ATTACHMENT (1)

REPLACEMENT PAGES FOR THE
CALVERT CLIFFS UNIT 1, CYCLE 11 RELOAD ANALYSIS

1.0 INTRODUCTION AND SUMMARY

This report provides an evaluation of design and performance for the operation of Calvert Cliffs Unit 1 at full rated power of 2700 MWt during its eleventh fuel cycle. All planned operating conditions remain the same as those for Cycle 10. The core will consist of 132 presently operating Batch L and M assemblies, 1 reinserted Batch K* assembly which had been discharged at the end of Unit 1 Cycle 9, and 84 fresh Batch N assemblies.

The fresh Batch N fuel will employ the GUARDIAN™ Design. This design features an enhanced debris trapping capability and improved fuel pin resistance to debris. It is being implemented to minimize the incidence of debris induced failure and, thereby, to lower the activity level of the reactor coolant. A quite dissimilar feature, i.e., small flow holes, was introduced in Unit 2 Cycle 9 for the same purpose (see Reference 1).

Four of the irradiated Batch M assemblies are the Advanced Nuclear Fuel (ANF) demonstration assemblies carried over from Cycle 10 (see Reference 2 for discussion). These four demonstration assemblies contain Gadolinium bearing fuel pins and were included in the Cycle 10 core as part of the effort to qualify ANF fuel for 24-month cycle operation. The analyses presented in the main body of this report support the neutronic modelling of the core, the safety evaluation of the core, and the acceptable performance of the C-E fuel to be contained in Cycle 11. The discussion in the Appendix of Reference 2 supports the performance of the ANF fuel.

The fuel management for Cycle 11 will be similar to that employed for the reference cycle, Unit 2 Cycle 9 (see below), and for Cycle 10, which was the first Unit 1 cycle to use low-leakage fuel management. However, to further reduce the fluence to the critical vessel weld, beyond what was initially achieved in the change to low-leakage fuel management in Cycle 10, two modifications are being introduced in Cycle 11. First, fresh fuel on the periphery near the critical weld is being replaced with twice burned fuel. This change will be referred to as low-fluence fuel management. Second, Guide Tube Flux Suppressors (GTFSs), which are essentially CEA fingers, are being placed in selected guide tubes near the periphery.

Plant operating requirements have created a need for flexibility in the Cycle 10 termination point. This need has been met by using an End-of-Cycle 10 window ranging from 17,500 MWD/T to 21,500 MWD/T in the Cycle 11 analyses. In performing analyses of design basis events, determining limiting safety settings and establishing limiting conditions for operation, limiting values of key parameters were chosen to assure that expected Cycle 11 conditions would be enveloped, provided the Cycle 10 termination point falls within this end-of-cycle burnup range. The analysis presented herein supports a Cycle 11 length which varies from 18,000 to 20,600 MWD/T, depending upon the Cycle 10 shutdown burnup, including a coastdown in inlet temperature to 537°F and a coastdown in power to approximately 75%.

The evaluations of the reload core characteristics have been conducted with respect to the Calvert Cliffs Unit 2 Cycle 9 safety analysis described in Reference 1. Unit 2 Cycle 9 will hereafter be referred to as the "reference cycle" in this report, unless otherwise noted. This is the appropriate reference cycle because its design/safety basis is the one most recently reported to the NRC and because the basic system characteristics of the two reload cores are very similar, Unit 2 Cycle 9 being a 24-month cycle using low-leakage fuel management.

Specific core differences have been accounted for in the Unit 1 Cycle 11 analyses. In all cases, it has been concluded that either the reference cycle analyses envelope the new conditions or the revised analyses discussed herein continue to show acceptable results. Where dictated by variations from the previous cycle (Unit 1 Cycle 10, Reference 2), proposed modifications to the existing plant Technical Specifications are provided and are justified by the analyses discussed herein. A large proportion of these proposed modifications are identical or nearly identical to those approved (Reference 3) for the reference cycle.

The Unit 1 Cycle 11 analyses used the same methodology as the reference cycle with two significant exceptions. First, improved physics methods have been implemented, including the accounting for anisotropic scattering effects and the application of the Nodal Expansion Method (NEM) for solving the coarse-mesh flux. Second, the improved fuel performance methodology that justifies internal pin pressures above system pressure (No-Clad-Lift-Off) has been applied.

