April 11, 2003

TVA-BFN-TS-424

10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN P1-35
Washington, D.C. 20555-0001

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 – LICENSE AMENDMENTS AND TECHNICAL SPECIFICATION CHANGES – REVISION IN THE NUMBER OF EMERGENCY CORE COOLING SYSTEMS REQUIRED IN RESPONSE TO A LOSS OF COOLANT ACCIDENT (TS-424)

Pursuant to 10 CFR 50.59 and 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for an amendment and Technical Specification changes to licenses DPR-33, DPR-52 and DPR-68 for BFN Units 1, 2 and 3, respectively.

TVA's planned restart of Unit 1 will require modifications to eliminate the potential for overloading a Units 1/2 4KV shutdown board or diesel generator when both Units 1 and 2 are in-service. These modifications will reduce the number of Emergency Core Cooling System (ECCS) subsystems that are actually available in response to certain design basis Loss of Coolant Accident (LOCA) scenarios. The reduction in the actual number of ECCS subsystems available to mitigate the consequences of a LOCA is a reduction in redundancy and requires a license amendment under the provisions of 10 CFR 50.59. The reduction in the actual number of ECCS subsystems available to mitigate the consequences of a LOCA will result in a change to Updated Final Safety Analysis Report (UFSAR) Table 6.5-3 for two non-bounding cases:

- Recirculation suction break, coupled with the opposite unit false LOCA signal as the assumed single failure; and

- Recirculation discharge break, coupled with the opposite unit false LOCA signal as the assumed single failure.

The modifications also result in a revision to the number of required channels for the Low Pressure Coolant Injection pump start time delay relay function specified in Technical Specification Table 3.3.5.1-1.

The present BFN LOCA analysis is conservative with respect to the current plant's actual equipment availability. The reduced number of available ECCS subsystems has previously been analyzed and is consistent with the current LOCA analysis. Therefore, the proposed amendments and Technical Specifications are acceptable based upon the current approved LOCA analysis and conforms to 10 CFR 50.46 and Appendix K. Since no changes to the LOCA analysis are required, the requested amendments and Technical Specification changes are not being submitted as a "risk-informed licensing action" as defined by Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decision on Plant-Specific Changes to the Licensing Basis."

TVA has determined that there are no significant hazards considerations associated with the proposed amendments and Technical Specification changes. The proposed amendments and Technical Specification changes qualify for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and attachments to the Alabama State Department of Public Health.

Enclosure 1 provides TVA's evaluation of the proposed amendments and Technical Specification changes. Enclosure 2 contains copies of the appropriate marked-up Units 1, 2 and 3 Technical Specification pages showing the proposed changes. Enclosure 3 contains copies of the appropriate marked-up Units 1, 2 and 3 Technical Specification Bases pages showing the resulting changes.

TVA currently utilizes nuclear fuel manufactured by Global Nuclear Fuels. As discussed in Technical Specification Change 421 (Reference 1), TVA is preparing to use fuel assemblies from a different manufacturer (Framatome Advanced Nuclear Power). The ECCS performance analysis discussed in Enclosure 1 was performed by General Electric, using NRC generically approved methods. When TVA utilizes Framatome fuel, the ECCS performance will be re-analyzed using Framatome's generically approved methodology. The same ECCS performance parameters utilized in Enclosure 1 will be utilized by Framatome when it performs the reload analysis with the new fuel. NRC review and approval of this proposed amendments and Technical Specification changes are not affected by any potential change in fuel type or manufacturer.

The proposed amendments and Technical Specification changes are necessary to support the restart of Unit 1. Portions of the modifications necessary to implement the amendments and Technical Specification changes are required to be installed on Unit 2 during an outage that precedes the restart of Unit 1. The Unit 3 modifications discussed are not required to eliminate the potential for overloading any units' shutdown board or diesel generator. They may be performed at TVA's discretion for fidelity between the three units. Therefore, TVA requests that the amendments be made effective upon issuance and the revised Technical Specifications be made effective for:

- Unit 1 within 60 days of approval,
- Unit 2, during the Unit 2, Cycle 13 refueling outage (February 2005), and
- Unit 3, during the Unit 3, Cycle 12 refueling outage (March 2006).

To support this schedule, TVA requests that the amendments and Technical Specification changes be approved by April 1, 2004.

There are no regulatory commitments associated with this submittal. If you have any questions about this matter, please contact me at (256)729-2636.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 11, 2003.

Sincerely,

original signed by:

T. E. Abney
Manager of Licensing
and Industry Affairs

Enclosures:

1. TVA Evaluation of Proposed Amendments and Technical Specifications changes
2. Marked-up Units 1, 2 and 3 Technical Specifications pages
3. Marked-up Units 1, 2 and 3 Technical Specification Bases pages

Reference:

1. TVA letter, T.E. Abney to NRC, “Browns Ferry Nuclear Plant (BFN) – Units 1, 2, and 3 – Technical Specifications (TS) Change 421 – Framatome Fuel Design and Storage,” February 13, 2003.

Enclosures
cc(Enclosures):

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R. E. Wiggall, PEC 2A-BFN
NSRB Support, LP 5M-C
EDMS-K (with Enclosures)

s:lic/submit/TechSpec/TS-424 Common Accident Signal R27

Enclosure 1

License Amendments and Technical Specification Changes – Revision in the Number of Emergency Core Cooling System Subsystems Required in Response to a Loss of Coolant Accident (TS-424)

TVA Evaluation of Proposed Amendments and Technical Specification Changes

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1.0 DESCRIPTION

This letter requests an amendment and Technical Specification changes to licenses DPR-33, DPR-52 and DPR-68 for BFN Units 1, 2 and 3, respectively. TVA's planned restart of Unit 1 will require modifications to eliminate the potential for overloading a Units 1/2 4KV shutdown board or diesel generator when both Units 1 and 2 are in-service. These modifications will reduce the number of Emergency Core Cooling Systems (ECCS) subsystems that are actually available in response to certain design basis Loss of Coolant Accident (LOCA) scenarios. The reduction in the actual number of ECCS subsystems available to mitigate the consequences of a LOCA is a reduction in redundancy and requires a license amendment under the provisions of 10 CFR 50.59. The modifications also result in a revision to the number of required channels for the Low Pressure Coolant Injection (LPCI) pump start time delay relay function specified in Technical Specification Table 3.3.5.1-1.

The present BFN LOCA analysis is conservative with respect to the current plant's actual equipment performance. The reduced number of available ECCS subsystems has previously been analyzed and is consistent with the current LOCA analysis. Therefore, the proposed amendments and Technical Specification changes are acceptable based upon the current approved LOCA analysis and conforms to 10 CFR 50.46 and Appendix K.

The proposed amendments and Technical Specification changes are necessary to support the restart of Unit 1. Portions of the modifications necessary to implement the amendments and Technical Specification changes are required to be installed on Unit 2 during an outage that precedes the restart of Unit 1. The Unit 3 modifications are not required to eliminate the potential for overloading any units' shutdown board or diesel generator. They may be performed at TVA's discretion for fidelity between the three units. Therefore, TVA requests that the amendments be made effective upon issuance and the revised Technical Specifications be made effective for:

- Unit 1 within 60 days of approval,
- Unit 2, during the Unit 2, Cycle 13 refueling outage (February 2005), and
- Unit 3, during the Unit 3, Cycle 12 refueling outage (March 2006).

To support this schedule, TVA requests that the amendments and Technical Specification changes be approved by April 1, 2004.

2.0 PROPOSED AMENDMENTS / TECHNICAL SPECIFICATION CHANGES

The proposed amendments and Technical Specifications changes are described below. The associated Technical Specification Bases changes are provided for information and do not require NRC approval.

2.1 Proposed Amendments

The number of ECCS subsystems actually available to mitigate the consequences of a LOCA is being reduced for the following four analyzed cases:

- Recirculation Suction Break, coupled with one of the following assumed single failures:

-	Battery	Instead of three Residual Heat Removal (RHR) pumps operating and injecting water through two LPCI loops, two RHR pumps will be operating and injecting water through one LPCI loop.
-	Opposite Unit False LOCA Signal (Units 1 and 2 only)	Instead of two RHR pumps operating and injecting water through two LPCI loops in each unit (one pump in each loop), two RHR pumps will be operating and injecting water through one LPCI loop in each unit.

- Recirculation Discharge Break, coupled with one of the following assumed single failures:

-	Battery	Instead of one RHR pump operating and injecting water through a LPCI loop, no RHR pumps will be available for LPCI.
-	Opposite Unit False LOCA Signal (Units 1 and 2 only)	Instead of one RHR pump operating and injecting water through a LPCI loop, no RHR pumps will be available for LPCI.

