ENCLOSURE 1

PROPOSED TECHNICAL SPECIFICATION

BROWNS FERRY NUCLEAR PLANT

UNIT 2

(TVA BFN TS 281)

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UNIT 2
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TABLE 3.2.B
INSTRUMENTATION THAT INITIATES OR CONTROLS THE CORE AND CONTAINMENT COOLING SYSTEMS

Minimum No. Operable Per Trip Sys(1)	Function	Trip Level Setting	Action	Remarks
2	Instrument Channel - Reactor Low Water Level (LIS-3-58A-D)	≥ 470" above vessel zero.	A	1. Below trip setting initiated HPCI.
2	Instrument Channel - Reactor Low Water Level (LIS-3-58A-D)	≥ 470" above vessel zero.	A	1. Multiplier relays initiate RCIC.
* 2	Instrument Channel - Reactor Low Water Level (LS-3-58A-D)	≥ 378" above vessel zero.	A	1. Below trip setting initiates CSS. Multiplier relays initiate LPCI. 2. Multiplier relay from CSS initiates accident signal (15).
2(16)	Instrument Channel - Reactor Low Water Level (LS-3-58A-D)	≥ 378" above vessel zero.	A	1. Below trip settings, in conjunction with drywell high pressure, low water level permissive, ADS timer timed out and CSS or RHR pump running, initiates ADS. 2. Below trip settings, in conjunction with low reactor water level permissive, ADS timer timed out, ADS high drywell pressure bypass timer timed out, CSS or RHR pump running, initiates ADS.
1(16)	Instrument Channel - Reactor Low Water Level Permissive (LIS-3-184, 185)	≥ 544" above vessel zero.	A	1. Below trip setting permissive for initiating signals on ADS.
1	Instrument Channel - Reactor Low Water Level (LIS-3-52 and LIS-3-62A)	≥ 312 5/16" above vessel zero. (2/3 core height)	A	1. Below trip setting prevents inadvertent operation of containment spray during accident condition.

* The automatic initiation capability of this instrument channel is not required to be OPERABLE while the Reactor Vessel water level monitoring modification is being performed. Manual initiation capability of the associated system will be available during that time the automatic initiation logic is out-of-service.

TABLE 3.2.B (Continued)

Minimum No. Operable Per Trip Sys(1)	Function	Trip Level Setting	Action	Remarks
2	Instrument Channel - Drywell High Pressure (PIS-64-58 E-H)	1≤ p≤2.5 psig	A	1. Below trip setting prevents inadvertent operation of containment spray during accident conditions.
2	Instrument Channel - Drywell High Pressure (PIS-64-58 A-D)	≤ 2.5 psig	A	1. Above trip setting in conjunction with low reactor pressure initiates CSS. Multiplier relays initiate HPCI. 2. Multiplier relay from CSS initiates accident signal. (15)
2	Instrument Channel - Drywell High Pressure (PIS-64-58A-D)	≤ 2.5 psig	A	1. Above trip setting in conjunction with low reactor pressure initiates LPCI.
2(16)	Instrument Channel - Drywell High Pressure (PIS-64-57A-D)	≤ 2.5 psig	A	1. Above trip setting, in conjunction with low reactor water level, low reactor water level permissive, ADS timer timed out, and CSS or RHR pump running, initiates ADS.

TABLE 3.2.B (Continued)

Minimum No. Operable Per Trip Sys(1)	Function	Trip Level Setting	Action	Remarks
2	Instrument Channel - Reactor Low Pressure (PIS-3-74 A & B) (PIS-68-95, 96)	450 psig ± 15	A	1. Below trip setting permissive for opening CSS and LPCI admission valves.
2	Instrument Channel - Reactor Low Pressure (PS-3-74 A & B) (PS-68-95, 96)	230 psig ± 15	A	1. Recirculation discharge valve actuation.
1	Instrument Channel - Reactor Low Pressure (PS-68-93 & 94, SW #1)	100 psig ± 15	A	1. Below trip setting in conjunction with containment isolation signal and both suction valves open will close RHR (LPCI) admission valves.
2	Core Spray Auto Sequencing Timers (5)	$6 \le t \le 8$ sec.	B	1. With diesel power 2. One per motor
2	LPCI Auto Sequencing Timers (5)	$0 \le t \le 1$ sec.	B	1. With diesel power 2. One per motor
1	RHRSW A1, B3, C1, and D3 Timers	$13 \le t \le 15$ sec.	A	1. With diesel power 2. One per pump
2	Core Spray and LPCI Auto Sequencing Timers (6)	$0 \le t \le 1$ sec. $6 \le t \le 8$ sec. $12 \le t \le 16$ sec. $18 \le t \le 24$ sec.	B	1. With normal power 2. One per CSS motor 3. Two per RHR motor
1	RHRSW A1, B3, C1, and D3 Timers	$27 \le t \le 29$ sec.	A	1. With normal power 2. One per pump

TABLE 3.2.B (Continued)

Minimum No. Operable Per Trip Sys(1)	Function	Trip Level Setting	Action	Remarks
2	Instrument Channel - RHR Discharge Pressure	100 ±10 psig	A	1. Below trip setting defers ADS actuation.
2	Instrument Channel CSS Pump Discharge Pressure	185 ±10 psig	A	1. Below trip setting defers ADS actuation.
1(3)	Core Spray Sparger to Reactor Pressure Vessel d/p	2 psid ±0.4	A	1. Alarm to detect core sparger pipe break.
	RHR (LPCI) Trip System bus power monitor	N/A	C	1. Monitors availability of power to logic systems.
1	Core Spray Trip System bus power monitor	N/A	C	1. Monitors availability of power to logic systems.
1	ADS Trip System bus power monitor	N/A	C	1. Monitors availability of power to logic systems and valves.