Similar to the modifications made for Unit 2 Cycle 9, changes in the LCO monitoring function are being proposed to accommodate the use of the CECOR 3.3 computer code. Specifically, the CECOR 3.3 code would replace the INCA code and would be combined in an on-line network, as described in Appendix B of Reference 1, to monitor compliance with the LHR and DNB LCOs. The Unit 2 Cycle 9 Technical Specifications provided, as a contingency, for the continued use of the INCA incore monitoring system. The requested Technical Specification changes for Unit 1 Cycle 11 have not been drafted to permit the use of INCA because the performance of the CECOR 3.3 monitoring system for Unit 2 Cycle 9 has been satisfactory.

The performance of Combustion Engineering (C-E) 14x14 fuel at extended burnup was discussed in Reference 4 and approved in Reference 5 for 1-pin burnups up to 52,000 MWD/T. The further performance of C-E 14x14 fuel at Calvert Cliffs for burnups beyond those considered in Reference 4 was discussed in the Supplement (Reference 6) to the Unit 2 Cycle 9 License Submittal (Reference 1). That Supplement supports operation to a 1-pin burnup of 60,000 MWD/T, a value considerably in excess of the maximum 1-pin burnup projected for Cycle 11 (approximately 57,150 MWD/T).

2.0 OPERATING HISTORY OF THE PREVIOUS CYCLE

Calvert Cliffs Unit 1 is presently operating in its tenth fuel cycle utilizing Batch K, L, and M fuel assemblies. Calvert Cliffs Unit 1 Cycle 10 began operation on July 1, 1988 and reached approximate full power conditions on July 9, 1988. Cycle 10 startup testing was reported to the NRC in Reference 1. The reactor has operated up to the present time with core reactivity, power distributions and peaking factors closely following the calculated predictions.

It is presently estimated that Cycle 10 will terminate on or about March 20, 1992. The Cycle 10 termination point can vary between 17,500 MWD/T and 21,500 MWD/T to accommodate the plant schedule and still be within the assumptions of the Cycle 11 analyses. As of March 2, 1992, the Cycle 10 burnup had reached 20,141 MWD/T.

3.0 GENERAL DESCRIPTION

The Cycle 11 core will consist of the numbers and types of assemblies and fuel batches as described in Table 3-1. The fuel management will entail the removal of 85 irradiated assemblies: 4 Batch L, 12 Batch L*, 48 Batch K, and 21 Batch K* assemblies. These assemblies will be replaced by 84 fresh assemblies: 12 unshimmed Batch N assemblies, 20 4-shimmed (B_4C) Batch NX assemblies, and 52 8-shimmed (B_4C) Batch N/ assemblies at 4.20 wt% U-235 enrichment; and by one K* assembly which was discharged at the end of Unit 1 Cycle 9.

Figure 3-1 shows the fuel management pattern to be employed in Cycle 11. This fuel management will be similar to those employed for the reference cycle (Unit 2 Cycle 9) and Unit 1 Cycle 10. The only significant change is the use of twice burned fuel in Quarter Core (QC) Locations 2 and 54 (see Figure 3-1) and the placement of Guide Tube Flux Suppressors (GTFSs) in QC Locations 1, 2, 45, and 54. The purpose of these changes is to further reduce the fluence to the critical vessel weld beyond what was initially achieved in the change to low-leakage fuel management in Unit 1 Cycle 10. The critical weld is a vertical weld located along the center line of the core, i.e., adjacent to the upper right corner of QC Location 2. The use of all twice burned fuel in QC Locations 1, 2, 45, and 54 results in what is being termed low-fluence fuel management.

Figure 3-2 shows the locations of the fuel and B_4C burnable absorber rods within the NX, N/, and M* shimmed assemblies, and the placement of the fuel only and Gadolinium burnable absorber fuel bearing rods in the ANF demonstration assemblies (MX). The Unit 1 Cycle 11 fuel management pattern will accommodate Cycle 10 termination burnups from 17,500 MWD/T to 21,500 MWD/T.

