2.0 LIMITING CONDITIONS FOR OPERATION

2.10 Reactor Core (Continued)

2.10.4 Power Distribution Limits (Continued)

(5) DNBR Margin During Power Operation Above 15% of Rated Power

(a) The following DNB related parameters shall be maintained within the limits shown:

(i)	Cold Leg Temperature	$\leq$ 545°F *
(ii)	Pressurizer Pressure	$\geq$ 2075 psia*
(iii)	Reactor Coolant Flow	$\geq$ 197,000 gpm**
(iv)	Axial Shape Index, Y_I	$\leq$ Figure 2-7

(b) With any of the above parameters exceeding the limit, restore the parameter to within its limit within 2 hours or reduce power to less than 15% of rated power within the next 8 hours.

Basis

Linear Heat Rate

The limitation on linear heat rate ensures that in the event of a LOCA, the peak temperature of the fuel cladding will not exceed 2200°F.

Either of the two core power distribution monitoring systems, the Excore Detector Monitoring System, or the Incore Detector Monitoring System, provide adequate monitoring of the core power distribution and are capable of verifying that the linear heat rate does not exceed its limits. The Excore Detector Monitoring System performs this function by continuously monitoring the axial shape index with the operable quadrant symmetric excore neutron flux detectors and verifying that the axial shape index is maintained within the allowable limits of Figure 2-6 as adjusted by Specification 2.10.4.(1).(c) for the allowed linear heat rate of Figure 2-5, RC Pump configuration, and F_{xy}^T of Figure 2-9. In conjunction with the use of the excore monitoring system and in establishing the axial shape index limits, the following assumptions are made: (1) the CEA insertion limits of Specification 2.10.2.(6) and long term insertion limits of Specification 2.10.2.(7) are satisfied, (2) the flux peaking augmentation factors are as shown in Figure 2-8, (3) the azimuthal power tilt restrictions of Specification 2.10.4.(4) are satisfied, and (4) the total planar radial peaking factor does not exceed the limits of Specification 2.10.4.(3).

*Limit not applicable during either a thermal power ramp in excess of 5% of rated thermal power per minute or a thermal power step of greater than 10% of rated thermal power.

**This number is an actual limit and corresponds to an indicated flow rate of 202,500 gpm. All other values in this listing are indicated values and include an allowance for measurement uncertainty (e.g., 545°F, indicated, allows for an actual T_c of 547°F).

TABLE B-1

Explanation for Cycle 9 Technical Specification Changes

Change	Tech. Spec. Number	Changes	Reasons
13	Figure 2-9	Replace Figure 2-9 with enclosed Figure 2-9	The $F_{xy}T$ and F_RT limits have been changed to reflect higher radial peaking factors in conjunction with the statistical combination of uncertainties program
14	2.10.4(1)(2) Page 2-50	Change 1.07 to 1.062	Changed to reflect CECOR accuracy in measuring F_Q (CENPD-153-P, Rev. 1-P-A, INCA/CECOR Power Peaking Uncertainty)
15	2.10.4(2) Page 2-57a	Change limited to $\leq$ 1.62 to limited to $\leq$ 1.73 and with $F_RT > 1.62$ to with $F_RT > 1.73$	The F_RT changes have been made to reflect proposed changes in Tech. Spec. 1.1
16	2.10.4(3) Page 2-57a	Change limited to $\leq$ 1.67 to limited to $\leq$ 1.78 and with $F_RT > 1.67$ to with $F_RT > 1.78$	The $F_{xy}T$ changes have been made to reflect proposed changes in Tech. Spec. 1.1
17	2.10.4(5)(a)iii** Page 2-57c	Change ** to provide allowed measured value of RCS flow rate not including uncertainties	Provide operators with the indicated measured limit on RCS flow rate for consistency with rest of parameters in table.
18	Table 2-2 Page 2-67	Add steam generator differential pressure	See Change 6
19	Table 3-1 Page 3-5	Add steam generator differential pressure as Item 11	See Change 6
20	Table 3-1 Page 3-5	Change reactor protective system logic units from Item 11 to Item 12	Maintain consistent numbering scheme