TABLE 3.2.B (Continued)

Minimum No. Operable Per Trip Sys(1)	Function	Trip Level Setting	Action	Remarks
1(10)	Instrument Channel – Thermostat (Core Spray Area Cooler Fan)	≤ 100°F	A	1. Above trip setting starts Core Spray area cooler fans.
1(10)	RHR Area Cooler Fan Logic	N/A	A	
1(10)	Core Spray Area Cooler Fan Logic	N/A	A	
1(11)	Instrument Channel – Core Spray Motors A or D Start	N/A	A	1. Starts RHRSW pumps A1, B3, C1, and D3
1(11)	Instrument Channel – Core Spray Motor B or C Start	N/A	A	1. Starts RHRSW pumps A1, B3, C1, and D3
1(12)	Instrument Channel – Core Spray Loop 1 Accident Signal (15)	N/A	A	1. Starts RHRSW pumps A1, B3, C1, and D3
1(12)	Instrument Channel – Core Spray Loop 2 Accident Signal (15)	N/A	A	1. Starts RHRSW pumps A1, B3, C1, and D3
1(13)	RHRSW Initiate Logic	N/A	(14)	
1	RPT Logic	N/A	(17)	1. Trips recirculation pumps on turbine control valve fast closure or stop valve closure > 30% power.

TABLE 3.2.B (Continued)

Minimum No. Operable Per Trip Sys(1)	Function	Allowable Value	Action	Remarks
1(16)	ADS Timer	t≤115 sec.	A	1. Above trip setting in conjunction with low reactor water level permissive, low reactor water level; high drywell pressure or ADS high drywell pressure bypass timer timed out, and RHR or CSS pumps running, initiates ADS.
1(16)	ADS High Drywell Pressure Bypass Timer	t≤322 sec.	A	1. Above trip setting, in conjuntion with low reactor water level permissive, low reactor water level, ADS timer timed out and RHR or CSS pumps running, initiates ADS.

TABLE 4.2.B
SURVEILLANCE REQUIREMENTS FOR INSTRUMENTATION THAT INITIATE OR CONTROL THE CSCS

Function	Functional Test	Calibration		Instrument Check
Instrument Channel Reactor Low Water Level (LIS-3-58A-D)	(1) (27)	Once/18 Months	(28)	Once/day
Instrument Channel Reactor Low Water Level (LIS-3-184 & 185)	(1) (27)	Once/18 Months	(28)	Once/day
Instrument Channel Reactor Low Water Level (LIS-3-52 & 62A)	(1) (27)	Once/18 Months	(28)	Once/day
Instrument Channel Drywell High Pressure (PIS-64-58E-H)	(1) (27)	Once/18 Months	(28)	none
Instrument Channel Drywell High Pressure (PIS-64-58A-D)	(1) (27)	Once/18 Months	(28)	none
Instrument Channel Drywell High Pressure (PIS-64-57A-D)	(1) (27)	Once/18 Months	(28)	none
Instrument Channel Reactor Low Pressure (PIS-3-74A&B, PS-3-74A&B) (PIS-68-95, PS-68-95) (PIS-68-96, PS-68-96)	(1) (27)	Once/6 Months	(28)	none

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TABLE 4.2.B (Continued)
SURVEILLANCE REQUIREMENTS FOR INSTRUMENTATION THAT INITIATE OR CONTROL THE CSCS

Function	Functional Test	Calibration	Instrument Check
Instrument Channel Reactor Low Pressure (PS-68-93 & 94)	(1)	Once/3 months	none
Core Spray Auto Sequencing Timers (Normal Power)	(4)	Once/operating cycle	none
Core Spray Auto Sequencing Timers (Diesel Power)	(4)	Once/operating cycle	none
LPCI Auto Sequencing Timers (Normal Power)	(4)	Once/operating cycle	none
LPCI Auto Sequencing Timers (Diesel Power)	(4)	Once/operating cycle	none
RHRSW A1, B3, C1, D3 Timers (Normal Power)	(4)	Once/operating cycle	none
RHRSW A1, B3, C1, D3 Timers (Diesel Power)	(4)	Once/operating cycle	none
ADS Timer	(4)	Once/operating cycle	none
ADS High Drywell Pressure Bypass Timer	(4)	Once/operating cycle	none

In addition to reactor protection instrumentation which initiates a reactor scram, protective instrumentation has been provided which initiates action to mitigate the consequences of accidents which are beyond the operator's ability to control, or terminates operator errors before they result in serious consequences. This set of specifications provides the limiting conditions of operation for the primary system isolation function, initiation of the core cooling systems, control rod block and standby gas treatment systems. The objectives of the Specifications are (i) to assure the effectiveness of the protective instrumentation when required by preserving its capability to tolerate a single failure of any component of such systems even during periods when portions of such systems are out of service for maintenance, and (ii) to prescribe the trip settings required to assure adequate performance. When necessary, one channel may be made inoperable for brief intervals to conduct required functional tests and calibrations.

Some of the settings on the instrumentation that initiate or control core and containment cooling have tolerances explicitly stated where the high and low values are both critical and may have a substantial effect on safety. The setpoints of other instrumentation, where only the high or low end of the setting has a direct bearing on safety, are chosen at a level away from the normal operating range to prevent inadvertent actuation of the safety system involved and exposure to abnormal situations.

Actuation of primary containment valves is initiated by protective instrumentation shown in Table 3.2.A which senses the conditions for which isolation is required. Such instrumentation must be available whenever primary containment integrity is required.

The instrumentation which initiates primary system isolation is connected in a dual bus arrangement.

The low water level instrumentation set to trip at 538 inches above vessel zero closes isolation valves in the RHR System, Drywell and Suppression Chamber exhausts and drains and Reactor Water Cleanup Lines (Groups 2 and 3 isolation valves). The low reactor water level instrumentation that is set to trip when reactor water level is 470 inches above vessel zero (Table 3.2.B) trips the recirculation pumps and initiates the RCIC and HPCI systems. The RCIC and HPCI system initiation opens the turbine steam supply valve which in turn initiates closure of the respective drain valves (Group 7).

The low water level instrumentation set to trip at 378 inches above vessel zero (Table 3.2.B) closes the Main Steam Isolation Valves, the Main Steam Line Drain Valves, and the Reactor Water Sample Valves (Group 1). Details of valve grouping and required closing times are given in Specification 3.7. These trip settings are adequate to prevent core uncovery in the case of a break in the largest line assuming the maximum closing time.