The Cycle 11 core loading pattern is 90° rotationally symmetric. That is, if one quadrant of the core were rotated 90° into its neighboring quadrant, each assembly would be aligned with a similar assembly. This similarity includes batch type, number of fuel rods, initial enrichment, burnup, and GTFS placement.

Figure 3-3 shows the beginning of Cycle 11 assembly burnup distribution for a Cycle 10 termination burnup of 17,500 MWD/T. The initial enrichment of the fuel assemblies is also shown in Figure 3-3. Figure 3-4 shows the end of Cycle 11 assembly burnup distribution. The end of Cycle 11 core average exposure is approximately 34,500 MWD/T and the average discharge exposure is approximately 43,650 MWD/T. The end of cycle burnups are based on a Cycle 10 length of 21,500 MWD/T and a Cycle 11 length of 18,000 MWD/T.

TABLE 3-1

CALVERT CLIFFS UNIT 1 CYCLE 11

CORE LOADING

Assembly Designation	No. of Assem.	Initial Assembly Average Enrichment (wt% U-235)	Batch Average Burnup (MWD/T) BOC11(1)	EOC11(2)	Non-Fuel Bearing B_4C Rods Per Assem.	Initial B_4C Loading (gms B^{10}/in)	Total Non-Fuel Bearing B_4C Rods	Total No. of Fuel Rods
N	12	4.20	0	17,100	0	0	0	2112
NX	20	4.20	0	20,100	4	.036	80	3440
N/	52	4.20	0	24,200	8	.036	416	8736
M(3)	16	4.06	14,100	34,600	0	0	0	2816
MX(3,5)	4	3.89	20,250	42,600	0	0	0	704
M*(3)	76	4.07	21,250	44,800	12	.036	912	12464
L(3)	36	4.04	28,850	40,900	0	0	0	6336
K*(4)	1	3.40	27,650	42,300	0	0	0	176
Total	217		13,750	34,500			1408	36,784 35,763(6)

(1) Cycle 10 burnup of 17,500 MWD/T.
(2) Cycle 10 burnup of 21,500 MWD/T and Cycle 11 burnup of 18,000 MWD/T.
(3) Carried over from Cycle 10 to Cycle 11 of Unit 1.
(4) Reinserted; discharged at the end of Cycle 9 of Unit 1.
(5) ANF Gadolinia bearing demonstration assemblies.
(6) Provision has been made for the displacement of up to 21 fuel rods by stainless steel replacement rods during reconstitution efforts.

							1 L 41,200	2 L 40,800
				3 L 35,700	4 N 16,000	5 M 33,100	6 NX 20,400	7 NX 21,300
			8 L 41,000	9 NX 19,300	10 M 36,100	11 N/ 24,200	12 M* 46,000	13 M* 41,000
		14 L 41,000	15 N 19,300	16 M* 45,600	17 N/ 24,400	18 M* 46,500	19 N/ 24,200	20 M* 46,900
	21 L 35,700	22 NX 19,300	23 M* 45,700	24 N/ 24,300	25 M* 46,500	26 M* 42,100	27 M* 45,800	28 N/ 24,700
	29 N 16,000	30 M 36,100	31 N/ 24,400	32 M* 46,500	33 N/ 24,100	34 M* 40,900	35 N/ 24,100	36 L 50,600
45 L 41,100	37 M 33,100	38 N/ 24,200	39 M* 46,500	40 M* 42,100	41 M* 40,900	42 M* 44,500	43 M* 46,000	44 N/ 24,300
54 L 40,800	46 NX 20,300	47 M* 45,800	48 N/ 24,200	49 M* 45,800	50 N/ 24,100	51 M* 45,900	52 N/ 23,600	53 MX 42,600
	55 NX 21,300	56 M* 41,000	57 M* 46,900	58 N/ 24,700	59 L 50,600	60 N/ 24,300	61 MX 42,600	62 K* 42,300

Legend: X - BATCH; ZZ,ZZZ - BURNUP (MWD/T)

EOC 10 = 21,500 MWD/T
EOC 11 = 18,000 MWD/T

BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY AVERAGE BURNUP AT EOC	FIGURE 3-4