The number of available ECCS subsystems evaluated in the current Browns Ferry SAFER/GESTR-LOCA Analysis is described in Table 6.5-3 of the Updated Final Safety Analysis Report (UFSAR). As a result of the change to the number of ECCS subsystems actually available to mitigate the consequences of a LOCA, the proposed amendments will revise UFSAR Table 6.5-3 for two of the non-bounding cases:

- Recirculation suction break, coupled with the opposite unit false LOCA signal as the assumed single failure; and

- Recirculation discharge break, coupled with the opposite unit false LOCA signal as the assumed single failure.

No changes to UFSAR Table 6.5-3 are required for the non-bounding case of a Recirculation discharge break, coupled with the assumed single failure of a battery, since the actual ECCS subsystems available to mitigate the consequences of the LOCA will be the same as that evaluated in the current Browns Ferry SAFER/GESTR-LOCA Analysis. Similarly, no changes to UFSAR Table 6.5-3 are required for the bounding case of a Recirculation suction break, coupled with the assumed single failure of a battery, since the actual ECCS subsystems available to mitigate the consequences of the LOCA will also be the same as that evaluated in the current Browns Ferry SAFER/GESTR-LOCA Analysis.

The changes to UFSAR Table 6.5-3 are described below. Deletions are noted by strikeout text (e.g., ~~deletion~~) and additions are bolded (e.g., **addition**). The table will be revised for both the recirculation suction pipe break and recirculation discharge pipe break scenarios.

1. The table currently states that for a recirculation suction pipe break, combined with a false accident signal between Units 1 and 2, the following systems would be available:

   - Automatic Depressurization System (ADS);
   - High Pressure Coolant Injection (HPCI);
   - One Low Pressure Core Spray (LPCS) loop; and
   - Two RHR pumps in LPCI mode injecting in two recirculation loops.

   The proposed change would state that for a recirculation suction pipe break, combined with a false accident signal between Units 1 and 2, the following systems would be available:

   - ADS;
   - HPCI;
   - One LPCS loop; and
   - Two RHR pumps in LPCI mode injecting in ~~two~~ **one** recirculation ~~loops~~ **loop**.

2. The table currently states that for a recirculation discharge pipe break, combined with a false accident signal between Units 1 and 2, the following systems would be available:
   - ADS;
   - HPCI;
   - One LPCS loop; and
   - One LPCI loop (Two RHR pumps injecting in one recirculation loop).

The proposed change would state that for a recirculation discharge pipe break, combined with a false accident signal between Units 1 and 2, the following systems would be available:

- ADS;
- HPCI; and
- ~~•~~ One LPCS loop. ~~and~~
- ~~One LPCI loop (Two RHR pumps injecting in one recirculation loop).~~

A mark-up of the change to UFSAR Table 6.5-3 is provided on Page E1-23.

2.2 Technical Specification Changes

The required modifications result in a proposed revision to the number of required channels for the LPCI pump start time delay relay function specified in Technical Specification Table 3.3.5.1-1. The required number of channels for the LPCI pump start time delay relay is specified for various pumps with diesel or normal power available. These changes are described below:

1. For Units 1 and 2, six channels are currently required for LPCI Pumps A, B, C and D with diesel power available. With the proposed change, only four channels are required. In addition, Footnote (e) is being deleted, which states that Pumps A, B, C and D have two relays each (one per trip system).

2. For Unit 3, eight channels are currently required for LPCI Pumps A, B, C and D with diesel power available. With the proposed change, only four channels are required. In addition, Footnote (e) is being deleted, which states that Pumps A, B, C and D have two relays each (one per trip system).

3. For Units 1 and 3, two channels are currently required for LPCI Pumps A and B with normal power available (one per trip system). With the proposed change, only one channel is required.

4. For Units 2 and 3, two channels are currently required for LPCI Pumps C and D with normal power available (one per trip system). With the proposed change, only one channel is required.

A mark-up of the proposed changes to Units 1, 2 and 3 Technical Specification Table 3.3.5.1-1 is provided as Enclosure 2.

2.3 Technical Specification Bases Changes

The revision to the number of required channels for the LPCI pump start time delay relay function must also be reflected in Units 1, 2 and 3 Technical Specification Bases Section 3.3.5.1, in the description of Applicable Safety Analyses, LCO and Applicablity. These changes are described below:

1. The Units 1 and 2 Bases state:

   > "There are four CS Pump and six LPCI Pump Start - Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits (LPCI pumps C and D have two time delay relays, one in each trip system)."

   The Units 1 and 2 Bases would be revised to state:

   > There are four CS Pump and four LPCI Pump Start - Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits.

2. The Units 1 and 2 Bases also state:

   > "There are also four CS and six LPCI Pump Start - Time Delay Relays when power is being provided by the standby source, one in each of the pump start logic circuits (LPCI pumps C and D have two time delay relays, one in each trip system)."

   The Units 1 and 2 Bases would be revised to state:

   > There are also four CS and four LPCI Pump Start - Time Delay Relays when power is being provided by the standby source, one in each of the pump start logic circuits.

3. Similarly, the Unit 3 Bases state:

   > "There are four CS Pump and eight LPCI Pump Start - Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits (all four LPCI pumps have two time delay relays, one in each trip system)."

The Unit 3 Bases would be revised to state:

> There are four CS Pump and four LPCI Pump Start - Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits.

4. The Unit 3 Bases also state:

> “There are also four CS and eight LPCI Pump Start-Time Delay Relays when power is being provided by the standby source, one in each of the pump start logic circuits (all four LPCI pumps have two time delay relays, one in each trip system).”

The Unit 3 Bases would be revised to state:

> There are also four CS and four LPCI Pump Start-Time Delay Relays when power is being provided by the standby source, one in each of the pump start logic circuits.

3.0 BACKGROUND

The BFN ECCS consists of the following:

- HPCI,
- ADS,
- LPCS, and
- LPCI, which is an operating mode of RHR.

The ECCS subsystems are designed to limit clad temperature over the complete spectrum of possible break sizes in the nuclear system process barrier, including the design basis break. The design basis break is defined as the complete and sudden circumferential rupture of the largest pipe connected to the reactor vessel (i.e., one of the recirculation loop pipelines) with displacement of the ends so that blowdown occurs from both ends.

This proposed amendments result in changes to the number of low-pressure ECCS subsystems available to respond to certain design basis LOCA scenarios. The low-pressure ECCS consists of LPCS and LPCI.

The LPCS consists of two independent loops. Each loop consists of two pumps, a spray sparger inside the core shroud and above the core, piping and valves to convey water from the pressure suppression pool to the sparger, and the associated controls and instrumentation. When the system is actuated, water is taken from the pressure suppression pool. Flow then passes through a normally open motor-operated valve in the suction line to each 50 percent capacity pump.

The RHR System is designed for five modes of operation (i.e., shutdown cooling; Containment spray and pool cooling; LPCI; standby cooling; and supplemental fuel pool cooling. During LPCI operation, the four RHR pumps take suction from the pressure suppression pool and discharge to the reactor vessel into the core region through both of the recirculation loops. Two pumps discharge to each recirculation loop. The LPCI subsystem may be initiated by automatic or manual means. Automatic initiation occurs for:

- Reactor Vessel Water Level – Low Low Low Level 1, or
- Both Drywell Pressure – High and Reactor Steam Dome Pressure – Low.

Upon receipt of an initiation signal, if normal AC power is available, the four RHR (LPCI) pumps start one at a time. The starting sequence is controlled by time delay relays. (If normal AC power is not available, the four pumps start simultaneously, as soon as the standby power source is available.) Surveillance requirements for these LPCI pump start time delay relays is specified in Technical Specification Section 3.3.5.1 and Technical Specification Table 3.3.5.1-1.

BFN is a three-unit plant. As discussed in UFSAR Section 1.5, sufficient redundancy and independence is provided for essential safety functions to ensure that no single failure of active components can prevent the required actions. For systems or components to which IEEE-279 is applicable, single failures of passive electrical components is also considered. The licensing and design basis for addressing unit interactions is summarized in UFSAR Appendix F, Unit Sharing and Interactions. As described therein, the design basis of BFN assumes only one of the three units could be in a LOCA or post-accident recovery mode at any point in time. Additionally, a postulated single failure must be assumed to occur in the plant. During accident scenarios that assume the loss of offsite power, the BFN licensing basis also postulates that a spurious accident signal could originate from one of the non-accident units. This spurious accident signal is considered to be one of the postulated single failures. Plant systems must be adequate to address accident signals, spurious and valid, in any order (i.e., valid followed by a spurious signal in one of the non-accident units or a spurious signal from a non-accident unit followed by a valid signal). The design basis for the emergency electric power system was approved by the NRC in Supplement 4 to the original Safety Evaluation Report for the operation of Browns Ferry Units 1, 2 and 3, dated September 10, 1973.