The low reactor water level instrumentation that is set to trip when reactor water level is 378 inches above vessel zero (Table 3.2.B)

initiates the LPCI, Core Spray Pumps, contributes to ADS initiation, and starts the diesel generators. These trip setting levels were chosen to be high enough to prevent spurious actuation but low enough to initiate CSCS operation so that postaccident cooling can be accomplished and the guidelines of 10 CFR 100 will not be violated. For large breaks up to the complete circumferential break of a 28-inch recirculation line and with the trip setting given above, CSCS initiation is initiated in time to meet the above criteria.

The high drywell pressure instrumentation is a diverse signal to the water level instrumentation and, in addition to initiating CSCS, it causes isolation of Groups 2 and 8 isolation valves. For the breaks discussed above, this instrumentation will initiate CSCS operation at about the same time as the low water level instrumentation; thus, the results given above are applicable here also.

ADS provides for automatic nuclear steam system depressurization, if needed, for small breaks in the nuclear system so that the LPCI and the CSS can operate to protect the fuel from overheating. ADS uses six of the 13 MSRVs to relieve the high pressure steam to the suppression pool. ADS initiates when the following conditions exist: low reactor water level permissive (level 3), low reactor water level (level 1), high drywell pressure or the ADS high drywell pressure bypass timer timed out, and the ADS timer timed out. In addition, at least one RHR pump or two core spray pumps must be running.

The ADS high drywell pressure bypass timer is added to meet the requirements of NUREG 0737, Item II.K.3.18. This timer will bypass the high drywell pressure permissive after a sustained low water level. The worst case condition is a main steam line break outside primary containment with HPCI inoperable. With the ADS high drywell pressure bypass timer analytical limit of 360 seconds, a Peak Cladding Temperature (PCT) of 1500°F will not be exceeded for the worst case event. This temperature is well below the limiting PCT of 2200°F.

Venturis are provided in the main steam lines as a means of measuring steam flow and also limiting the loss of mass inventory from the vessel during a steam line break accident. The primary function of the instrumentation is to detect a break in the main steam line. For the worst case accident, main steam line break outside the drywell, a trip setting of 140 percent of rated steam flow in conjunction with the flow limiters and main steam line valve closure limits the mass inventory loss such that fuel is not uncovered, fuel cladding temperatures remain below 1000°F, and release of radioactivity to the environs is well below 10 CFR 100 guidelines. Reference Section 14.6.5 FSAR.

Temperature monitoring instrumentation is provided in the main steam line tunnel to detect leaks in these areas. Trips are provided on this instrumentation and when exceeded, cause closure of isolation valves.

The setting of 200°F for the main steam line tunnel detector is low enough to detect leaks of the order of 15 gpm; thus, it is capable of covering the entire spectrum of breaks. For large breaks, the high steam

LIMITING CONDITIONS FOR OPERATION

3.5.G Automatic Depressurization System (ADS)

1. Six valves of the Automatic Depressurization System shall be OPERABLE:

   (1) PRIOR TO STARTUP from a COLD CONDITION, or,

   (2) whenever there is irradiated fuel in the reactor vessel and the reactor vessel pressure is greater than 105 psig, except in the COLD SHUTDOWN CONDITION or as specified in 3.5.G.2 and 3.5.G.3 below.

2. With one of the above required ADS valves inoperable, provided the HPCI system, the core spray system, and the LPCI system are OPERABLE, restore the inoperable ADS valve to OPERABLE status within 14 days or be in at least a HOT SHUTDOWN CONDITION within the next 12 hours and reduce reactor steam dome pressure to $\leq$105 psig within 24 hours.

3. With two or more of the above required ADS valves inoperable, be in at least a HOT SHUTDOWN CONDITION within 12 hours and reduce reactor steam dome pressure to $\leq$105 psig within 24 hours.

SURVEILLANCE REQUIREMENTS

4.5.G Automatic Depressurization System (ADS)

1. During each operating cycle the following tests shall be performed on the ADS:

   a. A simulated automatic actuation test shall be performed PRIOR TO STARTUP after each refueling outage. Manual surveillance of the relief valves is covered in 4.6.D.2.

2. No additional surveillances are required.

LIMITING CONDITIONS FOR OPERATION

3.5.H. Maintenance of Filled Discharge Pipe

Whenever the core spray systems, LPCI, HPCI, or RCIC are required to be OPERABLE, the discharge piping from the pump discharge of these systems to the last block valve shall be filled.

The suction of the RCIC and HPCI pumps shall be aligned to the condensate storage tank, and the pressure suppression chamber head tank shall normally be aligned to serve the discharge piping of the RHR and CS pumps. The condensate head tank may be used to serve the RHR and CS discharge piping if the PSC head tank is unavailable. The pressure indicators on the discharge of the RHR and CS pumps shall indicate not less than listed below.

P1-75-20	48 psig
P1-75-48	48 psig
P1-74-51	48 psig
P1-74-65	48 psig

SURVEILLANCE REQUIREMENTS

4.5.H. Maintenance of Filled Discharge Pipe

The following surveillance requirements shall be adhered to assure that the discharge piping of the core spray systems, LPCI, HPCI, and RCIC are filled:

1. Every month and prior to the testing of the RHRS (LPCI and Containment Spray) and core spray system, the discharge piping of these systems shall be vented from the high point and water flow determined.

2. Following any period where the LPCI or core spray systems have not been required to be OPERABLE, the discharge piping of the inoperable system shall be vented from the high point prior to the return of the system to service.

3. Whenever the HPCI or RCIC system is lined up to take suction from the condensate storage tank, the discharge piping of the HPCI and RCIC shall be vented from the high point of the system and water flow observed on a monthly basis.

4. When the RHRS and the CSS are required to be OPERABLE, the pressure indicators which monitor the discharge lines shall be monitored daily and the pressure recorded.

3.5.E. High Pressure Coolant Injection System (HPCIS)

The HPCIS is provided to assure that the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break in the nuclear system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The HPCI system permits the reactor to be shut down while maintaining sufficient reactor vessel water level inventory until the vessel is depressurized. The HPCIS continues to operate until reactor vessel pressure is below the pressure at which LPCI operation or Core Spray system operation maintains core cooling. The capacity of the system is selected to provide the required core cooling. The HPCI pump is designed to pump 5000 gpm at reactor pressures between 1120 and 150 psig. The HPCIS is not required to be operable below 150 psig since this is well within the range of the low pressure cooling systems and below the pressure of any events for which HPCI is required to provide core cooling.

