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SUBJECT:
FOWARDING BAW-1493 ENTITLED: "OCONEE UNIT 1, CYCLE 5 RELOAD REPT", AND SUPPLEMENT TO APPLICANT"S LTR OF 06/26/78 REQUESTING LIC AMEND & TECH SPEC REVISIONS TO SUPPORT THE OPERATION OF UNIT 1 AT FULL PWR FOR CYCLE 5 BASED ON A CYCLE 4 LENGTH OF 235 PLUS-M

PLANT NAME: OCONEE - UNIT 1

REVIEWER INITIAL: XJM
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****************** DISTRIBUTION OF THIS MATERIAL IS AS FOLLOWS ******************

NOTES:
1. M. CUNNINGHAM - ALL AMENDMENTS TO FSAR AND CHANGES TO TECH SPECS

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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

September 6, 1978

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch #4

Re: Oconee Nuclear Station, Unit 1
Docket No. 50-269

Dear Mr. Denton:

My letter of June 26, 1978 provided an initial submittal requesting a license amendment and Technical Specification revisions to support the operation of Oconee Unit 1 at full power for Cycle 5 based on a Cycle 4 length of 235 ± 10 EFPD.

Subsequently, Oconee Unit 1 was operated to approximately 250 EFPD. An analysis of the effects of this increased length of Cycle 4 on Cycle 5 was performed by B&W. Attachment 1 provides the pages of BAW-1493, "Oconee Unit 1, Cycle 5 Reload Report," which have been affected with the corrected values noted. The analysis included verification of the operating limits provided previously in my letter of June 26, 1978 which indicated that all of the figures are conservative and no changes are required, with the exception of Figure 2.3-2A. A revised Figure 2.3-2A is provided in Attachment 2. These changes to the reload report are provided now in order to facilitate review and approval of the request by the NRC. A complete smooth version of BAW-1493, Revision 2 will be submitted promptly upon receipt from Babcock and Wilcox.

In a March 20, 1978 letter, a request was submitted to increase the allowable tilt limit to 6.03% for Cycle 4. Inasmuch as Unit 1 has shut down to refuel for Cycle 5, this change is no longer required and is hereby rescinded.

This submittal is considered to supplement my earlier submittal and as such no license fees are provided. As required, 40 copies of this submittal are provided.

Very truly yours,

William O. Parker, Jr.

RLG:vr
Attachments

ATTACHMENT 1

Revised Pages

BAW-1493
OCONEE UNIT 1 - CYCLE 5
RELOAD REPORT

Pages

2-1
3-3
4-2
4-4
5-3
5-4
5-5
7-3

2. OPERATING HISTORY

The reference cycle for the nuclear and thermal-hydraulic analyses of Oconee 1, cycle 5 is the currently operating cycle 4. This cycle 5 design is based on a planned cycle 4 length of 250 EFPD rather than the design length of 292 EFPD.

Cycle 5 will operate in a feed-and-bleed mode for its entire design length of 320 EFPD. Initial cycle 4 operation was in a rodded mode. However, a quadrant power tilt was detected during cycle 4 power escalation[1], and the mode of operation was converted to feed-and-bleed to provide a larger margin for cycle 4 operation.[2] The shuffle pattern for cycle 5 was designed to minimize the effects of any power tilts present in cycle 4. No control rod interchange is planned during cycle 5.

Figure 3-2. Enrichment and Burnup Distribution for Oconee 1, Cycle 5

	8	9	10	11	12	13	14	15
H	3.20 28,923	2.75 20,985	2.75 16,578	3.20 31,581	3.02 0	2.75 16,428	2.79 6,288	3.02 0
K		3.02 0	2.75 14,746	2.79 5,477	2.75 19,695	2.79 9,080	2.75 16,881	3.02 0
L			2.75 17,841	2.79 6,247	2.79 8,787	2.75 16,404	3.02 0	3.02 0
M				2.75 17,846	2.79 5,346	2.75 18,853	3.02 0	
N					2.79 6,227	2.79 7,549	3.02 0	
O						3.02 0		
P								
R								

x.xx	Initial Enrichment
xxxxx	BOC Burnup, MWd/mtU

4.2. Fuel Rod Design

4.2.1. Cladding Collapse

Creep collapse analyses were performed for three-cycle assembly power histories as well as for batch 4D's four-cycle assembly power histories. For cycle 5, the batch 5 fuel is more limiting than all other batches except for 4D because of its previous incore exposure time. The batch 5 and 4D assembly power histories were analyzed, and the most limiting assembly from each batch was determined.