5.0 NUCLEAR DESIGN

5.1 PHYSICS CHARACTERISTICS

5.1.1 Fuel Management

The Cycle 11 fuel management employs a low-fluence pattern along with GTFSs, as described in Section 3, Figures 3-1 and 3-5. This arrangement of fuel and CEA fingers, i.e., GTFSs, results in very low-fluence to the critical pressure vessel weld which is located along the center line of the core, i.e., adjacent to the upper right corner of Quarter Core Box No. 2. Due to the shift in power and fluence away from that part of the periphery near the critical weld, the Cycle 11 fuel and GTFS arrangement yields slightly high power levels in the interior of the core.

The fresh Batch N fuel is comprised of three sets of assemblies, all using non-poison fuel pins of just one enrichment (4.20 wt% U-235) with each set containing a unique number of B_4C shims per assembly. The unique number of shims per assembly was chosen to minimize radial power peaking and to control [illegible] MTCs. Specifically, Batch N consists of 12 unshimmed assemblies, 2[illegible] assemblies with 4 B_4C shims per assembly, and 52 assemblies with 8 B_4C shims per assembly. With this loading, the Cycle 11 burnup capacity for full power operation is expected to be between 17,000 MWD/T and 19,600 MWD/T, depending on the final Cycle 10 termination point.

The Cycle 11 core characteristics have been examined for Cycle 10 terminations between 17,500 and 21,500 MWD/T and limiting values established for the safety analyses. The loading pattern (see Section 3) is applicable to any Cycle 10 termination point between the stated extremes.

Physics characteristics for Cycle 11 are listed in Table 5-1 along with the corresponding values from the reference cycle (Reference 1). Please note that the values of parameters actually employed in safety analyses are different from those displayed in Table 5-1 and are typically chosen to conservatively bound predicted values with accommodation for appropriate uncertainties and allowances.

Table 5-1a presents a summary of CEA shutdown worths and reactivity allowances for the end of Cycle 11 zero power steam line break accident and a comparison to reference cycle data. The EOC zero power steam line break accident was selected since it is the most limiting zero power transient with respect to reactivity requirements and, thus, provides the basis for verifying the Technical Specification required shutdown margin.

Table 5-2 shows the reactivity worths of the three CEA groups which are allowed in the core during critical conditions. These reactivity worths were calculated at full power conditions for Cycle 11 and the reference cycle. The CEA configurations are identical to

those of the reference cycle. The power dependent insertion limit (PDIL) curve is also the same as that of the reference cycle.

5.1.2 Power Distributions

Figures 5-1 through 5-3 illustrate the all rods out (ARO) integrated radial power distributions at BOC11, MOC11 and EOC11, respectively, that are characteristic of the high burnup end of the Cycle 10 shutdown window. The high burnup end of the Cycle 10 shutdown window tends to increase the integrated 1-pin radial power peaking. The integrated radial power distributions with CEA Group 5 fully inserted at beginning and end of Cycle 11 are shown in Figures 5-4 and 5-5, respectively, for the high burnup end of the Cycle 10 shutdown window.

The reactivity level and location of the ANF assemblies together yield maximum 1-pin peaks in the ANF assemblies which are predicted to be at least 30% below the maximum 1-pin peak in the core for standard operating conditions (see Figures 5-1 through 5-5). It should be noted that the Gadolinium in these demonstration assemblies has burned out to residual levels by BOC11.

The radial power distributions described in this section are calculated data without uncertainties or other allowances. However, the single rod power peaking values do include the increased peaking that is characteristic of fuel rods adjoining the water holes in the fuel assembly lattice. For both DNB and kw/ft safety and setpoint analyses in either rodded or unrodded configurations, the power peaking values actually used are higher than those expected to occur at any time during Cycle 11. These conservative values, which are used in Section 7 of this document, establish the allowable limits for power peaking to be observed during operation.

The range of allowable axial peaking is defined by the Limiting Conditions for Operation (LCOs) that are dependent on Axial Shape Index (ASI). Within these ASI limits, the necessary DNBR and kw/ft margins are maintained for a wide range of possible axial shapes. The maximum three-dimensional or total peaking factor anticipated in Cycle 11 during normal base load, all rods out operation at full power is 1.93, not including uncertainty allowances.