The HPCIS is not designed to operate at full capacity until reactor pressure exceeds 150 psig and the steam supply to the HPCI turbine is automatically isolated before reactor pressure decreases below 100 psig. The ADS, CSS, and RHRS (LPCI) must be OPERABLE when starting up from a Cold Condition. Steam pressure is sufficient at 150 psig to run the HPCI turbine for operability testing yet still below the shutoff head of the CSS and RHRS pumps so they will inject water into the vessel if required. The ADS provides additional backup to reduce pressure to the range where the CSS and RHRS will inject into the vessel if necessary. Considering the low reactor pressure, the redundancy and availability of CSS, RHRS, and ADS during startup from a Cold Condition, twelve hours is allowed as a reasonable time to demonstrate HPCI operability once sufficient steam pressure becomes available. The alternative to demonstrate HPCI operability prior to startup using auxiliary steam is provided for plant operating flexibility.

With the HPCIS inoperable, a seven-day period to return the system to service is justified based on the availability of the ADS, CSS, RHRS (LPCI) and the RCICS. The availability of these redundant and diversified systems provides adequate assurance of core cooling while HPCIS is out of service.

The surveillance requirements, which are based on industry codes and standards, provide adequate assurance that the HPCIS will be OPERABLE when required.

3.5.F Reactor Core Isolation Cooling System (RCICS)

The RCICS functions to provide core cooling and makeup water to the reactor vessel during shutdown and isolation from the main heat sink and for certain pipe break accidents. The RCICS provides its design flow between 150 psig and 1120 psig reactor pressure. Below 150 psig, RCICS is not required to be operable since this pressure is substantially below that for any events in which RCICS is required to provide core cooling. RCICS will continue to operate below 150 psig at reduced flow until it automatically isolates at greater than or equal to 50 psig reactor steam pressure. 150 psig is also below the shutoff head of the CSS and RHRS, thus, considerable overlap exists with the cooling systems that provide core cooling at low reactor pressure.

The ADS, CSS, and RHRS (LPCI) must be OPERABLE when starting up from a Cold Condition. Steam pressure is sufficient at 150 psig to run the RCIC turbine for operability testing, yet still below the shutoff head of the CSS and RHRS pumps so they will inject water into the vessel if required. Considering the low reactor pressure and the availability of the low pressure coolant systems during startup from a Cold Condition, twelve hours is allowed as a reasonable time to demonstrate RCIC operability once sufficient steam pressure becomes available. The alternative to demonstrate RCIC operability prior to startup using auxiliary steam is provided for plant operating flexibility.

With the RCICS inoperable, a seven-day period to return the system to service is justified based on the availability of the HPCIS to cool the core and upon consideration that the average risk associated with failure of the RCICS to cool the core when required is not increased.

The surveillance requirements, which are based on industry codes and standards, provide adequate assurance that the RCICS will be OPERABLE when required.

3.5.G Automatic Depressurization System (ADS)

The ADS consists of six of the thirteen relief valves. It is designed to provide depressurization of the reactor coolant system during a small break loss of coolant accident (LOCA) if HPCI fails or is unable to maintain the required water level in the reactor vessel. ADS operation reduces the reactor vessel pressure to within the operating pressure range of the low pressure emergency core cooling systems (core spray and LPCI) so that they can operate to protect the fuel barrier. Specification 3.5.G applies only to the automatic feature of the pressure relief system.

Specification 3.6.D specifies the requirements for the pressure relief function of the valves. It is possible for any number of the valves assigned to the ADS to be incapable of performing their ADS functions because of instrumentation failures, yet be fully capable of performing their pressure relief function.

The emergency core cooling system LOCA analyses for small line breaks assumed that four of the six ADS valves were operable. By requiring six

valves to be operable, additional conservatism is provided to account for the possibility of a single failure in the ADS system.

Reactor operation with one of the six ADS valves inoperable is allowed to continue for fourteen days provided the HPCI, core spray, and LPCI systems are operable. Operation with more than one ADS valve inoperable is not acceptable.

With one ADS valve known to be incapable of automatic operation, five valves remain operable to perform the ADS function. This condition is within the analyses for a small break LOCA and the peak clad temperature is well below the 10 CFR 50.46 limit. Analysis has shown that four valves are capable of depressurizing the reactor rapidly enough to maintain peak clad temperature within acceptable limits.

3.5.H. Maintenance of Filled Discharge Pipe

If the discharge piping of the core spray, LPCI, HPCIS, and RCICS are not filled, a water hammer can develop in this piping when the pump and/or pumps are started. To minimize damage to the discharge piping and to ensure added margin in the operation of these systems, this Technical Specification requires the discharge lines to be filled whenever the system is in an OPERABLE condition. If a discharge pipe is not filled, the pumps that supply that line must be assumed to be inoperable for Technical Specification purposes.

The core spray and RHR system discharge piping high point vent is visually checked for water flow once a month and prior to testing to ensure that the lines are filled. The visual checking will avoid starting the core spray or RHR system with a discharge line not filled. In addition to the visual observation and to ensure a filled discharge line other than prior to testing, a pressure suppression chamber head tank is located approximately 20 feet above the discharge line high point to supply makeup water for these systems. The condensate head tank located approximately 100 feet above the discharge high point serves as a backup charging system when the pressure suppression chamber head tank is not in service. System discharge pressure indicators are used to determine the water level above the discharge line high point. The indicators will reflect approximately 30 psig for a water level at the high point and 45 psig for a water level in the pressure suppression chamber head tank and are monitored daily to ensure that the discharge lines are filled.

When in their normal standby condition, the suction for the HPCI and RCIC pumps are aligned to the condensate storage tank, which is physically at a higher elevation than the HPCIS and RCICS piping. This assures that the HPCI and RCIC discharge piping remains filled. Further assurance is provided by observing water flow from these systems' high points monthly.

3.5.I. Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)

This specification assures that the peak cladding temperature following the postulated design basis loss-of-coolant accident will not exceed the limit specified in the 10 CFR 50, Appendix K.

