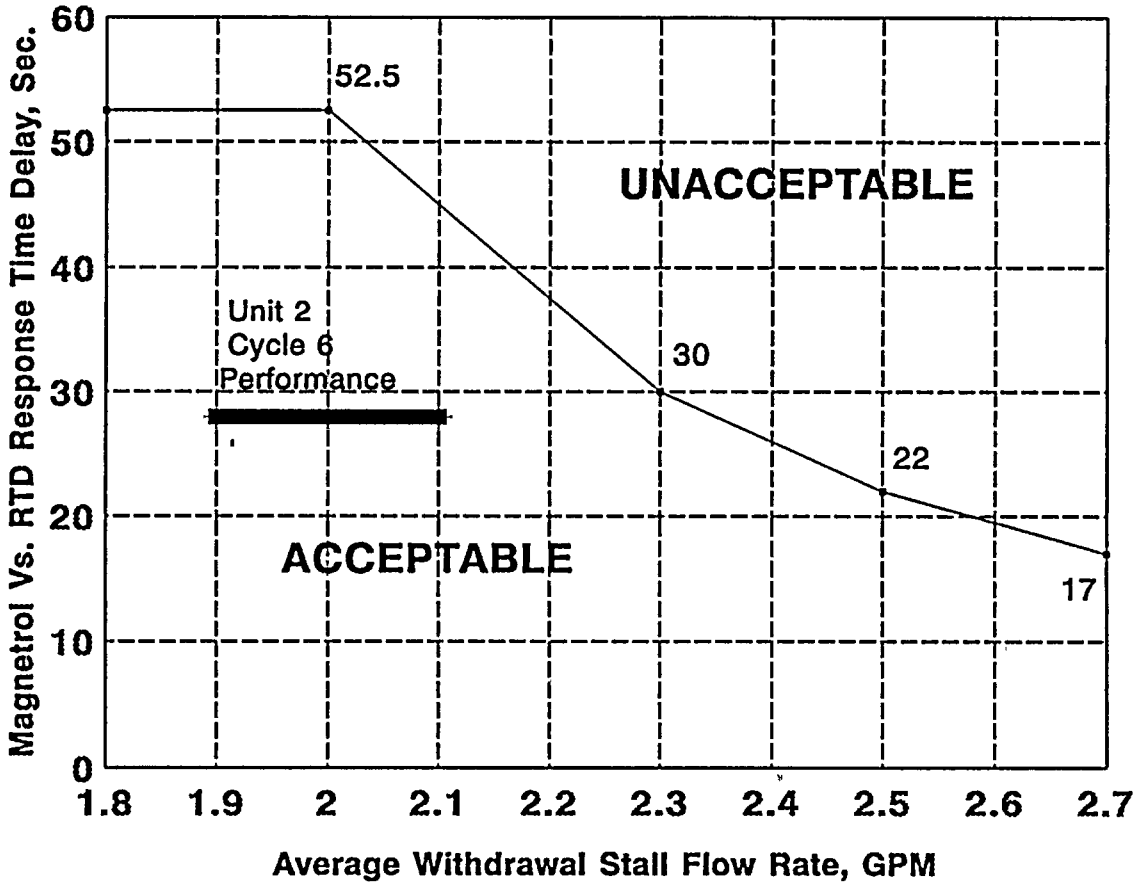
SUMMARY OF GENERIC SER REQUIREMENTS

The scram air header pressure switches perform the same function as the diverse and redundant high water level switches in the SDIV for fast fill events in which the high level instrument response time may have been inadequate. Section 4.2.4.1 of the generic SER states that the CRD system shall be analyzed based on a plant-specific maximum inleakage to ensure that the system function is not lost prior to initiation of automatic scram. The maximum inleakage is the maximum flow rate, past the CRD seals and through the scram discharge line, without control rod motion, summed over all control rods. The analysis should show no need for vents or drains. The Technical Basis for this section states that a maximum flow rate past the scram outlet valve, without rod motion, is 5 gpm per rod. This value should be used in the analysis to assure system function, or justification should be provided for using a different value. Any value that is used must be verified to be conservative by assured CRD seal maintenance requirements based on stall flow tests.