The power histories for the most limiting assemblies were used to calculate the fast neutron flux level for the energy range above 1 MeV. The collapse time for the most limiting assembly from each batch was conservatively determined to be more than 30,000 effective full-power hours (EFPH), which is longer than the maximum projected batch 5 residence time of 21,336 EFPH (three cycles) and the maximum projected batch 4D residence time of 28,349 EFPH (four cycles). The creep collapse analyses were performed based on the conditions set forth in references 4 and 5.

4.2.2. Cladding Stress

The Oconee 1 stress parameters are enveloped by a conservative fuel rod stress analysis. Since worst-case stress conditions are at BOL, the batch 4D fuel is also bounded by the fuel rod stress analysis. For design evaluation, the primary membrane stress must be less than two-thirds of the minimum specified unirradiated yield strength, and all stresses (primary and secondary) must be less than the minimum specified unirradiated yield strength. The margin is in excess of 30% in all cases. With respect to Oconee 1 fuel, the following conservatisms were used in the analysis:

1. Low post-densification internal pressure.
2. Low initial pellet density.
3. High system pressure.
4. High thermal gradient across the cladding.

The stresses reported in reference 6 for core 1 fuel represent conservative values with respect to the cycle 5 core.

4.2.3. Cladding Strain

The fuel design criteria specify a limit of 1.0% on cladding circumferential plastic strain. The pellet design is established for plastic cladding strain

Reactor	Current cycle	Max assembly burnup, MWd/mtU		Cumulative net elect. output, mWh
		Incore	Disch.	
TMI-1	3	31,720	25,860	18,430,506
ANO-1	2	28,290	17,650	14,575,320
Rancho Seco	2	22,300	17,170	10,297,637
Crystal River 3	1	10,430	--	4,936,412
Davis-Besse 1	1	2,490	--	1,009,741

Table 4-1. Fuel Design Parameters and Dimensions

	Thrice-burned FAs, Batch 4D	Twice-burned FAs, Batch 5	Once-burned FAs, Batch 6	Fresh FAs, Batch 7
FA type	Mark-B3	Mark-B4	Mark-B4	Mark-B4
No. of FAs	5	60	56	56
Fuel rod OD, in.	0.430	0.430	0.430	0.430
Fuel rod ID, in.	0.377	0.377	0.377	0.377
Flex. spacers, type	Spring	Spring	Spring	Spring
Rigid spacers, type	Zr-4	Zr-4	Zr-4	Zr-4
Undensif active fuel length (nom), in.	142.0	142.6	142.25	142.25
Fuel pellet initial density (nom), % TD	>94.5	93.5	94.0	94.0
Fuel pellet OD (mean specif), in.	0.3685	0.3700	0.3695	0.3695
Initial fuel enrich., wt % ^{235}U	3.20	2.75	2.79	3.02
BOC burnup (avg), MWd/mtU	31,049	17,524	6,965	0
Cladding collapse time, EFPH	>30,000	>30,000	>30,000	>30,000
Estimated residence time (max), EFPH	28,349	21,336	22,320	26,256

Table 5-1. Oconee 1, Cycle 5 Physics Parameters[a]