The peak cladding temperature following a postulated loss-of-coolant accident is primarily a function of the average heat generation rate of all the rods of a fuel assembly at any axial location and is only dependent secondarily on the rod-to-rod power distribution within an assembly. Since expected local variations in power distribution within a fuel assembly affect the calculated peak clad temperature by less than ± 20°F relative to the peak temperature for a typical fuel design, the limit on the average linear heat generation rate is sufficient to assure that calculated temperatures are within the 10 CFR 50 Appendix K limit. The limiting value for MAPLHGR is shown in Tables 3.5.I-1, 2, 3, and 4. The analyses supporting these limiting values are presented in Reference 1.

3.5.J. Linear Heat Generation Rate (LHGR)

This specification assures that the linear heat generation rate in any rod is less than the design linear heat generation if fuel pellet densification is postulated.

The LHGR shall be checked daily during reactor operation at ≥ 25 percent power to determine if fuel burnup, or control rod movement has caused changes in power distribution. For LHGR to be a limiting value below 25 percent rated thermal power, the R factor would have to be less than 0.241 which is precluded by a considerable margin when employing any permissible control rod pattern.

3.5.K. Minimum Critical Power Ratio (MCPR)

At core thermal power levels less than or equal to 25 percent, the reactor will be operating at minimum recirculation pump speed and the moderator void content will be very small. For all designated control rod patterns which may be employed at this point, operating plant experience and thermal hydraulic analysis indicated that the resulting MCPR value is in excess of requirements by a considerable margin. With this low void content, any inadvertent core flow increase would only place operation in a more conservative mode relative to MCPR. The daily requirement for calculating MCPR above 25 percent rated thermal power is sufficient since power distribution shifts are very slow when there have not been significant power or control rod changes. The requirement for calculating MCPR when a limiting control rod pattern is approached ensures that MCPR will be known following a change in power or power shape (regardless of magnitude) that could place operation at a thermal limit.

3.5.L. APRM Setpoints

Operation is constrained to a maximum LHGR of 13.4 kW/ft for 8x8 fuel. This limit is reached when core maximum fraction of limiting power density (CMFLPD) equals 1.0. For the case where CMFLPD exceeds the fraction of rated thermal power, operation is permitted only at less than 100-percent rated power and only with APRM scram settings as required by Specification 3.5.L.1. The scram trip setting and rod block trip setting are adjusted to ensure that no combination

ENCLOSURE 2

SUMMARY OF CHANGES (UNIT 2)

1. Revise the remarks for the function "Instrument Channel - Reactor Low Water Level (LS-3-58A-D)" in Table 3.2.B on page 3.2/4.2-14 (Instrumentation that Initiates or Controls the Core and Containment Cooling Systems).

    a. Existing remark 1 reads in part:

    ". . . low water level permissive, 105 sec. delay timer . . ."

    Revised remark 1 would read in part:

    ". . . low water level permissive, ADS timer timed out . . ."

    b. Existing remark 2 reads in part:

    ". . . low reactor water level permissive, 105 sec. delay timer, 12 1/2 min. delay timer . . ."

    Revised remark 2 would read in part:

    ". . . low reactor water level permissive, ADS timer timed out, ADS high drywell pressure bypass timer timed out . . ."

2. Revise the remarks for function "Instrument Channel - Drywell High Pressure (PIS-64-57A-D)" in Table 3.2.B on page 3.2/4.2-15.

    Existing remark 1 reads in part:

    ". . . low reactor water level permissive, 105 sec. delay timer . . ."

    Revised remark 1 would read in part:

    ". . . low reactor water level permissive, ADS timer timed out . . ."

3.a. Delete the existing functions "ADS Timer" and "ADS Timer (12 1/2 min.)" from Table 3.2.B on page 3.2/4.2-17.

    b. Add the following to Table 3.2.B on page 3.2/4.2-22a.

"Minimum No. Operable Per Trip Sys (1)	Function	Allowable Value	Action	Remarks
1(16)	ADS Timer	t≤115 sec.	A	1. Above trip setting in conjunction with low reactor water level permissive, low reactor water level, high drywell pressure or ADS high drywell pressure bypass timer timed out, and RHR or CSS pumps running, initiates ADS.
1(16)	ADS High Drywell Pressure Bypass Timer	t≤322 sec.	A	1. Above trip seting, in conjunction with low reactor water level permissive, low reactor water level, ADS timer timed out and RHR or CSS pumps running, initiates ADS."

4. Revise Table 4.2.B (Surveillance Requirements for Instrumentation that Initiate or Control the CSCS).

   a. Existing Table 4.2.B reads in part:

   ". . . ADS Timer (105 sec.) (4) Once/operating cycle . . ."

   Revised Table 4.2.B would read in part:

   ". . . ADS Timer (4) Once/operating cyle . . ."

   b. Existing Table 4.2.B reads in part:

   ". . . ADS timer (12 1/2 min.) (4) Once/operating cycle . . ."

   Revised Table 4.2.B would read in part:

   ". . . ADS High Drywell Pressure Bypass Timer (4) Once/operating cycle . . ."

5. Revise Bases Section 3.2.

Existing Bases Section 3.2 reads in part:

". . . ADS initiates when the following conditions exist: low reactor water level permissive (level 3), low reactor water level (level 1), high drywell pressure or the high drywell pressure bypass timer timed out (12 1/2 min.), and a 105 second time delay. In addition, at least one RHR pump or two core spray pumps must be running.

This high pressure bypass timer is added to meet the requirements of NUREG 0737, Item II.K.3.18. This timer will bypass the high drywell pressure permissive after a sustained low water level. The worst case condition is a main steam line break outside primary containment with HPCI inoperable. With the bypass timer set at 15 minutes, a Peak Cladding Temperature (PCT) of 1424°F is reached for the worst case event . . ."

Revised Bases Section 3.2 would read in part:

". . . ADS initiates when the following conditions exist: low reactor water level permissive (level 3), low reactor water level (level 1), high drywell pressure or the ADS high drywell pressure bypass timer timed out, and the ADS timer timed out. In addition, at least one RHR pump or two core spray pumps must be running.

The ADS high drywell pressure bypass timer is added to meet the requirements of NUREG 0737, Item II.K.3.18. This timer will bypass the high drywell pressure permissive after a sustained low water level. The worst case condition is a main steam line break outside primary containment with HPCI inoperable. With the ADS high drywell pressure bypass timer analytical limit of 360 seconds, a peak cladding temperature (PCT) of 1500°F will not be exceeded for the worst case event . . ."