5.1.3 Safety Related Data (Ejected CEA and Drop CEA Data)

The Cycle 11 safety related data for this section are identical to the safety related data used in the reference cycle.

5.1.4 GUARDIAN™ Design

The fresh Batch N fuel in Cycle 11 will use the GUARDIAN™ Design. This design includes a longer fuel pin end cap which results in the active region of the fresh fuel being raised 1.371 inches relative to the irradiated fuel (see Section 4.1.1). This offset between the fresh and irradiated fuel has been considered in the Cycle 11

X - BATCH ZZZ - RPD								
							1 L 0.25	2 L 0.33
				3 L 0.41	4 N 0.95	5 M 0.87	6 NX 1.18	7 NX 1.24
			8 L 0.42	9 NX 1.13	10 M 1.18	11 N/ 1.38	12 M* 1.06	13 M* 1.10
		14 L 0.42	15 N 1.14	16 M* 1.05	17 N/ 1.38	18 M* 1.06	19 N/ 1.33	20 M* 1.03
	21 L 0.41	22 NX 1.13	23 M* 1.04	24 N/ 1.36	25 M* 1.04	26 M* 1.03	27 M* 1.03	28 N/ 1.32
	29 N 0.95	30 M 1.18	31 N/ 1.38	32 M* 1.04	33 N/ 1.30	34 M* 1.05	35 N/ 1.26	36 L 0.89
45 L 0.25	37 M 0.87	38 N/ + 1.38	39 M* 1.06	40 M* 1.03	41 M* 1.05	42 M* 0.95	43 M* 0.96	44 N/ 1.24
54 L 0.33	46 NX 1.18	47 M* 1.06	48 N/ 1.33	49 M* 1.03	50 N/ 1.26	51 M* 0.97	52 N/ 1.19	53 MX ++ 0.87
	55 NX 1.24	56 M* 1.10	57 M* 1.03	58 N/ 1.32	59 L 0.89	60 N/ 1.24	61 MX ++ 0.87	62 K* 0.72

NOTE: + = MAXIMUM 1-PIN PEAK = 1.62
++ = MAXIMUM 1-PIN PEAK IN ANF ASSEMBLY = 1.00

BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY RELATIVE POWER DENSITY AT BOC, EQUILIBRIUM XENON	FIGURE 5-1

X	- BATCH
ZZZ	- RPD

							1 L 0.27	2 L 0.35
				3 L 0.41	4 N 0.88	5 M 0.83	6 NX 1.12	7 NX 1.16
			8 L 0.42	9 NX 1.06	10 M 1.08	11 N/ 1.33	12 M* 1.02	13 M* 1.07
		14 L 0.42	15 N 1.06	16 M* 0.99	17 N/ 1.35	18 M* 1.04	19 N/ 1.35	20 M* 1.03
	21 L 0.41	22 NX 1.06	23 M* 0.99	24 N/ 1.35	25 M* 1.03	26 M* 1.04	27 M* 1.06	28 N/ 1.38
	29 N 0.88	30 M 1.08	31 N/ 1.35	32 M* 1.03	33 N/ 1.35	34 M* 1.10	35 N/ 1.36	36 L 0.96
45 L 0.27	37 M 0.83	38 N/ 1.33	39 M* 1.04	40 M* 1.05	41 M* 1.10	42 M* 1.02	43 M* 1.04	44 N/ 1.37
54 L 0.35	46 NX 1.11	47 M* 1.02	48 N/ 1.34	49 M* 1.06	50 N/ 1.36	51 M* 1.05	52 N/ 1.33	53 MX ++ 0.96
	55 NX 1.16	56 M* 1.07	57 M* 1.03	58 N/ + 1.38	59 L 0.96	60 N/ 1.37	61 MX ++ 0.96	62 K* 0.82

