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

TVA-BFN-TS-382
September 15, 1996

10 CFR 50.4
10 CFR 50.90
10 CFR 50.91

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

Gentlemen:

In the Matter of) Docket No. 50-296
Tennessee Valley Authority)

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 3 - TECHNICAL SPECIFICATION (TS) 382 - TEMPORARY CHANGE TO THE REQUIREMENTS OF TECHNICAL SPECIFICATION (TS) LIMITING CONDITION FOR OPERATION (LCO) 3.6.F.1

In accordance with the provisions of 10 CFR 50.4 and 50.90, TVA is submitting a request for an amendment (TS-382) to license DPR-68 to change the Unit 3 TS LCO 3.6.F.1 in order to perform the repairs and maintenance necessary to return the reactor coolant system recirculation Loop A to operations. The current LCO 3.6.F.1 requires that the Unit 3 reactor be placed in a hot shutdown condition within 24 hours after one recirculation loop is out of service.

On September 14, 1996, at 8:47 pm Central Daylight Saving Time (CDST), Loop A of the Unit 3 recirculation system tripped due to a failure of its associated motor/generator. The bus bar carrying excitation current from the slip rings on the generator shaft to the generator rotating field failed. A failure and root cause analysis is in progress. With the Unit 3 recirculation Loop A inoperable and the temporary TS change not in place, TS 3.6.F.1 would require an orderly shutdown be initiated on September 15, 1996, and BFN Unit 3 be placed in a hot shutdown condition by 8:47 pm CDST. Since failure to act in a timely way would result in the shutdown of BFN Unit 3, TVA requests this proposed amendment be processed under the emergency provisions of 10 CFR 50.91.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the change is exempt from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). The BFN Plant Operations Review Committee and the BFN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of BFN Unit 3 in accordance with the proposed change will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosures to the Alabama State Department of Public Health.

Enclosure 1 to this letter provides the description and evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Enclosure 2 contains copies of the appropriate TS pages from Unit 3 marked-up to show the proposed change. Enclosure 3 forwards the revised TS pages for Unit 3 which incorporate the proposed change.

TVA requests that the revised TS be made effective within 2 hours of NRC approval. If you have any questions about this change, please contact me at (205) 729-2636.

Sincerely,

T. E. Abney
Manager of Licensing
and Industry Affairs

Enclosures
cc: see page 3

Subscribed and sworn to before me
on this 15th day of Sept 1996.

Barbara A. Blanton
Notary Public

My Commission Expires My Commission Expires 10/06/98

Enclosures
cc (Enclosures):

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ENCLOSURE 1

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

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE TS-382
DESCRIPTION AND EVALUATION OF THE PROPOSED CHANGE

I. DESCRIPTION OF THE PROPOSED CHANGE

TVA is requesting a temporary relaxation of the 24 hour restriction on single loop operation specified in TS Surveillance Requirement 3.6.F.1. The specific change is described below:

Current TS Surveillance Requirement 3.6.F.1:

> The reactor shall not be operated with one recirculation loop out of service for more than 24 hours. With the reactor operating, if one recirculation loop is out of service, the plant shall be placed in a HOT SHUTDOWN CONDITION within 24 hours unless the loop is sooner returned to service.

Proposed TS Surveillance Requirement 3.6.F.1:

> The reactor shall not be operated with one recirculation loop out of service for more than 24 hours. With the reactor operating, if one recirculation loop is out of service, the plant shall be placed in a HOT SHUTDOWN CONDITION on September 21, 1996, at 8:47 pm Central Daylight Saving Time unless the loop is sooner returned to service.

II. REASON FOR THE PROPOSED CHANGE

On September 14, 1996, at 8:47 pm Central Daylight Saving Time (CDST), Loop A of the Unit 3 recirculation system tripped due to the failure of its associated Motor/Generator set. The bus bar carrying excitation current from the slip rings on the generator shaft to the generator rotating field failed. A failure and root cause analysis is in progress. This failure requires an inspection of the Motor/Generator set, repairs, and performance of the required post-maintenance testing. The failure of the Motor/Generator set and the consequential inoperability of Loop A of the Unit 3 recirculation system was an unforeseen occurrence. Assessment of the extent of damage, identification of the required replacement parts, and necessary repairs were started as soon as practical. The repairs and maintenance necessary to return Loop A of the Unit 3 recirculation system to operations are expected to take a maximum of seven days (168 hours) to complete. Since

failure to act in a timely way would result in the shutdown of BFN Unit 3, TVA requests this proposed amendment be processed under the emergency provisions of 10 CFR 50.91.