Following initial startup and operation, the ECCS initiation logic was modified to satisfy the more stringent limitations required by 10 CFR 50, Appendix K and to resolve other regulatory issues. Browns Ferry was using the General Electric SAFE/CHASTE/REFLOOD LOCA analysis methodology when it modified the ECCS logic. In order to obtain acceptable results utilizing the SAFE/CHASTE/REFLOOD LOCA analysis methodology, TVA added a redundant cross-divisional start signal to an RHR pump in the opposite logic division to ensure that at least one pump would be operating in each LPCI loop (This is shown later in the ECCS initiation logic diagrams – Figures 1 through 3).

The three BFN units were voluntarily shutdown by TVA in 1985. In 1986, an internal Condition Adverse to Quality Report documented a concern that the electrical systems and ECCS initiation logic could not accommodate various combinations of spurious and valid accident signals if Units 1 and 2 were both in-service. Therefore, additional changes would be required to support simultaneous operation of Units 1 and 2.

TVA returned BFN Unit 2 to service in 1991. In order to support the restart of Unit 2, the spurious accident signal logic input from Unit 1 was temporarily disabled to prevent a spurious Unit 1 accident signal from:

- Unnecessarily starting the Unit 2 LPCS and RHR pumps and the site's diesel generators, or

- Tripping (or blocking the startup of) Unit 2 equipment responding to a valid accident signal.

TVA returned Unit 3 to service in 1995. Units 2 and 3 have greater electrical independence than Units 1 and 2. For simultaneous operation of just Units 2 and 3, each unit is supported by four dedicated diesel generators.

After years of research with large-scale experiments and the development of best estimate codes, NRC generically approved the SAFER/GESTR-LOCA analysis methodology (Reference 1). This methodology calculated more realistic (yet conservative) peak cladding temperatures. The development of the SAFER/GESTR-LOCA was intended to relieve unnecessary plant operating and licensing restrictions.

In 1996, TVA replaced the SAFE/CHASTE/REFLOOD LOCA analysis methodology with the SAFER/GESTR-LOCA methodology. The plant specific analysis to support the change to the SAFER/GESTR model and the associated Technical Specification changes were provided to NRC in References 2 and 3. NRC issued the change in Reference 4. The current ECCS performance analysis still utilizes this methodology (NEDC 32484P - Reference 5). The results of this analysis for a complete spectrum of pipe break sizes and postulated failures are provided in UFSAR Section 6.5. The bounding [1] postulated failures evaluated in the LOCA analysis are:

- The failure of a unit battery board, with offsite power either available or not available;
- A spurious accident signal from another unit;
- The failure of a LPCI valve;
- The failure of a diesel generator with offsite power not available; or
- The failure of HPCI.

The ECCS analysis (SAFER/GESTR–LOCA) results are documented in Browns Ferry Nuclear Plant Units 1, 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis, NEDC-32484P, and reflected in UFSAR Section 6.5. As part of the implementation of the SAFER/GESTR-LOCA methodology, Tables 6.5-2 and 6.5-3 were added to the UFSAR. Table 6.5-2 shows the ECCS equipment capacity credited in the analysis and Table 6.5-3 summarized the ECCS systems that were credited in the SAFER/GESTR-LOCA analysis to mitigate the consequences of either a recirculation suction line break or a recirculation discharge line break assuming several bounding postulated failures. These tables are shown below. The BFN specific SAFER/GESTR-LOCA analysis incorporates values for some ECCS performance parameters that are more conservative, relative to either the basis for the current Technical Specifications or actual equipment performance. The intent was

1 Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the assumed failures discussed herein.

to perform the analysis in a very conservative manner to allow for future potential relaxations of ECCS equipment performance requirements. TVA did not utilize the additional margins provided by the SAFER/GESTR-LOCA methodology to relieve the unnecessary plant operating and licensing restrictions imposed on the ECCS logic design by the SAFE/CHASTE/REFLOOD LOCA analysis methodology (e.g., the redundant cross-divisional start signals) when it originally implemented the SAFER/GESTR-LOCA methodology.

CURRENT UFSAR TABLE 6.5-2
ECCS EQUIPMENT CAPACITY EVALUATED IN SAFER/GESTR-LOCA ANALYSIS

Function	Number Installed	Flow
HPCI	1	4500 gpm at 1120 to 150 psid within 50 seconds
ADS Valves	6	800,000 lb/hr per valve at 1125 psig
Core Spray System	2 (two pumps for each system)	5600 gpm at 105 psid per two CS pumps
LPCI Pump	4	9400 gpm at 20 psid per pump on one loop 17,300 gpm at 20 psid per two pumps on one loop

NOTE: psid - pounds per square inch differential between reactor vessel and primary containment (torus)

CURRENT UFSAR TABLE 6.5-3
SINGLE FAILURE EVALUATION

Assumed Failure[1]	Recirculation Suction Break Systems Remaining[2]	Recirculation Discharge Break Systems Remaining
Battery[3]	ADS[3], 1LPCS[4] , 2LPCI (2 pumps into 1 loop)	ADS[3], 1LPCS
Opposite Unit False LOCA Signal	ADS, HPCI, 1LPCS, 2LPCI (2 pumps into 2 loops)	ADS, HPCI, 1LPCS, 1LPCI
LPCI Injection Valve	ADS, HPCI, 2LPCS, 2LPCI (2 pumps into 1 loop)	ADS, HPCI, 2LPCS
Diesel Generator	ADS, 1LPCS, HPCI, 2LPCI (2 pumps into 1 loop)	ADS, HPCI, 1LPCS
HPCI	ADS, 2LPCS, 4LPCI (2 per loop)	ADS, 2LPCS, 2LPCI (2 pumps into 1 loop)

(1) Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the above assumed failures.

(2) Systems remaining, as identified in this table for recirculation suction line breaks, are applicable to other non-ECCS line breaks. For a LOCA from an ECCS line break, the systems remaining are those listed for recirculation suction breaks, less the ECCS in which the break is assumed.

(3) Six ADS valves are available. The previous analysis assumed for the battery failure, the worst-case scenario is that five ADS valves are available with HPCI being inoperable. Another scenario for battery failure is that four ADS valves are available with HPCI operable, but this scenario is bounded by the worst-case scenario (five ADS valves without HPCI). For GE14 fuel, the analysis assumed all six ADS valves are available with HPCI inoperable with a supplemental analysis to support one ADS valve out of service.

(4) Each LPCS means operation of two core spray pumps in a system. It is assumed that both pumps in a system must operate to take credit for core spray cooling or inventory makeup.

As discussed in UFSAR Section 6.5.3.1, the recirculation suction line break with a battery failure results in the highest peak clad temperature. The recirculation suction line is the largest liquid line inside the drywell. A double-ended break in this line would result in the most rapid depressurization and inventory loss. The longer time needed to reflood the vessel results in the higher peak clad temperature.

If the table reflected the current, actual plant and equipment performance, it would appear as follows (Note that new footnotes were added and some were expanded to improve clarity).

SINGLE FAILURE EVALUATION
FOR ACTUAL PLANT RESPONSE

	Recirculation Suction Break	Recirculation Discharge Break
Assumed Failure [1]	Systems Remaining[2]	Systems Remaining
Battery [3]	ADS [3], 1LCPS [4], 3LPCI (3 pumps into 2 loops) [5]	ADS [3], 1LPCS, 1LPCI (1 pump into 1 loop) [5]
Opposite Unit False LOCA Signal (Units 1 & 2) [6]	ADS, HPCI, 1LPCS, 2LPCI (2 pumps into 2 loops) [5]	ADS, HPCI, 1LPCS, 1LPCI (1 pump into 1 loop) [5]
LPCI Injection Valve	ADS, HPCI, 2LPCS, 2LPCI (2 pumps into 1 loop) [5]	ADS, HPCI, 2LPCS
Diesel Generator	ADS, 1LPCS, HPCI, 3LPCI (3 pumps into 2 loops) [5]	ADS, HPCI, 1LPCS, 1LPCI (1 pump in 1 loop)
HPCI	ADS, 2LPCS, 4LPCI (2 pumps in 2 loops) [5]	ADS, 2LPCS, 2LPCI (2 pumps into 1 loop) [5]

(1) This Table describes the minimum number of systems actually available with the existing ECCS initiation logic to support a LOCA with the listed postulated failures. Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the above assumed failures.

(2) Systems remaining, as identified in this table for recirculation suction line breaks, are applicable to other non-ECCS line breaks. For a LOCA from an ECCS line break, the systems remaining are those listed for recirculation suction breaks, less the ECCS in which the break is assumed.

(3) Six ADS valves are available. The previous analysis assumed for the battery failure, the worst-case scenario is that five ADS valves are available with HPCI being inoperable. Another scenario for battery failure is that four ADS valves are available with HPCI operable, but this scenario is bounded by the worst-case scenario (five ADS valves without HPCI). For GE14 fuel, the analysis assumed all six ADS valves are available with HPCI inoperable with a supplemental analysis to support one ADS valve out of service.