NOTE: + = MAXIMUM 1-PIN PEAK = 1.54
++ = MAXIMUM 1-PIN PEAK IN ANF ASSEMBLY = 1.08

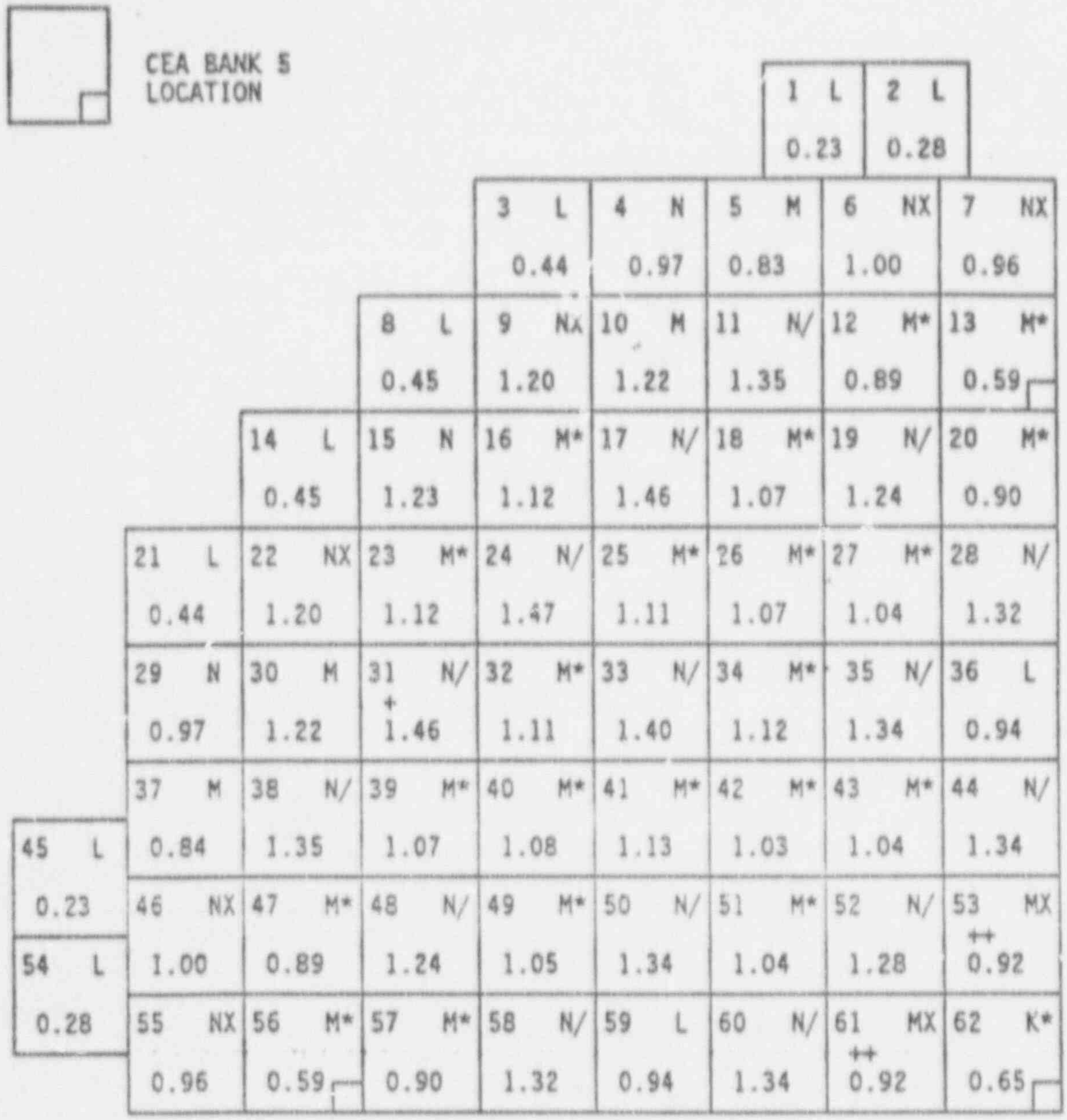
BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY RELATIVE POWER DENSITY AT 9.0 GWD/T, EQUILIBRIUM XENON	FIGURE 5-2