III. SAFETY ANALYSIS

SYSTEM DESCRIPTION -

The Reactor Coolant Recirculation System is designed to provide a forced coolant flow through the core to remove heat from the fuel. The forced coolant flow removes more heat from the fuel than would be possible with just natural circulation. The forced flow, therefore, allows operation at significantly higher power than would otherwise be possible. The recirculation system also controls reactivity over a wide span of reactor power by varying the recirculation flow rate to control the void content of the moderator. The Reactor Coolant Recirculation System consists of two recirculation pump loops external to the reactor vessel. These loops provide the piping path for the driving flow of water to the reactor vessel jet pumps. Each external loop contains one variable speed motor driven recirculation pump, a motor generator (MG) set to control pump speed and associated piping, jet pumps, valves, and instrumentation. The recirculation loops are part of the reactor coolant pressure boundary and are located inside the drywell structure. The jet pumps are reactor vessel internals.

The recirculated coolant consists of saturated water from the steam separators and dryers that has been subcooled by incoming feedwater. This water passes down the annulus between the reactor vessel wall and the core shroud. A portion of the coolant flows from the vessel, through the two external recirculation loops, and becomes the driving flow for the jet pumps. Each of the two external recirculation loops discharges high pressure flow into an external manifold, from which individual recirculation inlet lines are routed to the jet pump risers within the reactor vessel. The remaining portion of the coolant mixture in the annulus becomes the suction flow for the jet pumps. This flow enters the jet pump at suction inlets and is accelerated by the driving flow. The drive flow and suction flow are mixed in the jet pump throat section. The total flow then passes through the jet pump diffuser section into the area below the core (lower plenum), gaining sufficient head in the process to drive the required flow upward through the core. The subcooled water enters the bottom of the fuel channels and contacts the fuel cladding, where heat is transferred to the coolant. As it rises, the coolant begins to boil, creating steam voids within the fuel channel that continue until the coolant exits the core. Because of reduced moderation, the steam voiding introduces negative reactivity that must be compensated for to maintain or to

increase reactor power. The recirculation flow control allows operators to increase recirculation flow and sweep some of the voids from the fuel channel, overcoming the negative reactivity void effect. Thus, the reason for having variable recirculation flow is to compensate for reactivity effects of boiling over a wide range of power generation (i.e., 55 to 100% of RTP) without having to move control rods and disturb desirable flux patterns.

Each recirculation loop is manually started from the control room. The MG set provides regulation of individual recirculation loop drive flows. The flow in each loop is manually controlled.

SINGLE LOOP OPERATION -

The operation of the Reactor Coolant Recirculation System is an initial condition assumed in the design basis loss of coolant accident (LOCA) (Reference 1). During a LOCA caused by a recirculation loop pipe break, the intact loop is assumed to provide coolant flow during the first few seconds of the accident. The initial core flow decrease is rapid because the recirculation pump in the broken loop ceases to pump reactor coolant to the vessel almost immediately. The pump in the intact loop coasts down relatively slowly. This pump coastdown governs the core flow response for the next several seconds until the jet pump suction is uncovered. The analyses assure that both loops are operating at the same flow prior to the accident.

Only a limited time is allowed to restore the inoperable loop to operating status in the current BFN Technical Specifications. This restoration time is based on the low probability of a LOCA occurring during this time period and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected. To justify single-loop operation for an extended period, an emergency temporary Technical Specification change was approved by NRC on April 14, 1983 (Reference 2) for BFN Unit 1. The safety analyses were reviewed by TVA for one-pump operation. The analysis to support these Technical Specification amendments included the review of a broad spectrum of postulated accidents as covered by the six categories of design basis events. These events are the loss-of-coolant, recirculation pump seizure, control rod drop, main steamline break, refueling, and fuel assembly loading accidents. The results of the two-loop analysis for the last four events conservatively bound one-pump operation. The current plant procedures and training support single loop operation.

