UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

MODIFICATION TO THE AUTOMATIC DEPRESSURIZATION SYSTEM LOGIC

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

The final recommendation of the NRC's Bulletin and Orders Task Force, to mitigate accidents, required applicants for boiling water reactor (BWR) plants to perform a feasibility and risk assessment study. This study would determine the optimum Automatic Depressurization System (ADS) design modification that would eliminate the need for manual actuation to ensure adequate core cooling during certain accident and transient conditions with a loss of reactor coolant and no high drywell pressure.

In response to the TMI requirement, issue II.K.3.18 of NUREG-0737, concerning the ADS system, the BWR Owners Group (BWROG) conducted a study and identified modifications that would satisfy the basic concerns of manual versus automatic actuation of the ADS system. A study of alternatives was presented to the NRC staff by BWROG for ADS logic modifications to eliminate manual actuation and ensure core coverage.

By a letter dated June 3, 1983, the NRC staff transmitted to TVA an evaluation of the BWROG study applicable to the Browns Ferry nuclear plants. The BWROG study contained seven alternatives to the present ADS logic. The NRC staff evaluation of the study concluded that the following two alternatives are acceptable for ADS logic modification:

a. Elimination of the high drywell pressure permissive and addition of a manual inhibit switch.

b. Bypass of the high drywell pressure permissive after a sustained low water level and addition of a manual inhibit switch.

The NRC staff concluded that for both options listed, the manual inhibit switch should be addressed by TVA in the emergency operating procedures, and a surveillance plan for the switch should be included in the Technical Specifications. Also, for adoption of the second option, the setting of the bypass timer should be justified, and a plan for periodic testing of the timer should be submitted by TVA.

A meeting was held between TVA and the NRC staff on July 14, 1986, to close the issue. Subsequently, TVA elected to implement a modification similar to option b described above. The ADS logic would be modified to allow the ADS to initiate vessel depressurization, automatically bypassing the high drywell pressure signal 10 minutes after a sustained lo-lo-lo reactor vessel water level signal. The 10-minute delay would consist of a new 8-minute bypass timer in conjunction with the existing ADS 2-minute timer. A manual switch would also be installed to allow the operator to inhibit the ADS as recommended by the BWROG emergency procedure guidelines. The above modification proposed by TVA during the July 14, 1986 meeting was confirmed by TVA in their letter to the NRC staff on March 5, 1987.

On July 29, 1988, TVA submitted, by letter, a request for amendment to license DPR-52 to change the Technical Specifications (TS) for Unit 2 to change the trip setpoint for the existing ADS timer and add the surveillance and setpoint requirements for a high drywell pressure bypass timer.

On August 10, 1988, the NRC staff requested, by letter, that TVA provide additional information on the proposed ADS modification. The staff requested that the complete design package change for the ADS actuation modification be provided, including TVA's safety evaluation and all drawings. This additional information was submitted to the NRC staff by TVA in a letter dated September 12, 1988.

2.0 EVALUATION

The automatic depressurization system (ADS) depressurizes the reactor vessel so that the low-pressure emergency core cooling system can inject water into the reactor vessel following small or intermediate size loss-of-coolant-accidents (LOCA) concurrent with the high-pressure coolant injection (HPCI) system failure. The ADS system consists of redundant signal logic arranged in two separated solenoid-operated air pilot valves on the six main steam relief valves that relieve steam to the suppression pool. The two separate logic buses, A and B, are comprised of two channels for each logic bus.

The ADS is actuated when the following conditions exist:

a. Low reactor water level permissive (level 3) 378" above vessel zero.
   Instrument Channels LIS-3-58 A, B, C, and D

b. Low reactor water level (level 1) 544" above vessel zero.
   Instrument Channels LIS-3-184 and 185

c. Drywell high pressure, 2.5 PSIG.
   Instrument Channels PSI-64-57 A, B, C, and D

d. Time delay 120 seconds has expired.
Timers 2E-K34 and 2E-K35

e. One low-pressure coolant injection (LPCI)-RHR pump running or two core spray pumps running.