6. Revise Limiting Condition for Operation (LCO) 3.5.G.1 (Automatic Depressurization System) [ADS].

Existing LCO 3.5.G.1 reads in part:

"1. Four of the six valves of the Automatic Depressurization System shall be OPERABLE . . ."

Revised LCO 3.5.G.1 would read in part:

"1. Six valves of the Automatic Depressurization System shall be OPERABLE . . ."

7.a. Delete existing LCOs 3.5.G.2 and 3.5.G.3 (ADS).

b. Add revised LCOs 3.5.G.2 and 3.5.G.3.

"2. With one of the above required ADS valves inoperable, provided the HPCI system, the core spray system, and the LPCI system are OPERABLE, restore the inoperable ADS valve to OPERABLE status within 14 days or be in at least a HOT SHUTDOWN CONDITION within the next 12 hours and reduce reactor steam dome pressure to $\leq$105 psig within 24 hours.

3. With two or more of the above required ADS valves inoperable, be in at least a HOT SHUTDOWN CONDITION within 12 hours and reduce reactor steam dome pressure to $\leq$105 psig within 24 hours."

8. Revise Bases Section 3.5.G (ADS).

Existing Bases Section 3.5.G reads as follows:

"This specification ensures the operability of the ADS under all conditions for which the depressurization of the nuclear system is an essential response to station abnormalities.

The nuclear system pressure relief system provides automatic nuclear system depressurization for small breaks in the nuclear system so that the low-pressure coolant injection (LPCI) and the core spray subsystems can operate to protect the fuel barrier. Note that this specification applies only to the automatic feature of the pressure relief system.

Specification 3.6.D specifies the requirements for the pressure relief function of the valves. It is possible for any number of the valves assigned to the ADS to be incapable of performing their ADS functions because of instrumentation failures, yet be fully capable of performing their pressure relief function.

Because the automatic depressurization system does not provide makeup to the reactor primary vessel, no credit is taken for the steam cooling of the core caused by the system actuation to provide further conservatism to the CSCS.

With two ADS valves known to be incapable of automatic operation, four valves remain OPERABLE to perform their ADS function. The ECCS loss-of-coolant accident analyses for small line breaks assumed that four of the six ADS valves were OPERABLE. Reactor operation with three ADS valves inoperable is allowed to continue for seven days provided that the HPCI system is OPERABLE. Operation with more than three of the six ADS valves inoperable is not acceptable."

Revised Bases Section 3.5.G would read as follows:

"The ADS consists of six of the thirteen relief valves. It is designed to provide depressurization of the reactor coolant system during a small break loss of coolant accident (LOCA) if HPCI fails or is unable to maintain the required water level in the reactor vessel. ADS operation reduces the reactor vessel pressure to within the operating pressure range of the low pressure emergency core cooling systems (core spray and LPCI) so that they can operate to protect the fuel barrier. Specification 3.5.G applies only to the automatic feature of the pressure relief system.

Specification 3.6.D specifies the requirements for the pressure relief function of the valves. It is possible for any number of the valves assigned to the ADS to be incapable of performing their ADS function because of instrumentation failures, yet be fully capable of performing their pressure relief function.

The emergency core cooling system LOCA analyses for small line breaks assumed that four of the six ADS valves were operable. By requiring six valves to be operable, additional conservatism is provided to account for the possibility of a single failure in the ADS system.

Reactor operation with one of the six ADS valves inoperable is allowed to continue for fourteen days provided the HPCI, core spray, and LPCI systems are operable. Operation with more than one ADS valve inoperable is not acceptable.

With one ADS valve known to be incapable of automatic operation, five valves remain operable to perform the ADS function. This condition is within the analyses for a small break LOCA and the peak clad temperature is well below the 10 CFR 50.46 limit. Analysis has shown that four valves are capable of depressurizing the reactor rapidly enough to maintain peak clad temperature within acceptable limits."

ENCLOSURE 3

REASON AND JUSTIFICATION FOR THE PROPOSED CHANGES

Reason for Changes

The Browns Ferry Nuclear Plant (BFN) Unit 2 Technical Specification (TS) 3.2.B settings for the Automatic Depressurization System (ADS) initiation timers and the ADS high drywell pressure bypass timers are being revised. These changes are a result of a reanalysis of the calculation for the ADS high drywell pressure bypass timer function and a recalculation of the accuracy of the ADS timers.

The Limiting Condition for Operation (LCO) for the ADS currently requires four valves to be operable prior to startup. If while operating with four operable valves an event occurs which requires the ADS there is a potential that only two ADS valves could be available for reactor depressurization. This is because a single failure (loss of a 250 VDC Reactor MOV Board) could make two ADS valves inoperable. Analyses have shown that depressurization with two ADS valves and no high pressure coolant injection will result in exceeding the peak cladding temperature limits. This change will revise the ADS LCO 3.5.G.1 to require six valves to be operable prior to startup. This will ensure that with an event which makes two ADS valves inoperable, sufficient ADS capacity exists to mitigate an accident. ADS LCOs 3.5.G.2 and 3.5.G.3 are also being revised to be consistent with the Boiling Water Reactor Standard TSs (NUREG 0123).

Justification for the Changes

The ADS is part of the Core Standby Cooling system (CSCS). The CSCS consists of the High Pressure Coolant Injection (HPCI) system, the ADS, the Core Spray (CS) system, and the Low Pressure Coolant Injection (LPCI) mode of the Residual Heat Removal (RHR) system. The CSCS in conjunction with the primary and secondary containments is designed to limit the release of radioactive materials to the environs following a loss-of-coolant accident (LOCA), so that resulting radiation exposures are kept to a practical minimum and are within the guideline values in 10 CFR 100. The CSCS performs this safety objective by limiting clad temperature over the complete spectrum of possible break sizes in the nuclear system process barrier including the design basis break.