As documented in NEDO-24236, Browns Ferry Nuclear Plant Units 1, 2 and 3 Single Loop Operation, it was determined that increased uncertainties in the core total flow and TIP readings result in an 0.01 incremental increase in the MCPR

fuel cladding integrity safety limit during single-loop operation. These uncertainties were compensated for by adding 0.01 to the MCPR operating limit for single-loop operation. No other increase in this limit was required, as core-wide transients were bounded by the rated power/flow analyses performed for each cycle, and the recirculation flow-rate dependent rod block and scram setpoint equations given in the Technical Specifications were adjusted for one-pump operation. A derived MAPLHGR reduction of 0.82 for the P8x8R and BP8x8R fuel designs was also calculated.

The current Browns Ferry Unit 3 Cycle 7 Supplemental Reload Licensing Report (Reference 3) contains an analysis consistent with NEDO-24236 for the P8x8R and BP8x8R fuel designs. For GE11 fuel, the Single Loop Operation MAPLHGR multiplier has been determined to be 0.70. These conservative changes to the MAPLHGR and MCPR limits ensures that the core response to design basis events is bounded by the FSAR Chapter 14 analyses. TVA's analyses are consistent with other BWR's that operate in single loop mode with respect to having either the crosstie removed or the equalizing valve locked closed.

TVA's September 6, 1996, proposed conversion to the Improved Standard Technical Specifications did not incorporate the single-loop analysis since its use was not permitted by the current Technical Specifications and its incorporation was not considered to be in the scope of the conversion process.

NEDO-24236 concludes that single loop operation is not the bounding condition for stability. The least stable power/flow conditions attainable under normal conditions occurs at natural circulation with control rods set for rated power and flow. This condition may be reached following a trip of both recirculation pumps. Acceptable regions of operation for stability concerns are governed by Technical Specification Figure 3.5.M-1. Stability issues specifically related to single loop operation were raised by the Staff during the review of Technical Specification 172, dated November 8, 1982. In response to those concerns, detailed tests and analyses were performed and the issues were resolved as documented in ORNL/TM-9601. It was concluded that observed neutron flux noise was the result of flow noise associated with jet pumps during single loop operation and that stability margin was preserved during single loop operation.

Even though single loop operation is analyzed for this Unit 3 operating cycle, the following compensatory measures are in effect while Loop A of the Unit 3 recirculation system is inoperable:

- No planned maintenance activities are scheduled or will be performed on any equipment that could affect the operation of Loop B of the Unit 3 recirculation system.

- There are no ongoing maintenance activities which could render critical safety equipment (such as diesel generators or emergency core cooling system pumps) out of service. Special authorization from the Plant Manager is required to perform these activities. TVA has developed a list of critical safety equipment within the scope of this limitation.

- Corrective maintenance is not being performed on critical safety equipment, unless necessary to restore operability. Corrective maintenance to restore equipment operability receives the highest priority.

- Flow-rate dependent rod block and scram setpoint equations given in the Technical Specifications were adjusted for one-pump operation.

- Adding 0.01 to the MCPR operating limit for single-loop operation.

- Implementing the Single Loop Operation MAPLHGR multipliers for each fuel type.

These compensatory measures provide controls above and beyond those required by the Technical Specifications. These measures provide additional assurance that BFN Unit 3 will be operated in a safe manner for the duration of the repairs and testing necessary to restore the operability of Loop A of the Unit 3 recirculation system.

Browns Ferry has accomplished a Probabilistic Safety Assessment (PSA) that considers the operation of Unit 3 under conditions that reflect the shared mission of some components, systems, and structures at the plant and that also reflect the current operational configuration of the Browns Ferry Nuclear Plant. For this PSA analysis, Unit 1 was assumed to remain in extended layup with no fuel in the core. Unit 2 is modeled in the PSA analysis as being in service; specifically, Unit 2 is assumed to be either operating at power or in an outage. This PSA analysis has been reviewed to determine if the operation of Unit 3 in single-loop operation would have any affect on the inputs, method of analysis, or the analysis results. The review did not identify any changes to the PSA analysis nor the PSA results. The PSA analysis suggests that the current procedures, practices, and equipment performance for Unit 3 provides for the interval between calculated core damage events to be quite large compared to the lifetime of the plant.