TABLE 7-2

FORT CALHOUN UNIT 1, CYCLE 9
CORE PARAMETERS INPUT TO SAFETY ANALYSES
FOR DNB AND CTM (CENTERLINE TO MELT) DESIGN LIMITS

Physics Parameters	Units	Reference Cycle (Cycle 8) Values	Cycle 9 Values
Radial Peaking Factors			
For DNB Margin Analyses (F_RT)			
Unrodded Region		1.65	1.75+,*
Bank 4 Inserted		1.69	1.79+,*
For Planar Radial Component ($F_{xy}T$) of 3-D Peak (CTM Limit Analyses)			
Unrodded Region		1.72	1.78+,*
Bank 4 Inserted		1.81	1.93+,*
Maximum Augmentation Factor		1.057	1.057
Moderator Temperature Coefficient	$10^{-4}\Delta\rho/°F$	-2.5 to +0.5	-2.7 to +0.5
Shutdown Margin (Value Assumed in Limiting EOC Zero Power SLB)	$\%\Delta\rho$	-4.0	-4.0
Tilt Allowance	%	3.0	3.0

*For the Loss of Coolant Flow and CEA Drop Events, the effects of uncertainties on these parameters were accounted for statistically in the DNBR and CTM calculations. The DNBR analysis utilized the methods discussed in Section 6.1 of this report. The procedures used in the Statistical Combination of Uncertainties (SCU) as they pertain to DNB and CTM limits are detailed in References 2a, 2b, 2c.

+The values assumed are conservative with respect to the Technical Specification limits.

TABLE 7-2
(Continued)

Safety Parameters	Units	Cycle 8 Values	Cycle 9 Values
Power Level	MWt	1530	1530*
Maximum Steady State Temperature	°F	547	547*
Minimum Steady State Pressurizer Pressure	psia	2053	2053*
Reactor Coolant Flow	gpm	197,000	202,500*
Negative Axial Shape LCO Extreme Assumed at Full Power (Ex-Cores)	I_p	-0.20	-0.18
Maximum CEA Insertion at Full Power	% Insertion of Bank 4	25	25
Maximum Initial Linear Heat Rate for Transient Other than LOCA	KW/ft	15.22	15.22
Steady State Linear Heat Rate for Fuel CTM Assumed in the Safety Analysis	KW/ft	21.0	21.0
CEA Drop Time to 100% Including Holding Coil Delay	sec	3.1	3.1
Minimum DNBR (CE-1)		1.19	1.22*

*For the Loss of Coolant Flow and CEA Drop Events, the effects of uncertainties on these parameters were accounted for statistically in the DNBR and CTM calculations. The DNBR analysis utilized the methods discussed in Section 6.1 of this report. The procedures used in the Statistical Combination of Uncertainties (SCU) as they pertain to DNB and CTM limits are detailed in References 2a, 2b, 2c.

TABLE 7.2.1-1

FORT CALHOUN CYCLE 9
KEY PARAMETERS ASSUMED IN THE CEA WITHDRAWAL ANALYSIS

Parameter	Units	HZP	HFP
Initial Core Power Level	MWt	1	102% of 1500*
Core Inlet Coolant Temperature	°F	532*	547*
Pressurizer Pressure	psia	2053*	2053*
Moderator Temperature Coefficient	$x10^{-4}\Delta\rho/°F$	+0.5	+0.5**
Doppler Coefficient Multiplier		0.85	0.85
CEA Worth at Trip	$10^{-2}\Delta\rho$	-5.25	-6.66
Reactivity Insertion Rate Range	$x10^{-4}\Delta\rho/sec$	0 to 1.0	0 to 1.0
CEA Group Withdrawal Rate	in/min	46	46
Holding Coil Delay Time	sec	0.5	0.5

*The effects of uncertainties on these parameters were accounted for deterministically and the DNBR calculations used the methods discussed in Section 6.1 of this document and detailed in References 2a, 2b, and 2c.