(4) Each LPCS means operation of two core spray pumps in a system. It is assumed that both pumps in a system must operate to take credit for core spray cooling or inventory makeup.

(5) 1LPCI (1 pump in 1 loop) means one LPCI loop with one RHR pump operating, 2LPCI (2 pumps in 1 loop) means one LPCI loop with two RHR pumps operating, 2LPCI (2 pumps in 2 loops) means one RHR pump in each loop operating, 3LPCI (3 pumps in 2 loops) means two RHR pumps operating in one loop and one RHR pump operating in the other loop, 4LPCI (2 pumps in 2 loops) means two RHR pumps in each of the two loops operating.

(6) An Opposite Unit False LOCA signal only affects the number of available systems for combinations of real and spurious accident signals between Units 1 and 2. Combinations of real and spurious accident signals between Units 1 and 3, or between Units 2 and 3 will not impact the number of available systems in either Unit.

Note that for the bounding LOCA case (a recirculation suction line break, with the assumed single failure of a battery), additional equipment is actually available over that evaluated in the SAFER/GESTR-LOCA analysis. Instead of two RHR pumps operating and injecting water through one LPCI loop, three RHR pumps will be operating and injecting water through two LPCI loops.

As previously discussed, TVA’s planned restart of Unit 1 will require modifications to eliminate the potential for overloading a Units 1/2 4KV shutdown board or diesel generator when both Units 1 and 2 are in-service. There are two aspects of the modifications to correct this potential situation that result in a reduction to the number of ECCS subsystems available to respond to a LOCA:

1. The deletion of redundant opposite division ECCS initiation signals, and

2. The assignment of Division I ECCS loads to Unit 1 and Division II ECCS loads to Unit 2 (Preferred Pump Logic).

Additional information on these aspects is provided below:

1. Deletion of Redundant ECCS Initiation Signals

   The current Units 1, 2 and 3 ECCS initiation logic sends a start signal to one or more RHR pumps in the opposite division to ensure that at least one pump is operating in each LPCI loop following a LOCA. The opposite division’s RHR (LPCI) pump start signal, including the associated pump start time delay relay, will be deleted. The ECCS initiation logic will be modified so that the Division I RHR initiation logic will only start the Division I RHR pumps (A and C). The Division II RHR initiation logic will only start the Division II RHR pumps (B and D).

   Because the start of the opposite division’s RHR pump is being deleted, the cross-divisional signals for closure of the opposite LPCI loop’s recirculation pump’s discharge valve or opening of the LPCI injection valve are no longer required. Therefore, the ECCS initiation logic will be modified so that the Division I signal will only close the B recirculation pump discharge valve and open the Division I inboard injection valve, while the Division II signal will only close the A recirculation pump discharge valve and open the Division II inboard injection valve.

Simplified diagrams showing the current (Figures 1-3) and subsequent (Figure 4) ECCS initiation logic are shown below:

FIGURE 1
CURRENT UNIT 1 ECCS INITIATION LOGIC

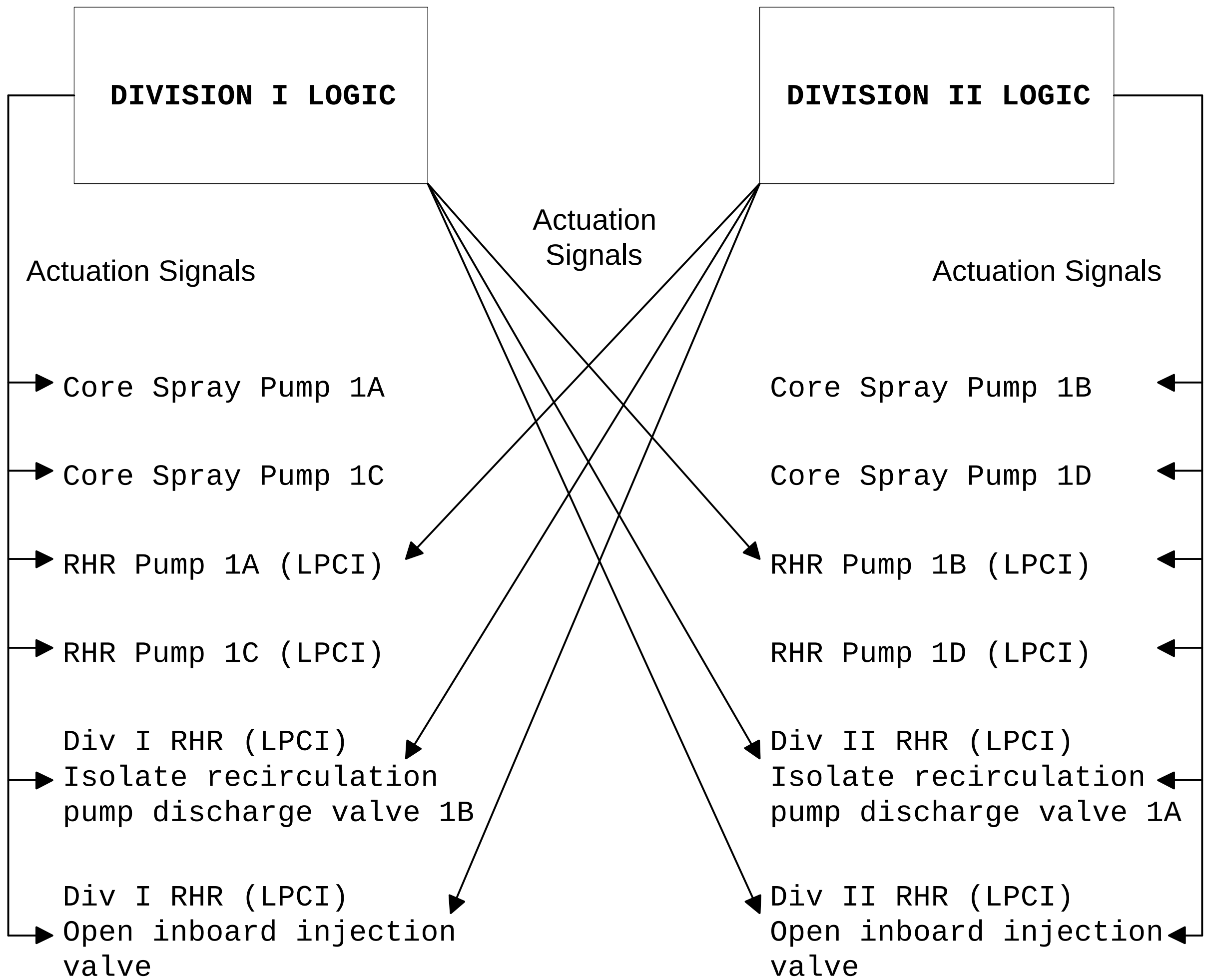


FIGURE 2
CURRENT UNIT 2 ECCS INITIATION LOGIC

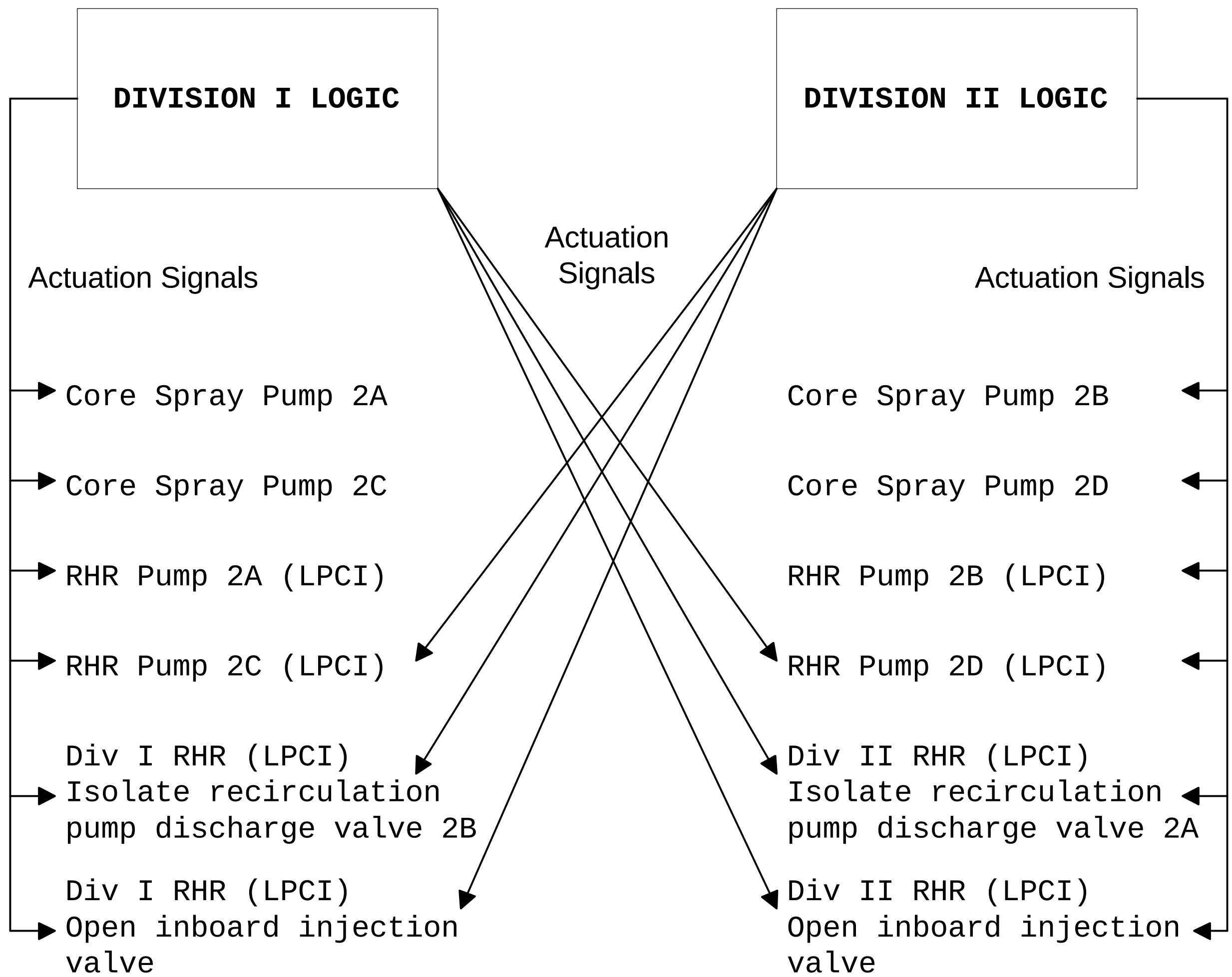


FIGURE 3
CURRENT UNIT 3 ECCS INITIATION LOGIC

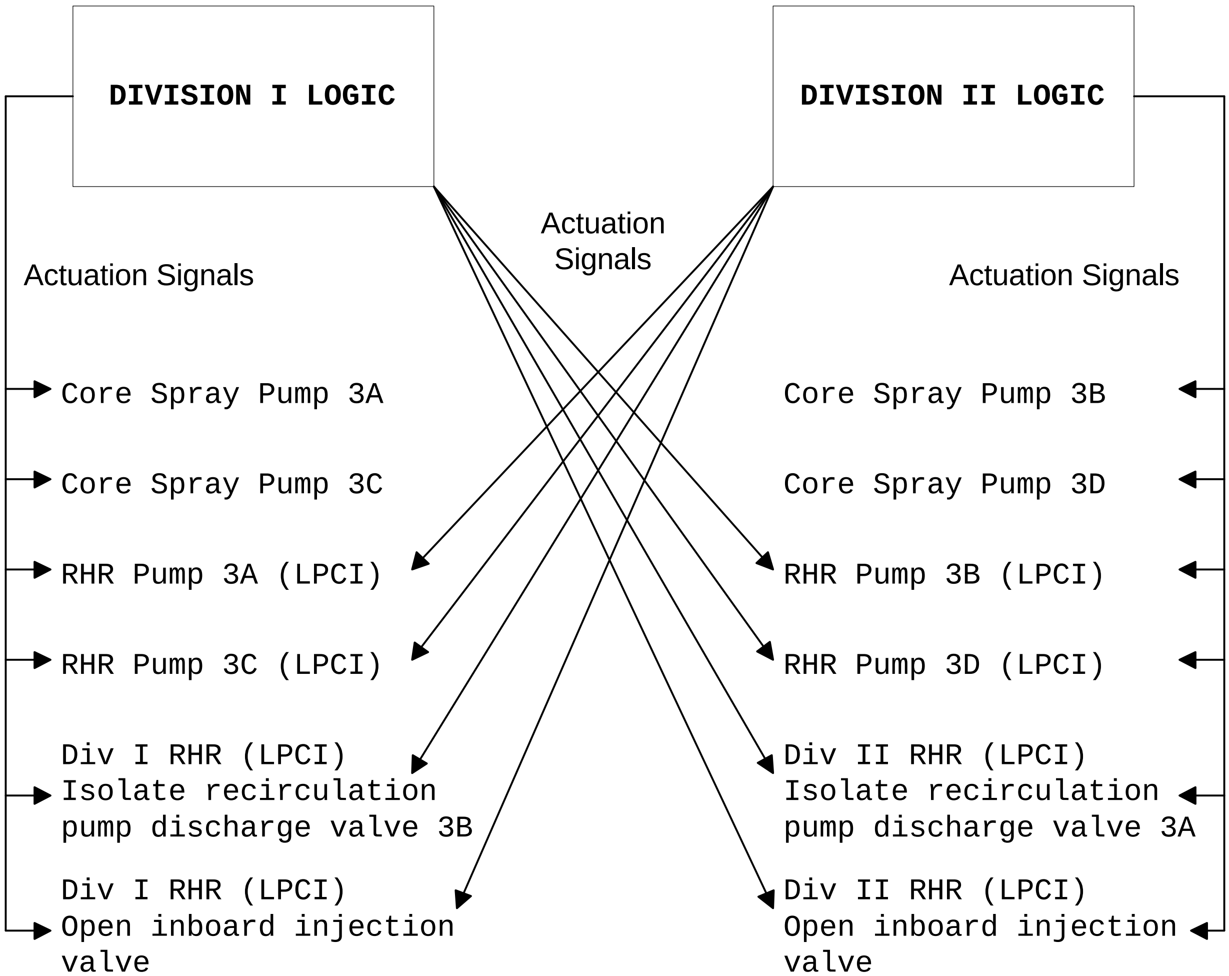
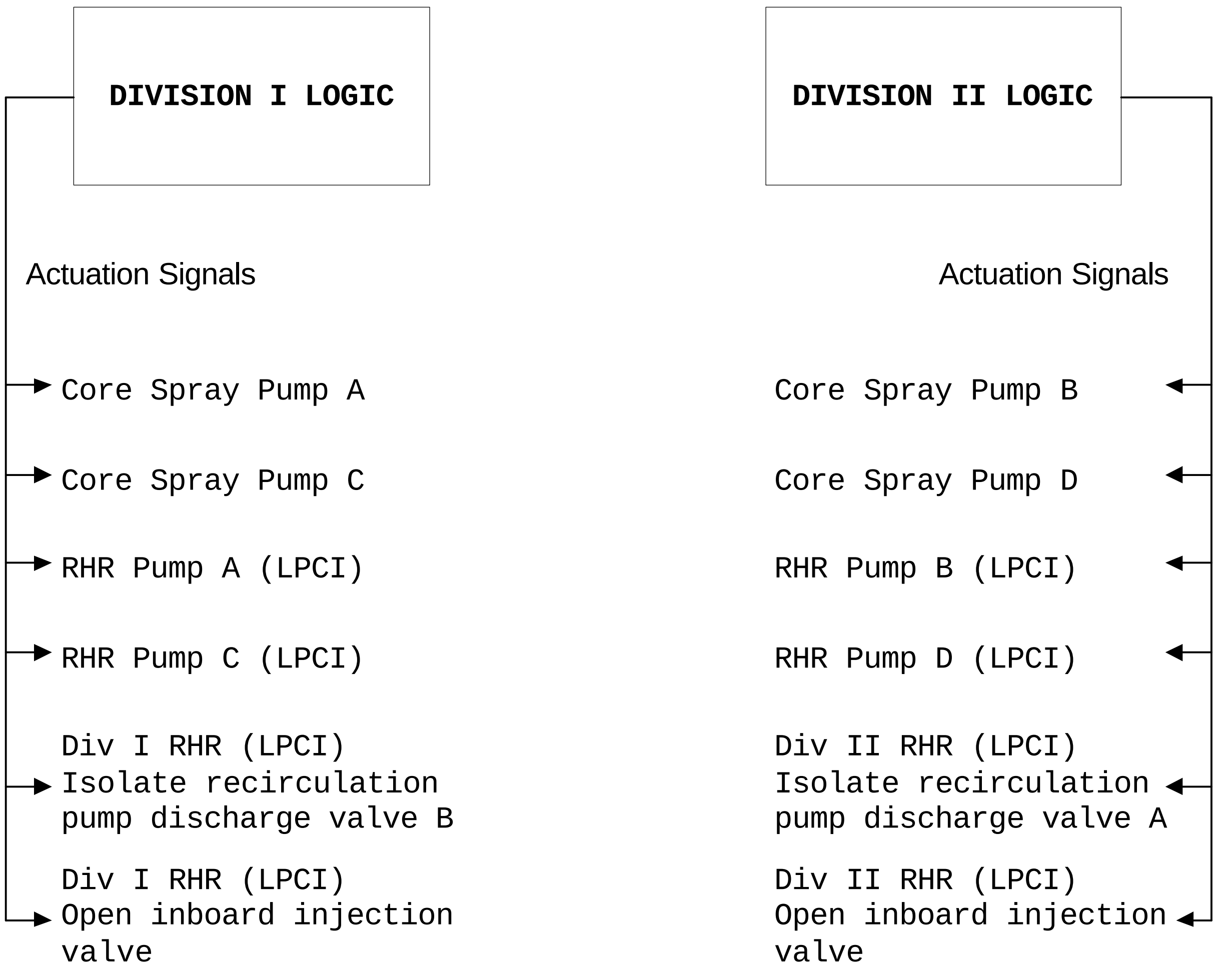


FIGURE 4
UNITS 1, 2 AND 3 ECCS INITIATION LOGIC
FOLLOWING APPROVAL OF PROPOSED AMENDMENT



2. Preferred Pump Logic

The current Units 1 and 2 ECCS Preferred Pump logic was designed to initiate in the event of a LOCA, coincident with a Loss of Offsite Power, coupled with a spurious accident signal from a non-accident unit. The Unit 1 accident signal input has been temporarily disabled during the Unit 1 shutdown period.