	Cycle 4[b]	Cycle 5[c]
Cycle length, EFPD	292	320
Cycle burnup, MWd/mtU	9,136	10,014
Average core burnup, EOC, MWd/mtU	19,034	19,055
Initial core loading, mtU	82.1	82.1
Critical boron, BOC (no Xe), ppm		
HZP, group 8 37.5% wd[d]	1415	1426
HZP, groups 7 and 8 inserted	1335	1293
HFP, group 8 inserted	1145	1242
Critical boron, EOC (eq Xe), ppm		
HZP, group 8 37.5% wd	373	338
HFP, group 8 37.5% wd	88	43
Control rod worths, HFP, BOC, % Δk/k		
Group 6	1.07	1.19
Group 7	0.93	1.44
Group 8 37.5% wd	0.50	0.42
Control rod worths, HFP, EOC, % Δk/k		
Group 7	1.16	1.52
Group 8 37.5% wd	0.47	0.48
Max ejected rod worth, HZP, % Δk/k[e]		
BOC (N-12)	0.68	0.57
EOC (N-12)	0.61	0.70
Max stuck rod worth, HZP, % Δk/k		
BOC (N-12)	1.74	2.17
EOC (N-12)	2.02	2.01
Power deficit, HZP to HFP, % Δk/k		
BOC	1.49	1.31
EOC	2.07	2.11
Doppler coeff, 10^{-5}(Δk/k-°F)		
BOC, 100% power, no Xe	-1.45	-1.45
EOC, 100% power, eq Xe	-1.55	-1.61
Moderator coeff, HFP, 10^{-4}(Δk/k-°F)		
BOC (0 Xe, crit ppm, gp 8 ins)	-1.00	-0.48
EOC (eq Xe, 17 ppm, gp 8 ins)	-2.55	-2.63
Boron worth, HFP, ppm/% Δk/k		
BOC (1150 ppm)	109	108
EOC (17 ppm)	101	97
Xenon worth, HFP, % Δk/k		
BOC (4 EFPD)	2.60	2.62
EOC (equilibrium)	2.61	2.74
Eff delayed neutron fraction, HFP		
BOC	0.00593	0.00595
EOC	0.00530	0.00520

[a] Cycle 5 data are for the conditions stated in this report. The cycle 4 core conditions are identified in reference 4.

[b] Based on 292 EFPD at 2568 MWt, cycle 3.

[c] Cycle 5 data are based on a "planned" cycle 4 length of 250 EFPD; the cycle 4 "design" lifetime is 292 EFPD.

[d] HZP denotes hot zero power (532F T_{avg}), HFP denotes hot full power (579F T_{avg}).

[e] Ejected rod worth for groups 5 through 8 inserted.

Table 5-2. Shutdown Margin Calculation for Oconee 1, Cycle 5

	BOC, % Δk/k	EOC, % Δk/k
Available rod worth		
Total rod worth, HZP	8.85	8.76
Worth reduction due to burnup of poison material	-0.36	- 0.41
Maximum stuck rod, HZP	-2.17	-2.01
Net worth	6.32	6.34
Less 10% uncertainty	-0.63	-0.63
Total available worth	5.69	5.71
Required rod worth		
Power deficit, HFP to HZP	1.31	2.11
Max allowable inserted rod worth	0.38	0.68
Flux redistribution	0.59	1.19
Total required worth	2.28	3.98
Shutdown margin (total available worth minus total required worth)	3.41	1.73

Note: Required shutdown margin is 1.00% Δk/k.

Figure 5-1. BOC (4 EFPD), Cycle 5 Two-Dimensional Relative Power Distribution — Full Power, Equilibrium Xenon, Normal Rod Positions (Group 8 Inserted)

	8	9	10	11	12	13	14	15
H	0.82	0.93	0.95	0.89	1.37	1.02	1.10	0.89
K		1.35	1.06	1.20	0.98	1.09 (7)	0.94	0.85
L			1.03 (7)	1.23	1.02 (8)	0.94	1.17	0.69
M				1.08	1.22	0.89	0.93	
N					1.21	0.94	0.62	
O						0.71		
P								
R								

Legend: x — Inserted Rod Group No.; x.xx — Relative Power Density

Table 7-1. Comparison of Key Parameters for Accident Analysis

Parameter	FSAR and densification report value	Predicted cycle 5 value
Doppler coeff, $\Delta k/k/°F$		
BOC	-1.17×10^{-5}	-1.45×10^{-5}
EOC	-1.33×10^{-5}	-1.61×10^{-5}
Moderator coeff, $\Delta k/k/°F$		
BOC	$+0.5 \times 10^{-4}$	-0.48×10^{-4}
EOC	-3.0×10^{-4}	-2.63×10^{-4}
All-rod group worth, HZP % $\Delta k/k$	10	8.85
Initial boron conc'n, HFP, ppm	1400	1242
Boron reactivity worth at 70F, ppm/1% $\Delta k/k$	75	76
Max ejected rod worth, HFP, % $\Delta k/k$	0.65	0.25
Dropped rod worth (HFP), % $\Delta k/k$	0.46	0.20