The ADS provides for automatic depressurization of the nuclear system as needed to allow operation of LPCI and CS to protect the fuel barrier from overheating. The ADS uses six of the thirteen nuclear system pressure relief valves to relieve high pressure steam from the reactor vessel to the suppression pool. For a large line break of the primary system, operation of the ADS would not be required since the large break would result in rapid depressurization of the primary system. However, for smaller line breaks in which the primary system does not depressurize quickly and the high pressure coolant systems cannot maintain reactor vessel level greater than 378 inches above vessel zero (AVZ), the ADS operates to reduce the reactor vessel pressure to within the discharge head of the LPCI and CS Systems. By performing this function, the ADS in conjunction with LPCI and/or CS acts as a backup to the HPCI system, thus ensuring core cooling when the HPCI system is not available.

The ADS automatically initiates based upon receipt of all four of the following signals:

1. Low Reactor Water Level (≤ 378 inches AVZ),

2. High Drywell Pressure (sealed-in), or ADS high drywell pressure bypass timer timed out (modification in progress to provide seal-in)

3. Low Reactor Water Level Permissive (≤ 544 inches AVZ), and

4. One RHR pump or two CS pumps running,

the ADS initiation timer will start, which will initiate ADS after timing out.

The ADS high drywell pressure bypass timers were added as a result of TVA's response to NUREG 0737, "Clarification of TMI Action Plan Requirements," Item II.K.3.18 and provide for automatic actuation of the ADS for certain LOCA events where a high drywell pressure does not exist (e.g., pipe breaks outside containment). This eliminates the need for manual operator action to assure adequate core cooling for events where reactor vessel level cannot be maintained and a high drywell pressure signal does not exist. The ADS initiation timer allows time for the operator to cancel the automatic depressurization signal if control room information indicates that the signal is false or depressurization is not needed. Changes are being made to TS Table 3.2.B and 4.2.B to reflect the calculation of the accuracy and allowable setpoints for the ADS initiation timers and ADS high drywell pressure bypass timers. Bases Section 3.2 is also being revised to reflect these changes.

A reanalysis of the original ADS high drywell pressure bypass timer calculation was performed because of differences between the calculation assumptions and actual plant configuration and operation. This analysis was required because of the following differences:

a. The Yarway columns for the water level instruments for unit 2 have been replaced with instrumentation located outside the drywell. This eliminates the bias of the reactor low level setpoint for ADS, LPCI, and CS initiation assumed in the previous analysis. This bias was the result of the high drywell temperature effect associated with Yarway water leg columns. Events leading to the activation of ADS, through the ADS bypass timer, would not have the high drywell temperature condition. Therefore, the ADS bypass timer would initiate later with the Yarway column replaced by the new instrumentation.

b. The ADS initiation timer (120 seconds in the original calculation) has a higher uncertainty than used in that calculation. To compensate for that uncertainty, an analytical limit time delay of 130 seconds was utilized in the reanalysis.

Additionally, a concern exists for a loss of a DC reactor MOV board during a HPCI steam line break outside the primary containment. This could degrade the ADS such that only four of the six ADS relief valves are operable. The reanalysis bounded this concern by assuming only four of the six valves are operable for the main steam line break outside primary containment event.

General Electric (GE) utilized data from the previous analysis for the ADS high drywell pressure timers for BFN and data from similar plants to perform a bounding analysis. The bounding analysis utilized a conservative extrapolation of these data to account for the differences in the previous evaluation and for the current design configuration of BFN. For an ADS high drywell pressure bypass timer analytical limit of 360 seconds, GE determined that the peak cladding temperature (PCT) will not exceed the design goal of 1500°F for the ADS bypass timer.

The TS allowable value for the ADS high drywell pressure bypass timer will be ≤ 322 seconds. Given immeasurable instrument error, the maximum time delay for the bypass timer will be approximately 354 seconds which is below the bounding analytical limit value of 360 seconds established by GE. The TS allowable value for the ADS initiation timer will be ≤ 115 seconds. Given immeasurable instrument error, the maximum time delay for the initiation timer will be approximately 126 seconds which is below the bounding analytical limit value of 130 seconds established by GE. These allowable values have been determined by TVA calculations. Trip settings for both timers will be established in plant instructions to ensure that the allowable values are not exceeded taking into account instrument drift and inaccuracies.

Based on the results of the recent calculation and analysis, it is concluded that the proposed changes are conservative and do not degrade the nuclear safety characteristics of the ADS and will not affect the intent of the TS.

Changes are also being made to ADS LCO 3.5.G and its bases. These changes will increase the number of ADS valves required to be operable prior to startup to six (up from the current four). The ADS uses six of the thirteen nuclear system pressure relief valves to relieve high pressure steam from the reactor vessel to the suppression pool. The ADS valves are air operated with DC power. Two valves are supplied from each of the three 250V DC Reactor MOV boards. The valves require power and air to operate for the ADS function; however, they provide overpressure protection independent of power or air supplies.

As discussed previously, the analysis for the ADS high drywell pressure bypass timer assumed that four of the six ADS valves were operable. With only four ADS valves operable prior to startup (as currently allowed by LCO 3.5.G.1), a single failure of a 250V DC Reactor MOV board could result in only two ADS valves being operable. Analyses show that depressurization with two ADS valves and no HPCI system available could result in exceeding the established PCT goal of 1500°F for the fuel (the PCT limit established in 10CFR50.46 is 2200°F). This change, therefore, ensures that at least four ADS valves will be available to help mitigate an accident, and that the PCT of the fuel will not be exceeded even in the event of a single failure.

LCOs 3.5.G.2 and 3.5.G.3 are also being revised to be consistent with the Boiling Water Reactor Standard TSs (NUREG 0123). These changes conservatively require HPCI, CS, and LPCI to be operable in order to allow a 14 day LCO with one ADS valve inoperable (LCO 3.5.G.2). With these systems operable, the depressurization function performed by ADS is not required because both high pressure and low pressure core cooling systems are available. Operation with more than one ADS valve inoperable is not acceptable so no time to restore operability is allowed (LCO 3.5.G.3).

The bases for the ADS are also revised to reflect the LCO changes and to more accurately reflect system characteristics. The LCO changes are in a conservative direction and will ensure that the ADS can adequately reduce reactor vessel pressure so that the PCT of the fuel is not exceeded.

ENCLOSURE 4

PROPOSED DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Description of Proposed Technical Specification (TS) Change

The BFN unit 2 TSs are being revised as follows:

1. Revise the remarks for the function "Instrument Channel - Reactor Low Water Level" to reflect new names for the Automatic Depressurization System (ADS) timers. The amount of time delay is no longer in the name.