With the revised logic, in the event of both a real and a spurious accident signal in both Units 1 and 2, Division I ECCS loads will be assigned to Unit 1 and Division II ECCS loads will be assigned to Unit 2. In Unit 1, the logic would block the automatic start of, and would load shed, any running Unit 2 Division I RHR and LPCS pumps. In Unit 2, the logic would block the automatic start of, and would load shed, any running Unit 1 Division II RHR and LPCS pumps. For all other accident scenarios (i.e. an accident signal on only one unit), both divisions will attempt to start all pumps powered by that division.

Simplified diagrams showing the pumps that are loaded by the current and proposed Preferred Pump logic are show below:

FIGURE 5
CURRENT ECCS PREFERRED PUMP LOGIC

Unit 1		Unit 2	
DIVISION 1	DIVISION 2	DIVISION 1	DIVISION 2
Core Spray Pump 1A	Core Spray Pump 1B	Core Spray Pump 2A	**Core Spray Pump 2B**
Core Spray Pump 1C	Core Spray Pump 1D	Core Spray Pump 2C	**Core Spray Pump 2D**
RHR Pump 1A (LPCI)	**RHR Pump 1B (LPCI)**	RHR Pump 2A (LPCI)	RHR Pump 2B (LPCI)
RHR Pump 1C (LPCI)	RHR Pump 1D (LPCI)	**RHR Pump 2C (LPCI)**	**RHR Pump 2D (LPCI)**

Bold and underline indicates pump assignments in response to a design basis Loss of Coolant Accident combined with a spurious accident signal in the adjacent unit.

FIGURE 6
ECCS PREFERRED PUMP LOGIC FOLLOWING APPROVAL OF PROPOSED AMENDMENT

Unit 1		Unit 2	
DIVISION 1	**DIVISION 2**	**DIVISION 1**	**DIVISION 2**
Core Spray Pump 1A	Core Spray Pump 1B	Core Spray Pump 2A	**Core Spray Pump 2B**
Core Spray Pump 1C	Core Spray Pump 1D	Core Spray Pump 2C	**Core Spray Pump 2D**
RHR Pump 1A (LPCI)	RHR Pump 1B (LPCI)	RHR Pump 2A (LPCI)	**RHR Pump 2B (LPCI)**
RHR Pump 1C (LPCI)	RHR Pump 1D (LPCI)	RHR Pump 2C (LPCI)	**RHR Pump 2D (LPCI)**

Bold and underline indicates pump assignments in response to a design basis Loss of Coolant Accident combined with a spurious accident signal in the adjacent unit.

If UFSAR Table 6.5-3 was revised to reflect the actual plant and equipment performance after these modifications were performed, it would appear as follows (Note that new footnotes were added and some expanded to improve clarity).

SINGLE FAILURE EVALUATION
ACTUALLY AVAILABLE FOR THE MODIFIED ECCS INITIATION LOGIC

	Recirculation Suction Break	Recirculation Discharge Break
Assumed Failure [1]	Systems Remaining[2]	Systems Remaining
Battery [3]	ADS [3], 1LPCS [4], 2LPCI (2 pumps into 1 loop) [5]	ADS [3], 1LPCS
Opposite Unit False LOCA Signal (Units 1 & 2) [6]	ADS, HPCI, 1LPCS, 2LPCI (2 pumps into 1 loop) [5]	ADS, HPCI, 1LPCS
LPCI Injection Valve	ADS, HPCI, 2LPCS, 2LPCI (2 pumps into 1 loop) [5]	ADS, HPCI, 2LPCS
Diesel Generator	ADS, 1LPCS, HPCI, 3LPCI (3 pumps into 2 loops) [5]	ADS, HPCI, 1LPCS, 1 LPCI (1 pump in 1 loop)
HPCI	ADS, 2LPCS, 4LPCI (2 pumps in 2 loops) [5]	ADS, 2LPCS, 2LPCI (2 pumps into 1 loop)

(1) This Table describes the minimum number of systems actually available with the modified ECCS initiation logic to support a LOCA with the listed postulated failures. Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the above assumed failures.

(2) Systems remaining, as identified in this table for recirculation suction line breaks, are applicable to other non-ECCS line breaks. For a LOCA from an ECCS line break, the systems remaining are those listed for recirculation suction breaks, less the ECCS in which the break is assumed.

(3) Six ADS valves are available. The previous analysis assumed for the battery failure, the worst-case scenario is that five ADS valves are available with HPCI being inoperable. Another scenario for battery failure is that four ADS valves are available with HPCI operable, but this scenario is bounded by the worst-case scenario (five ADS valves without HPCI). For GE14 fuel, the analysis assumed all six ADS valves are available with HPCI inoperable with a supplemental analysis to support one ADS valve out of service.

(4) Each LPCS means operation of two core spray pumps in a system. It is assumed that both pumps in a system must operate to take credit for core spray cooling or inventory makeup.

(5) 2LPCI (2 pumps in 1 loop) means one LPCI loop with two RHR pumps operating, 2LPCI (2 pumps in 2 loops) means one RHR pump in each loop operating, 3LPCI (3 pumps in 2 loops) means two pumps operating in one loop with 1 pump in the other loop, 4LPCI (2 pumps in 2 loops) means two RHR pumps in each of the two loop operating.

(6) An Opposite Unit False LOCA signal only affects the number of available systems for combinations of real and spurious accident signals between Units 1 and 2. Combinations of real and spurious accident signals between Units 1 and 3, or between Units 2 and 3 will not impact the number of available systems in either Unit.

Note that for the bounding LOCA case (a recirculation suction line break, with the assumed single failure of a battery), the actual equipment available to respond to the LOCA will be the same as that evaluated in the SAFER/GESTR-LOCA analysis (as shown in the current UFSAR Table 6.5-2 on Page E1-12).

The modifications reduce the number of ECCS subsystems available to mitigate the consequences of a LOCA for the following cases:

- Recirculation Suction Break, coupled with the following assumed single failure:
  - Battery — Instead of three RHR pumps operating and injecting water through two LPCI loops, two RHR pumps will be operating and injecting water through one LPCI loop.
  - Opposite Unit False LOCA Signal (Units 1 and 2 only) — Instead of two RHR pumps operating and injecting water through two LPCI loops in each unit (one pump in each loop), two RHR pumps will be operating and injecting water through one LPCI loop in each unit.

- Recirculation Discharge Break, coupled with the following assumed single failure:
  - Battery — Instead of one RHR pump operating and injecting water through a LPCI loop, no LPCI loops will be available.
  - Opposite Unit False LOCA Signal (Units 1 and 2 only) — Instead of one RHR pump operating and injecting water through a LPCI loop, no LPCI loops will be available.

The reduction in the number of ECCS subsystems actually available to mitigate the consequences of a LOCA for these cases is a reduction in redundancy. This reduction was evaluated under the provisions of 10 CFR 50.59 and determined to require a license amendment. However, for the bounding LOCA case (a recirculation suction line break, with the assumed single failure of a battery), the actual equipment available to respond to the LOCA will be the same as that evaluated in the current SAFER/GESTR-LOCA analysis.