**DNBR analysis assumes MTC consistent with Reference 5.

TABLE 7.2.2-1

FORT CALHOUN CYCLE 9
KEY PARAMETERS ASSUMED IN THE LOSS OF COOLANT FLOW ANALYSIS

Parameter	Units	Cycle 9
Initial Core Power Level	MWt	1530*
Initial Core Inlet Coolant Temperature	°F	547*
Initial RCS Flow Rate	gpm	202,500*
Pressurizer Pressure	psia	2053*
Moderator Temperature Coefficient	$10^{-4}\Delta\rho/°F$	+.5
Doppler Coefficient Multiplier	- -	0.85
LFT Analysis Setpoint	% of initial flow	0.93
LFT Response Time	sec	0.65
4-Pump RCS Flow Coastdown		Figure 7.2.2-1
CEA Holding Coil Delay	sec	0.5
CEA Time to 100% Insertion (Including Holding Coil Delay)	sec	3.1
CEA Worth at Trip (all rods out)	$10^{-2}\Delta\rho$	-6.87
Total Unrodded Radial Peaking Factor (F_RT)		1.75

*The uncertainties on these parameters were combined statistically rather than deterministically. The values listed represent the bounds included in the statistical combination.

TABLE 7.2.3-1

FORT CALHOUN CYCLE 9
KEY PARAMETERS ASSUMED IN THE FULL LENGTH CEA DROP ANALYSIS

Parameter	Units		Cycle 8	Cycle 9
Initial Core Power Level	MWt		102% of 1500	102% of 1500*
Core Inlet Temperature	°F		547	547*
Pressurizer Pressure	psia		2053	2053*
Core Mass Flow Rate	gpm		197,000	202,500*
Moderator Temperature Coefficient	$x10^{-4}\Delta\rho/°F$		-2.7	-2.7
Doppler Coefficient Multiplier	--		1.15	1.15
CEA Insertion at Maximum Allowed Power	% Insertion of Bank 4		25	25
Dropped CEA Worth	$\%\Delta\rho$	unrodded	-0.28	-0.2261
		PDIL	-0.28	-0.2238
Maximum Allowed Power Axial Shape Index at Negative Extreme of LCO Band			-0.20	-0.18
Radial Peaking Distortion Factor				
Integrated Radial Peaking	Unrodded Region		1.1579	1.1585
	Bank 4 Inserted Region		1.1696	1.1557
Planar Radial Peaking	Unrodded Region		1.25	1.213
	Bank 4 Inserted Region		1.24	1.205

*The uncertainties on these parameters were combined statistically rather than deterministically. The values listed represent the bounds included in the statistical combination.

TABLE 7.2.5-1

FORT CALHOUN CYCLE 9
KEY PARAMETERS ASSUMED IN
THE ANALYSIS OF LOSS OF LOAD TO ONE STEAM GENERATOR

Parameter	Units	Cycle 4
Initial Core Power	MWt	102% of 1500*
Initial Core Inlet Temperature	°F	547*
Initial Pressurizer Pressure	psia	2053*
Moderator Temperature Coefficient	$\Delta\rho/°F$	-2.7×10^{-4}
Doppler Coefficient Multiplier		1.15

*The effects of uncertainties on these parameters were accounted for deterministically and the DNBR calculations used the methods discussed in Section 6.1 of this document and detailed in References 2a, 2b, and 2c.

DISCUSSION, JUSTIFICATION, AND SIGNIFICANT
HAZARDS CONSIDERATION FOR CYCLE 9 RELOAD

This application serves to revise the Cycle 9 reload amendment application. This revision deletes the proposed amendment of using an indicated value rather than an allowed value for the DNBR limiting conditions for operation on reactor coolant system flow rate. This revision incorporates the corresponding indicated reactor coolant system flow rate into a footnote, thus delineating the measurement uncertainty. Since this revision serves to clarify the Technical Specifications and reports the limits in a method acceptable to the staff, the significant hazards consideration discussion is unchanged and remains applicable for this revision.

ATTACHMENT B