2. Revise the remark for the function "Instrument Channel - Drywell High Pressure" to reflect that the 105 second delay timer is now called the ADS timer.

3. Revise the ADS timer entries in Table 3.2.B to reflect the new time delay names and the range of allowable values for each timer.

4. Revise the ADS timer entries in Table 4.2.B to reflect the new time delay names.

5. Revise Bases Section 3.2 to reflect the new ADS time delay names and to be in agreement with changes 1 through 4 above.

6. Revise Limiting Condition for Operation (LCO) 3.5.G.1 (ADS) to require six ADS valves to be operable prior to startup.

7. Revise LCOs 3.5.G.2 and 3.5.G.3 to be consistent with the Boiling Water Reactor (BWR) Standard TSs (NUREG 0123).

8. Revises Bases Section 3.5.G (ADS) to reflect the LCO changes and to more accurately reflect system characteristics.

A detailed description of the changes is provided by Enclosure 2.

Basis for Proposed No Significant Hazards Consideration Determination

NRC has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92(c). A proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, or (2) create the possibility of a new or different kind of accident from an accident previously evaluated, or (3) involve a significant reduction in a margin of safety.

1. The proposed change does not involve a significant increase in the probability or consequences of accident previously evaluated.

   Changes 1 through 5 above are the result of a revision to the settings for the ADS initiation timers and the ADS high drywell pressure bypass timers. The new settings are the result of a bounding reanalysis for the ADS high drywell pressure bypass timer function based on replacement of the Yarway columns for the water level instruments for unit 2 with instrumentation located outside the drywell. This eliminated the

[illegible]

bias of the reactor low level setpoint for ADS, low pressure coolant injection (LPCI) and core spray (CS) initiation assumed in the previous analysis. Also, the ADS initiation timer has a higher uncertainty than used in the original calculation.

These TS changes do not involve any changes to the plant except the ADS initiation and ADS high drywell pressure bypass timer settings. They will ensure that the ADS automatically initiates for events in which reactor vessel water level cannot be maintained. The ADS initiation will occur soon enough to ensure that the peak cladding temperature (PCT) does not exceed the applicable limits (i.e., 2200°F for events causing high drywell pressure). The large stresses on the reactor vessel caused by a rapid depressurization were included in the design of the reactor vessel and these stresses will not be increased by the proposed changes. The changes will allow the operator sufficient time to determine the necessity of an ADS initiation and to prevent unnecessary ADS initiations by resetting the ADS initiation timer or utilizing the manual inhibit switch.

Changes 6 through 8 increase the requirement for operable ADS valves prior to startup to six valves from the current four and revise LCOs 3.5.G.2 and 3.5.G.3 for inoperable ADS valves so they are similar to the BWR Standard TSs.

Conservatively increasing the number of ADS valves required to be operable prior to startup ensures that sufficient capacity exists to reduce reactor vessel pressure to within the operating range of the low pressure injection systems, even with two ADS valves made inoperable by the loss of a reactor MOV board.

The proposed changes to LCOs 3.5.G.2 and 3.5.G.3 will ensure that adequate capability exists to prevent the PCT from being exceeded in an accident even if sufficient ADS valves are not operable (i.e., HPCI, core spray, and LPCI are required to be operable). If more than one ADS valve is inoperable, continued operation is not allowed.

The only design basis accident described in chapter 14 of the Final Safety Analysis Report which is affected by this change is the main steam line break outside of secondary containment. These technical specification changes will revise the ADS initiation timer and ADS high drywell pressure bypass timer settings to ensure depressurization early enough so the low pressure injection systems can operate to maintain the PCT below 1500°F. The change to require six ADS valves operable will conservatively ensure that an adequate ADS capacity exists. Therefore, these changes will not increase the probability or consequences of this accident.

2. The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

The ADS provides for automatic depressurization of the nuclear system as needed to allow operation of LPCI and CS systems to protect the fuel barrier from overheating. The ADS uses six of the thirteen nuclear system pressure relief valves to relieve high pressure steam from the reactor vessel to the suppression pool. For a large line break of the primary system, operation of the ADS would not be required since the large break would result in rapid depressurization of the primary system. However,

for smaller line breaks in which the primary system does not depressurize quickly and the high pressure coolant systems cannot maintain reactor vessel level greater than 378 inches above vessel zero (AVZ), the ADS operates to reduce the reactor vessel pressure to within the discharge head of the LPCI and CS systems. By performing this function, the ADS in conjunction with LPCI and/or CS acts as a backup to the HPCI system, thus ensuring core cooling when the HPCI system is not available.

Initiation signals received by the ADS logic and the operation of plant systems following ADS initiation are not affected by this change. The TS change will result in earlier initiation of ADS which will ensure adequate core cooling when ADS is required to operate. The change will also require two additional ADS valves to be operable prior to startup. This will ensure that at least four ADS valves are available to mitigate an accident as required by the analysis even with two valves made inoperable by the loss of a reactor MOV board. No new or different kind of accident is introduced by requiring more valves or shortening the initiation times.

3. The proposed change does not involve a significant reduction in a margin of safety.

The analysis performed by General Electric for the original installation of the ADS high drywell pressure bypass timers evaluated the PCT after the bypass timer timed out, the ADS timer timed out (120 seconds), the ADS valves opened, and the low pressure cooling systems operated. The analysis predicted that the maximum PCT would be 1424°F.

The bounding reanalysis performed by GE utilized data from the previous BFN analysis and data from similar plants. It took into account differences between the original calculation assumptions and actual plant configuration and operation. This bounding analysis concluded that for an ADS high drywell pressure bypass timer analytical limit of 360 seconds, the PCT will not exceed 1500°F. This is not significantly different from the PCT of 1424°F which was previously calculated for the original installation of the bypass timers as required by NUREG 0737, Item II.K.3.18.

The change to require six ADS valves to be operable prior to startup will increase the margin of safety over the present requirement of four operable ADS valves. This will ensure that even if a failure of a reactor MOV board occurs and makes two ADS valves inoperable, four valves will still be operable. An analysis has shown that four ADS valves are capable of depressurizing the reactor rapidly enough to maintain a PCT of 1500°F.