After the modifications described above are performed, UFSAR Table 6.5-3 will be revised as follows:

USFAR TABLE 6.5-3 (REVISED)
SINGLE FAILURE EVALUATION

	Recirculation Suction Break	Recirculation Discharge Break
Assumed Failure[1]	Systems Remaining[2]	Systems Remaining
Battery[3]	ADS[3], 1LPCS[4], 2LPCI (2 pumps into 1 loop)	ADS[3], 1LPCS
Opposite Unit False LOCA Signal	ADS, HPCI, 1LPCS, 2LPCI (2 pumps into **1 loop**)	ADS, HPCI, 1LPCS
LPCI Injection Valve	ADS, HPCI, 2LPCS, 2LPCI (2 pumps into 1 loop)	ADS, HPCI, 2LPCS
Diesel Generator	ADS, 1LPCS, HPCI, 2LPCI (2 pumps into 1 loop)	ADS, HPCI, 1LPCS
HPCI	ADS, 2LPCS, 4LPCI (2 per loop)	ADS, 2LPCS, 2LPCI (2 pumps into 1 loop)

Deleted: 1 LPCI

Deleted: 2 loops

1. Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the above assumed failures.

2. Systems remaining, as identified in this table for recirculation suction line breaks, are applicable to other non-ECCS line breaks. For a LOCA from an ECCS line break, the systems remaining are those listed for recirculation suction breaks, less the ECCS in which the break is assumed.

3 Six ADS valves are available. The previous analysis assumed for the battery failure, the worst-case scenario is that five ADS valves are available with HPCI being inoperable. Another scenario for battery failure is that four ADS valves are available with HPCI operable, but this scenario is bounded by the worst-case scenario (five ADS valves without HPCI). For GE14 fuel, the analysis assumed all six ADS valves are available with HPCI inoperable with a supplemental analysis to support one ADS valve out of service.

4 Each LPCS means operation of two core spray pumps in a system. It is assumed that both pumps in a system must operate to take credit for core spray cooling or inventory makeup.

In summary, TVA’s planned restart of Unit 1 will require modifications to eliminate the potential for overloading a Units 1/2 4KV shutdown board or diesel generator when both Units 1 and 2 are in-service. These modifications will reduce the number of ECCS subsystems that are actually available in response to certain design basis LOCA scenarios. The reduction in the actual number of ECCS subsystems available to mitigate the consequences of a LOCA will result in a change to UFSAR Table 6.5-3 for two non-bounding cases:

- Recirculation suction break, coupled with the opposite unit false LOCA signal as the assumed single failure; and

- Recirculation discharge break, coupled with the opposite unit false LOCA signal as the assumed single failure.

The current BFN SAFER/GESTR-LOCA analysis is conservative with respect to the current plant's actual equipment performance. The actual number of ECCS subsystems available to mitigate the consequences of a LOCA for the bounding case (i.e., a recirculation suction line break with an assumed battery failure) will now be the same as that evaluated in the current BFN SAFER/GESTR-LOCA analysis.

4.0 TECHNICAL ANALYSIS

To conform with 10 CFR 50.46 and Appendix K, the post-accident peak cladding temperature must be less than 2200°F, cladding oxidation and hydrogen generation shall be limited below acceptable values, the core geometry shall remain amenable to cooling, and the core shall be cooled long-term. The proposed amendments and Technical Specification changes do not affect cladding oxidation and hydrogen generation, core geometry, or long-term core cooling.

The proposed amendments and Technical Specification changes reduce the actual number of ECCS subsystems that are available in response to certain design basis LOCA scenarios. For the non-bounding cases, the reduction in available ECCS subsystems will result in an increased peak cladding temperature. However, the peak cladding temperature will be less than the bounding case. The reduction in the number of ECCS subsystems that are actually available in response to the bounding LOCA case (a recirculation suction line break with an assumed battery failure) will now be the same as the number of ECCS subsystems evaluated in the current BFN SAFER/GESTR-LOCA analysis (Reference 6). The consequences of this bounding LOCA case have previously been evaluated as described in UFSAR Sections 6.5 and 14.6.3, and there is no increase in the previously analyzed peak cladding temperature. Therefore, the proposed revision in the number of ECCS subsystems that are available for these LOCA scenarios is consistent with and bounded by the current approved LOCA analysis results and conforms to 10 CFR 50.46 and Appendix K.

5.0 REGULATORY SAFETY ANALYSIS

The Tennessee Valley Authority (TVA) is submitting an amendment and Technical Specification change request to licenses DPR-33, DPR-52 and DPR-68 for the Browns Ferry Nuclear Plant Units 1, 2 and 3, respectively.

5.1 No Significant Hazards Consideration

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendments and Technical Specification changes by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment", as discussed below:

1. Does the proposed amendments and Technical Specification changes involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed amendments revise the actual number of Emergency Core Cooling System (ECCS) subsystems that are available in response to certain design basis Loss of Coolant Accident (LOCA) scenarios. The associated modifications also result in a revision to the number of required channels for the Low Pressure Coolant Injection (LPCI) pump start time delay relay function specified in Technical Specifications. The proposed amendments and Technical Specification changes do not affect any accident precursors. Therefore, the probability of an evaluated accident is not increased.

The reduction in the number of ECCS subsystems that are actually available in response to the bounding LOCA case (A recirculation suction line break with an assumed battery failure) will now be the same as the number of ECCS subsystems evaluated in the current BFN SAFER/GESTR-LOCA analysis. The ECCS performance for the bounding LOCA case has previously been evaluated using the approved SAFER/GESTR-LOCA application methodology and is described in Updated Final Safety Analysis Report (UFSAR) Sections 6.5 and 14.6.3. The revision to the number of required channels for the LPCI pump start time delay relay function does not affect the LOCA analysis. The requirements of 10 CFR 50.46 and Appendix K are met. Therefore, the proposed amendments and Technical Specification changes will not significantly increase the consequences of an accident previously evaluated.

2. Does the proposed amendments and Technical Specification changes create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed amendments revise the number of ECCS subsystems that are actually available in response to certain design basis LOCA scenarios. The proposed Technical Specification changes revise the number of required channels for the LPCI pump start time delay relay function. The proposed amendments and Technical Specification changes do not introduce new equipment, which could create a new or different kind of accident.

No new external threats, release pathways, or equipment failure modes are created. Therefore, the implementation of the proposed amendments and Technical Specification changes will not create a possibility for an accident of a new or different type than those previously evaluated.

3. Does the proposed amendments and Technical Specification changes involve a significant reduction in a margin of safety?

Response: No

The proposed amendments and Technical Specification changes revise the number of ECCS subsystems that are actually available in response to certain design basis LOCA scenarios. The reduction in the number of ECCS subsystems that are actually available in response to the bounding LOCA case (A recirculation suction line break with an assumed battery failure) will now be the same as the number of ECCS subsystems evaluated in the current BFN SAFER/GESTR-LOCA analysis. The ECCS performance for the bounding LOCA case has previously been evaluated using the approved SAFER/GESTR-LOCA application methodology. The revision to the number of required channels for the LPCI pump start time delay relay function does not affect the LOCA analysis. The requirements of 10 CFR 50.46 and Appendix K are met. Therefore, the proposed license amendments and Technical Specification changes do not involve a significant reduction in the margin of safety.

Based on the above, TVA concludes that the proposed amendments and Technical Specification changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The Normal Auxiliary Power System, Emergency A-C Power System and the proposed Emergency Core Cooling System initiation and Preferred Pump logic will support the electrical loads necessary to mitigate the consequences of a design basis accident. The performance of the ECCS was analyzed using the approved SAFER/GESTR-LOCA application methodology. The requirements of 10 CFR 50.46 and Appendix K are met.

A revision in the number of ECCS subsystems that are actually available in response to a design basis LOCA, coupled with certain postulated failures, will reduce diesel generator loading and eliminate the potential for overloading a Units 1/2 4KV shutdown board or diesel generator when both Units 1 and 2 are in-service. The proposed amendments and Technical Specification changes do not alter compliance with the requirements of 10 CFR 50, Appendix A, General Design Criterion 17 - Electric Power Systems, or the guidelines in Regulatory Guide 1.9, Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendments and Technical Specification changes will not be inimical to the common defense and security or the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendments and Technical Specification changes would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendments and Technical Specification changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendments and Technical Specification changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 50.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendments and Technical Specification changes.

7.0 REFERENCES

1. NRC letter, C.O. Thomas to J.F. Quirk (General Electric), “Acceptance for Referencing of Licensing Topical Report NEDE-23785, Revision 1, Volume III (P), The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident,” June 1, 1984.

2. TVA letter, T.E. Abney to NRC, “Browns Ferry Nuclear Plant (BFN) – Units 1, 2 and 3 – Adoption of the General Electric (GE) SAFER/GESTR Loss of Coolant Accident Methodology,” March 11, 1997.

3. TVA letter, T.E. Abney to NRC, “Browns Ferry Nuclear Plant (BFN) – Units 2 and 3 – Revision to Technical Specification (TS) Bases (TS-389),” April 24, 1997.

4. NRC letter, J.F. Williams to O.D. Kingsley, “Browns Ferry Nuclear Plant Units 1, 2 and 3 – Revision to Technical Specification Bases (TAC Nos. M97911, M97912, M97913, M98695 and M98696) (TS 388 and TS 389),” July 8, 1997.