X - BATCH
ZZZ - RPD

							1 L 0.32	2 L 0.40
				3 L 0.45	4 N 0.89	5 M 0.85	6 NX 1.15	7 NX 1.19
			8 L 0.45	9 NX 1.08	10 M 1.06	11 N/ 1.34	12 M* 1.02	13 M* 1.05
		14 L 0.45	15 N 1.06	16 M* 0.99	17 N/ 1.35	18 M* 1.02	19 N/ 1.34	20 M* 1.01
	21 L 0.45	22 NX 1.08	23 M* 0.98	24 N/ 1.35	25 M* 1.01	26 M* 1.00	27 M* 1.03	28 N/ 1.37
	29 N 0.89	30 M 1.07	31 N/ 1.35	32 M* 1.01	33 N/ 1.32	34 M* 1.05	35 N/ 1.34	36 L 0.96
45 L 0.32	37 M 0.85	38 N/ 1.34	39 M* 1.02	40 M* 1.00	41 M* 1.05	42 M* 0.98	43 M* 1.02	44 N/ 1.37
54 L 0.40	46 NX 1.15	47 M* 1.02	48 N/ 1.34	49 M* 1.03	50 N/ 1.34	51 M* 1.03	52 N/ 1.34	53 MX ++ 0.96
	55 NX 1.19	56 M* 1.05	57 M* 1.01	58 N/ 1.37	59 L 0.96	60 N/ + 1.37	61 MX ++ 0.96	62 K* 0.84

NOTE: + = MAXIMUM 1-PIN PEAK = 1.55
++ = MAXIMUM 1-PIN PEAK IN ANF ASSEMBLY = 1.06

BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY RELATIVE POWER DENSITY AT EOC, EQUILIBRIUM XENON	FIGURE 5-3



NOTE: + = MAXIMUM 1-PIN PEAK = 1.7[illegible]
++ = MAXIMUM 1-PIN PEAK IN ANF ASSEMBLY = 1.06

BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY RELATIVE POWER DENSITY WITH BANK 5 INSERTED HFP, BOC	FIGURE 5-4

CEA BANK 5
LOCATION

						1 L 0.28	2 L 0.34	
				3 L 0.47	4 N 0.91	5 M 0.82	6 NX 0.98	7 NX 0.91
			8 L 0.49	9 NX 1.15	10 M 1.10	11 N/ 1.31	12 M* 0.85	13 M* 0.53
		14 L 0.49	15 N 1.15	16 M* 1.06	17 N/ 1.42	18 M* 1.03	19 N/ 1.26	20 M* 0.88
	21 L 0.47	22 NX 1.15	23 M* 1.06	24 N/ 1.45	25 M* 1.08	26 M* 1.05	27 M* 1.05	28 N/ 1.38
	29 N 0.91	30 M 1.11	31 N/ 1.42	32 M* 1.08	33 N/ 1.42	34 M* 1.13	35 N/ 1.42	36 L 1.01
	37 M 0.82	38 N/ 1.31	39 M* 1.03	40 M* 1.05	41 M* 1.13	42 M* 1.06	43 M* 1.10	44 N/ 1.47
45 L 0.28	46 NX 0.98	47 M* 0.86	48 N/ 1.26	49 M* 1.05	50 N/ 1.42	51 M* 1.10	52 N/ 1.42	53 MX ++ 1.00
54 L 0.34	55 NX 0.91	56 M* 0.53	57 M* 0.88	58 N/ 1.38	59 L 1.01	60 N/ + 1.47	61 MX ++ 1.00	62 K* 0.72

NOTE: + = MAXIMUM 1-PIN PEAK = 1.66
++ = MAXIMUM 1-PIN PEAK IN ANF ASSEMBLY = 1.10

BALTIMORE GAS & ELECTRIC CO. CALVERT CLIFFS NUCLEAR POWER PLANT	CALVERT CLIFFS UNIT 1 CYCLE11 ASSEMBLY RELATIVE POWER DENSITY WITH BANK 5 INSERTED HFP, EOC	FIGURE 5-5

CLARIFYING INFORMATION ON THE UNIT 1, CYCLE 11 RELOAD ANALYSIS

Based upon discussions with the NRC Staff, the following clarifications are provided.