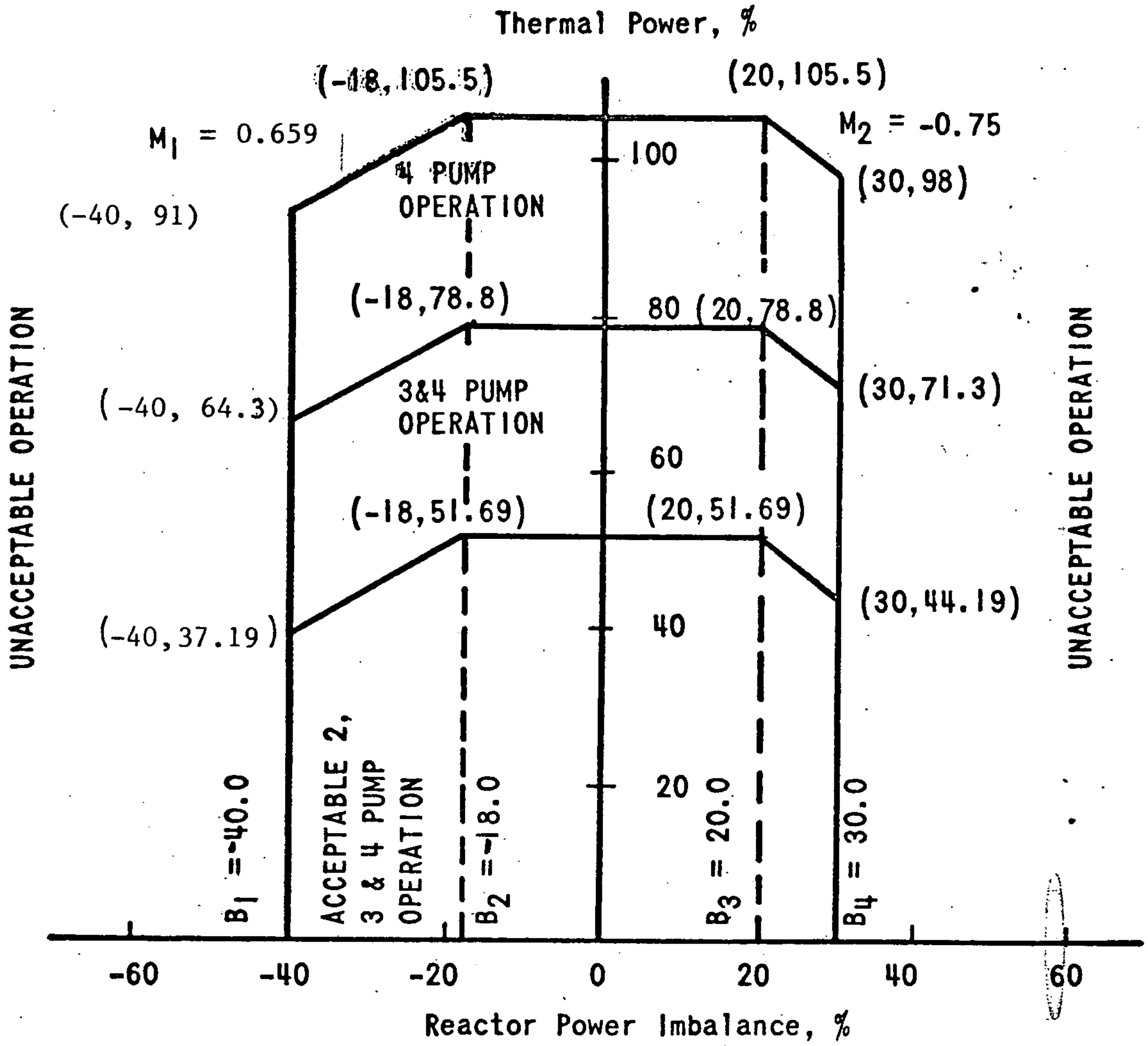
Table 7-2. LOCA Limits, Oconee 1, Cycle 5

Elevation, ft	LHR limits, kW/ft
2	15.5
4	16.6
6	18.0
8	17.0
10	16.0

ATTACHMENT 2

Revised

TECHNICAL SPECIFICATION PAGE
FIGURE 2.3-2A



PROTECTIVE SYSTEM
MAXIMUM ALLOWABLE SETPOINTS
UNIT 1

OCONEE NUCLEAR STATION

Figure 2.3-2A