SUMMARY OF REEVALUATION

TVA's previous analyses of the scram discharge system were performed assuming the 5 gpm per rod inleakage flow rate. This resulted in approximately 465 gpm inleakage into a SDV. The fast fill transient reanalysis was based upon unit specific CRD leakage rates and SDIV water level instrumentation characteristics. The intent of the analysis was to determine if a successful scram would be achieved using only the water level instrumentation and not the scram air header pressure switches. As discussed above, the water level in the SDIV is monitored by diverse and redundant Magnetrol and RTD level switches. Since the level switches are diverse and redundant, diversity and redundancy in the instrumentation that initiates the scram signal is maintained even with the removal of the scram air header pressure switches scram function. The RTD switches were confirmed to respond within two seconds and the response time delay associated with the Magnetrol float switches was included in the analysis. No credit was taken for vents or drains and control rod motion was assumed not to occur until scram initiation. A copy of the supporting calculation for this reanalysis is available for review at TVA's Rockville office.

The reanalysis concluded that the water level in the SDIV would not rise high enough to prevent a successful scram and a successful scram would be achieved, with the level instrumentation and without the scram air header pressure switches, provided that the CRD leakage rate and the water level instrumentation response characteristics remain within the success criteria region 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 Maximum allowable response time delay for either the East or West SDIV is defined as the maximum delay between any RTD level switch and any Magnetrol level switch for that SDIV.

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

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.

TVA's current procedures require measurements of CRD stall flow rates for a group of CRDs. In addition, prior to the restart of Units 1 and 3, TVA will revise its procedures to monitor and take appropriate actions to ensure CRD and scram discharge system performance within the acceptable response time delays and stall flow rates. These systems can degrade over time due to long term mechanisms such as crud buildup and corrosion. However, these mechanisms are relatively slow. Therefore, TVA considers an acceptable frequency of confirmation of the response time delay and stall flow rate to be once per operating cycle or at the next scram if a scram has not occurred during that cycle.
TVA also intends to submit a Technical Specification Amendment, to request deletion of the Class 1E scram air header pressure switches scram function from the Unit 2 Technical Specifications, to allow this design change to be implemented on Unit 2.

CONCLUSION

In summary, the inclusion of the Class 1E scram air header pressure switches was over and above the requirements of the December 9, 1980 generic SER. These switches perform the same function as the high water level switches in the SDIV for fast fill events in which the high level instrument response time may have been inadequate. Based on further analysis, TVA has determined that administrative controls on the average control rod drive withdrawal stall flow rate and level switch response time will preclude the need for the scram air header pressure switches. In addition, the potential for a plant transient due to the mal-operation or testing of these pressure switches, the resources required for surveillance and maintenance of the switches, and the costs associated with installing the Class 1E sdv low air pressure switches in Units 1 and 3 outweigh the safety benefits of this redundant scram feature.

Consequently, TVA has decided not to finalize the installation of the scram air header pressure switches scram function on Units 1 and 3. In accordance with Section 4.3 of the December 9, 1980 generic Safety Evaluation Report, since withdrawing this commitment on Units 1 and 3 does not change TVA's compliance with the generic acceptance criteria, no staff pre-implementation approval is required. TVA also intends to submit a Technical Specification Amendment, to request deletion of the Class 1E scram air header pressure switches scram function from the Unit 2 Technical Specifications, to allow this design change to be implemented on Unit 2.

ENCLOSURE 2

Tennessee Valley Authority

Browns Ferry Nuclear Plant (BFN)

Summary of Commitments

1) A design change will be implemented on Units 1 and 3 to remove the scram air header pressure switches scram function prior to the restart of each unit.

2) Prior to the restart of Units 1 and 3, TVA will revise its procedures to monitor and take appropriate actions to ensure CRD and scram discharge system performance within the acceptable region.