5. “Browns Ferry Nuclear Plant Units 1, 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis,” NEDC-32484P, Rev. 1, General Electric Company, February 1996.

6. General Electric SAFER/GESTR-LOCA, Loss of Coolant Analysis, Browns Ferry Units 1, 2, and 3, NEDC-32484P, Rev. 5, January 2002.

Enclosure 2

License Amendments and Technical Specification Changes – Revision in the Number of Emergency Core Cooling System Subsystems Required in Response to a Loss of Coolant Accident (TS-424)

Mark-up of Technical Specification Changes

Table 3.3.5.1-1 (page 3 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
f. Low Pressure Coolant Injection Pump Start - Time Delay Relay					
Pump A,B,C,D (with diesel power)	1,2,3, 4[(a)], 5[(a)]	~~6[(e)]~~ **4**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump A (with normal power)	1,2,3, 4[(a)], 5[(a)]	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump B (with normal power)	1,2,3, 4[(a)], 5[(a)]	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 6 seconds and ≤ 8 seconds
Pump C (with normal power)	1,2,3, 4[(a)], 5[(a)]	1	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 12 seconds and ≤ 16 seconds
Pump D (with normal power)	1,2,3, 4[(a)], 5[(a)]	1	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 18 seconds and ≤ 24 seconds
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level - Low Low, Level 2	1, 2[(d)], 3[(d)]	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 470 inches above vessel zero

(continued)

(a) When the associated subsystem(s) are required to be OPERABLE.

(d) With reactor steam dome pressure > 150 psig.

~~(e) Pumps C and D have 1 relay each and Pumps A and B have 2 relays each (1 per trip system).~~

Table 3.3.5.1-1 (page 3 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
f. Low Pressure Coolant Injection Pump Start - Time Delay Relay					
Pump A,B,C,D (with diesel power)	1,2,3, 4(a), 5(a)	~~6(e)~~ **4**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump A (with normal power)	1,2,3, 4(a), 5(a)	1	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump B (with normal power)	1,2,3, 4(a), 5(a)	1	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 6 seconds and ≤ 8 seconds
Pump C (with normal power)	1,2,3, 4(a), 5(a)	~~2 1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 12 seconds and ≤ 16 seconds
Pump D (with normal power)	1,2,3, 4(a), 5(a)	~~2 1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 18 seconds and ≤ 24 seconds
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level - Low Low, Level 2	1, 2(d), 3(d)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 470 inches above vessel zero

(continued)

(a) When the associated subsystem(s) are required to be OPERABLE.

(d) With reactor steam dome pressure > 150 psig.

~~(e) Pumps A and B have 1 relay each and Pumps C and D have 2 relays each (1 per trip system).~~

Table 3.3.5.1-1 (page 3 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
f. Low Pressure Coolant Injection Pump Start — Time Delay Relay					
Pump A,B,C,D (with diesel power)	1,2,3, 4(a), 5(a)	~~8(e)~~ **4**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump A (with normal power)	1,2,3, 4(a), 5(a)	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 0 seconds and ≤ 1 second
Pump B (with normal power)	1,2,3, 4(a), 5(a)	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 6 seconds and ≤ 8 seconds
Pump C (with normal power)	1,2,3, 4(a), 5(a)	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 12 seconds and ≤ 16 seconds
Pump D (with normal power)	1,2,3, 4(a), 5(a)	~~2~~ ~~1 per trip system~~ **1**	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 18 seconds and ≤ 24 seconds
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level — Low Low, Level 2	1, 2(d), 3(d)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 470 inches above vessel zero

(continued)

(a) When the associated subsystem(s) are required to be OPERABLE.

(d) With reactor steam dome pressure > 150 psig.

~~(e) Pumps A, B, C, and D have 2 relays each (1 per trip system).~~

Enclosure 3

License Amendments and Technical Specification Changes – Revision in the Number of Emergency Core Cooling System Subsystems Required in Response to a Loss of Coolant Accident (TS-424)

Mark-up of Technical Specification Bases Changes

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay

The reaction of the low pressure ECCS pumps to an initiation signal depends on the availability of power. If normal power (offsite power) is not available, the four RHR (LPCI) pumps start simultaneously after the standby power source (four diesel generators) is available while the CS pumps start simultaneously after a seven-second time delay. This time delay allows the start of LPCI pumps to avoid overloading the diesel generators. When normal power is available, the CS and RHR pump starts are staggered by shutdown board (i.e., A pumps start at 0 seconds, B pumps start at 7 seconds, C pumps start at 14 seconds, and D pumps start at 21 seconds). The purpose of this time delay, when power is being provided from the normal power source (offsite), is to stagger the start of the CS and LPCI pumps, thus limiting the starting transients on the 4.16 kV shutdown buses. The CS and LPCI Pump Start - Time Delay Relays are assumed to be OPERABLE in the accident and transient analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

four

There are four CS Pump and ~~six~~ LPCI Pump Start- Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits ~~(LPCI pumps A and B have two time delay relays, one in each trip system)~~. While each time delay relay is dedicated to a single pump start logic, a single failure of a CS or LPCI Pump Start - Time Delay Relay could result in the loss of normal power to a 4.16 kV shutdown board due to a voltage transient on the associated shutdown bus (e.g., as in the case where ECCS pumps on one shutdown bus start simultaneously due to an

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay (continued)

inoperable time delay relay). This would result in the affected board being powered by the associated diesel. Therefore, the worst case single failure would be failure of a single pump to start due to a relay failure leaving seven of the eight low pressure ECCS pumps OPERABLE; thus, the single failure criterion is met (i.e., loss of one instrument does not preclude ECCS initiation). Since the CS pumps are 50% capacity pumps, the LOCA analysis does not take credit for a CS loop if one of the pumps is inoperable. Therefore, a 4.16 kV shutdown board failure results in the loss of one RHR pump and one CS loop (two CS pumps) for the LOCA analysis. The Allowable Value for the CS and LPCI Pump Start - Time Delay Relays is chosen to be long enough so that most of the starting transient of the first set of pumps is complete before starting the second set of pumps on the same 4.16 kV shutdown bus and short enough so that ECCS operation is not degraded.

four

There are also four CS and ~~six~~ LPCI Pump Start - Time Delay Relays when power is being provided by the standby source, one in each of the pump start logic circuits ~~(LPCI pumps A and B have two time delay relays, one in each trip system)~~. While each relay is dedicated to a single pump start logic, a single failure of a Pump Start-Time Delay Relay could result in the failure of the two low pressure ECCS pumps (CS and LPCI) powered from the same shutdown board, to perform their intended function (e.g., as in the case where both ECCS pumps on one shutdown board start simultaneously due to an inoperable time delay relay). This still leaves six of eight low pressure ECCS pumps OPERABLE; thus, the single failure criterion is met (i.e., loss of one instrument does not preclude

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay

The reaction of the low pressure ECCS pumps to an initiation signal depends on the availability of power. If normal power (offsite power) is not available, the four RHR (LPCI) pumps start simultaneously after the standby power source (four diesel generators) is available while the CS pumps start simultaneously after a seven-second time delay. This time delay allows the start of LPCI pumps to avoid overloading the diesel generators. When normal power is available, the CS and RHR pump starts are staggered by shutdown board (i.e., A pumps start at 0 seconds, B pumps start at 7 seconds, C pumps start at 14 seconds, and D pumps start at 21 seconds). The purpose of this time delay, when power is being provided from the normal power source (offsite), is to stagger the start of the CS and LPCI pumps, thus limiting the starting transients on the 4.16 kV shutdown buses. The CS and LPCI Pump Start - Time Delay Relays are assumed to be OPERABLE in the accident and transient analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

four

There are four CS Pump and ~~six~~ LPCI Pump Start- Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits ~~(LPCI pumps A and B have two time delay relays, one in each trip system)~~. While each time delay relay is dedicated to a single pump start logic, a single failure of a CS or LPCI Pump Start - Time Delay Relay could result in the loss of normal power to a 4.16 kV shutdown board due to a voltage transient on the associated shutdown bus (e.g., as in the case where ECCS pumps on one shutdown bus start simultaneously due to an

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

<u>1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay</u> (continued)

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(continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay

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four

There are four CS Pump and ~~eight~~ LPCI Pump Start - Time Delay Relays when power is being provided from the normal power source, one in each of the pump start logic circuits ~~(all four LPCI pumps have two time delay relays, one in each trip system)~~. While each time delay relay is dedicated to a single pump start logic, a single failure of a CS or LPCI Pump Start - Time Delay Relay could result in the loss of normal power to a 4.16 kV shutdown board due to a voltage transient on the associated shutdown bus (e.g., as in the case where ECCS pumps on one shutdown bus start simultaneously due to an inoperable time delay relay).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.e, 2.f. Core Spray and Low Pressure Coolant Injection Pump Start - Time Delay Relay (continued)

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