There is a negligible risk to BFN Unit 1 during the extended allowed outage period since it is defueled and in a shutdown condition. There is also a negligible risk to BFN Unit 2 during this period since its continued operation at full power is not impacted since the inoperability of Loop A of the Unit 3 recirculation system does not directly impact the availability of systems required to support Unit 2 operation.

REFERENCES

1. FSAR, Section 14.6.3.

2. NRC letter to TVA, dated April 14, 1983, Single Loop Operation.

3. GE letter to TVA, dated August 25, 1995, Browns Ferry Unit 3 Cycle 7 Supplemental Reload Licensing Report, Revision 1.

IV. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

TVA has concluded that operation of Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 in accordance with the proposed change to the technical specifications does not involve a significant hazards consideration. TVA's conclusion is based on its evaluation, in accordance with 10 CFR 50.91(a)(1), of the three standards set forth in 10 CFR 50.92(c).

A. The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The proposed change extends the allowable time for plant operation with an inoperable recirculation loop. Recirculation pump operation is not a precursor to any design basis accident or transient analyzed in the Browns Ferry Updated Final Safety Analysis Report. Therefore, this change does not increase the probability of any previously evaluated accident.

BFN is currently licensed for a 24-hour allowed outage time (AOT). This requested change would extend the AOT for an additional 6 days (144 hours). During the AOT, recirculation Loop B will still be in operation. This configuration (single loop operation) has been analyzed and it does not result in a loss of the ability to mitigate the consequences of a design basis accident. Therefore, this proposed change does not significantly increase the consequences of any previously evaluated accident.

B. **The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.**

The proposed change extends the acceptable time for plant operation with an inoperable recirculation loop; it does not involve a modification to plant equipment. No new failure modes are introduced. There is no effect on the function of any plant system and no new system interactions are introduced by this proposed change. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

C. **The proposed amendment does not involve a significant reduction in a margin of safety.**

The proposed change extends the acceptable time for plant operation with an inoperable recirculation loop. This condition (single loop operation) has been analyzed and the margins of safety for the design basis accidents and transients analyzed in Chapter 14 of the BFN Final Safety Analysis Report have not been significantly reduced. The 0.01 increase in the MCPR fuel cladding integrity safety limit and the multiplier factor of 0.70 to the MAPLHGR safety limit ensure adequate safety margins.

In addition, Browns Ferry has accomplished a Probabilistic Safety Assessment (PSA) that considers the operation of Unit 3 under conditions that reflect the shared mission of some components, systems, and structures at the plant and that also reflect the current operational configuration of the Browns Ferry Nuclear Plant. For this PSA analysis, Unit 1 was assumed to remain in extended layup with no fuel in the core. Unit 2 is modeled in the PSA analysis as being in service; specifically, Unit 2 is assumed to be either operating at power or in an outage. This PSA analysis has been reviewed to determine if the operation of Unit 3 in single-loop operation would have any affect on the inputs, method of analysis, or the analysis results. The review did not identify any changes to the PSA analysis nor the PSA results. The PSA analysis suggests that the current procedures, practices, and equipment performance for Unit 3 provides for the interval between calculated core damage events to be quite large compared to the lifetime of the plant.

This increase in risk is negligible over the 168-hour time period of the total Allowed Outage Time. There is also negligible risk to BFN Units 1 and 2 during this

period since Unit 1 is defueled and in a shutdown condition. There is also a negligible risk to BFN Unit 2 during the period since its continued operation at full power is not impacted since the inoperability of Loop A of the Unit 3 recirculation system does not directly impact the availability of systems required to support Unit 2 operation. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

V. ENVIRONMENTAL IMPACT CONSIDERATION

The proposed change does not involve a significant hazards consideration, a change in the types of, or increase in, the amounts of any effluents that may be released offsite, or a significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.