LPCI-RHR pump discharge pressure PS-10-123 A, B, C, and D
Core spray pump discharge pressure PS-14-44 A, B, C, D

The following ADS design modifications were identified in TVA's proposed amendment to Technical Specification No. 248 and Design Change Request 3478 to comply with NUREG-0737, Item II.K.3.18, and BWROG recommendations.

f. Replacement of time delay relays, item d above, with qualified timers set for 105 seconds, plus or minus 7 seconds.

g. Addition of four time delay pick-up relays to bypass, item c above, high drywell pressure. The timers are set for 12-1/2 minutes, plus or minus 2 minutes.

h. Addition of two keylock control switches for each logic bus A and B to allow the operator to inhibit (block) the ADS initiation logic.

i. Addition of annunicator window number 31, annunciator XX-55-3C, control panel 9-3, to indicate to the operator that either logic bus A or B is inhibited.

The replacement of the existing ADS timer relay, item d above, with a Class 1E qualified timer relay, item f above, and changing the setpoint from 120 seconds, plus or minus 5 seconds, to 105 seconds, plus or minus 7 seconds, improve safety by ensuring ADS initiation within the time required. This required time is stated in Browns Ferry Nuclear (BFN) Final Safety Analysis Report (FSAR), Appendix N, Section N.6.5.10. The FSAR states that a time delay of 120 seconds is the maximum practical delay time for ADS initiation.

The installation of the high drywell pressure bypass timer, item g above, provides a means to ensure adequate core cooling for a main steam pipe break accident outside the primary containment with the HPCI inoperable. The time delay setting for the bypass timer allows for:

a. Avoidance of excess fuel cladding heatup.

b. Sufficient time to allow high-pressure makeup systems to recover the reactor vessel water level.

c. Sufficient time for the operator to prevent ADS from occurring during an anticipated transient without scram (ATWS) event.

TVA's letter of September 12, 1988, to the staff provided an analysis of the effects on safety of the ADS design modification. This analysis defined the design basis for the bypass timer to be the main steam pipe break outside the

primary containment accident. The analysis defined the analytical limits for the ADS bypass timer as 15 minutes to 10 minutes, based on the General Electrical Analysis DFR-A00-03088.

TS change No. 248 for the ADS submitted by TVA on July 29, 1988, revised Section 3.2, bases of the TS. This section states that for the worst-case condition, steam line break outside the primary containment with HPCI inoperable and the timer set at 15 minutes, a peak cladding temperature (PCT) of 1424°F will be reached. This temperature is less than the limiting PCT of 2200°F. This analysis for PCT versus time delay was also stated in the General Electric analysis previously mentioned.

The bypass timer will be functionally tested during the ADS logic system functional test which is performed once each operating cycle. The manual ADS inhibit switch and the associated annunication have not been addressed by TVA relative to the Technical Specification's limiting condition for operation (LCO) and functional surveillance of the switch.

TVA has revised Surveillance Procedure BF SI-4.2.B-44, Revision 2, to address the bypass timer functional test and Emergency Operating Procedure, Appendix 3, EOI 1, Revision 0, to address the operator use of the manual inhibit switch.

By letter dated May 9, 1988, the NRC Director of the Office of Nuclear Reactor Regulation transmitted an evaluation of the BWR Owners Group (BWROG) report identifying which Standard Technical Specification (STS) requirements BWROG believes should be retained in the new STS and which can be relocated in other licensee-controlled documents. In this evaluation, the BWR-Table 1, Section 3.3.3, Report Item 112B, the ADS manual inhibit switch is listed under LCOs to be retained. It is our understanding that TVA plans to incorporate surveillance of the manual inhibit switch in a BFN on-site surveillance procedure consistent with the BWR Standard Technical Specification, NUREG 0123.

3.0 CONCLUSION

The staff concludes that the proposed TVA design modification and TS change meet the requirements of Item II.K.3.18 of NUREG-0737. The following specific items are acceptable to the staff:

a. TVA has provided a basis for the setpoint of the high drywell bypass timer and has addressed the timer functional test surveillance.

b. TVA has provided a manual ADS inhibit (block) switch as recommended by BWROG.

c. The ADS modification does not decrease the safety function of the ADS system.

It is our understanding that TVA plans to incorporate surveillance of the manual inhibit switch in a BFN on-site surveillance procedure consistent with the BWR Standard Technical Specification, NUREG-0123.

It is our further understanding that BFN will comply with the final recommendations of the Technical Specification Improvement Program regarding this issue.

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Date: January 10, 1989