1) Has the CECOR 3.3 computer code, as referenced in the reload analysis, been approved by the NRC?

The CECOR 3.3 computer code was approved for use in Section 3.5 of the NRC's Safety Evaluation Report (SER) for the Unit 2, Cycle 9 reload analysis (Letter from Mr. S. A. McNeil (NRC) to Mr. G. C. Creel (BG&E), dated January 10, 1990, Issuance of Amendment). As stated in the SER, CECOR 3.3 is the SEL version of the mainframe computer code CECOR 2.0 which is described in CENPD-153-P, Rev. 1-P-A, "INCA/CECOR Power Peaking Uncertainty", dated May, 1980.

2) Section 5.3 of the reload analysis states that the new bias (0%) and new uncertainty (7%) versus the old bias (4%) and old uncertainty (9%) resulted in a total allowance of 7% versus 13%. Provide a reference to an approved method that supports this position.

The improved methods discussed in Section 5.3, with the exception of the application of assembly discontinuity factors which is a widely accepted procedure in the industry, have already been approved by the NRC (discussed in the first paragraph of Section 5.3). The use of anisotropic scattering within pin cells and anisotropic neutron currents at pin cell interfaces in the DIT code was described in the Gadolinium Topical Report (Reference 3 of Section 5.3) and approved by the NRC in the Safety Evaluation Report (SER) for that topical. The application of the Nodal Expansion Method (NEM) in the ROCS code was described in the ROCS/DIT topical (Reference 2 of Section 5.2) and approved by the NRC in the SER for that topical.

Although use of the NEM was approved when the ROCS/DIT Topical Report was approved, NEM was not a standard feature of CE neutronics methodology at that time. Consequently, the biases and uncertainties listed in the ROCS/DIT Topical Report were not necessarily appropriate for use with NEM. In fact, the SER for the ROCS/DIT Topical Report required that the biases and uncertainties established with the original methodology be reverified or adjusted when the NEM methodology was implemented. Similarly, the Gadolinium Topical Report had not yet been assembled at the time the ROCS/DIT Topical Report was approved. So, in preparation for the transition to the improved methodology, CE performed an extensive reevaluation of the entire set of biases and uncertainties using the same statistical methodology which had been approved in the ROCS/DIT Topical Report.

The database used in the determination of biases and uncertainties contained representative cycles for each class of plants using ABB/CE reload methodology. These cycles were chosen to reflect modern fuel management strategies and are more pertinent to current and future cycles than the early cycles documented in the ROCS/DIT Topical Report. Extensive use of Calvert Cliffs' data was made in the determination of the rod worth, reactivity, and moderator temperature coefficient biases and uncertainties. Since current and anticipated reload cycles are similar in that they use similar enrichments and loading patterns, similar burnable absorber patterns and loadings, similar checkerboard of fresh and burned assemblies, similar power densities, and similar cycle length and discharge exposures, it is concluded that the biases and uncertainties are applicable to all cycles currently being designed, licensed, or anticipated for Calvert Cliffs, including Calvert Cliffs Unit 1, Cycle 11.

The biases and uncertainties developed for the improved methodology were used in the calculations supporting the Calvert Cliffs Unit 1, Cycle 11 reload license application (see third paragraph of Section 5.3). With one exception the biases and uncertainties applied were the same as those determined in the extensive reevaluation discussed above. However, the biases and uncertainties from that study relating to shutdown margin and scram worth were modified in the conservative direction. Specifically, the bias value on scram worth (N-1) of +4.32% (under-prediction) was set to zero and the uncertainty on scram worth (N-1) of +6.28% was rounded up to 7.0%.

3) Are reload analysis Section 8 references 5, 6, 7 and 18 approved?

References 5 and 6 were approved in an NRC letter, D. M. Crutchfield (NRC) to A. E. Scherer (C-E), "Safety Evaluation of Combustion Engineering ECCS Large Break Evaluation Model and Acceptance for Referencing of Related Licensing Topical Reports", dated July 31, 1986.

Reference 7 was approved in an NRC letter, R. L. Baer (NRC) to A. E. Scherer (C-E), "Evaluation of Topical Report CENPD-135, Supplement #5", dated September 6, 1978.

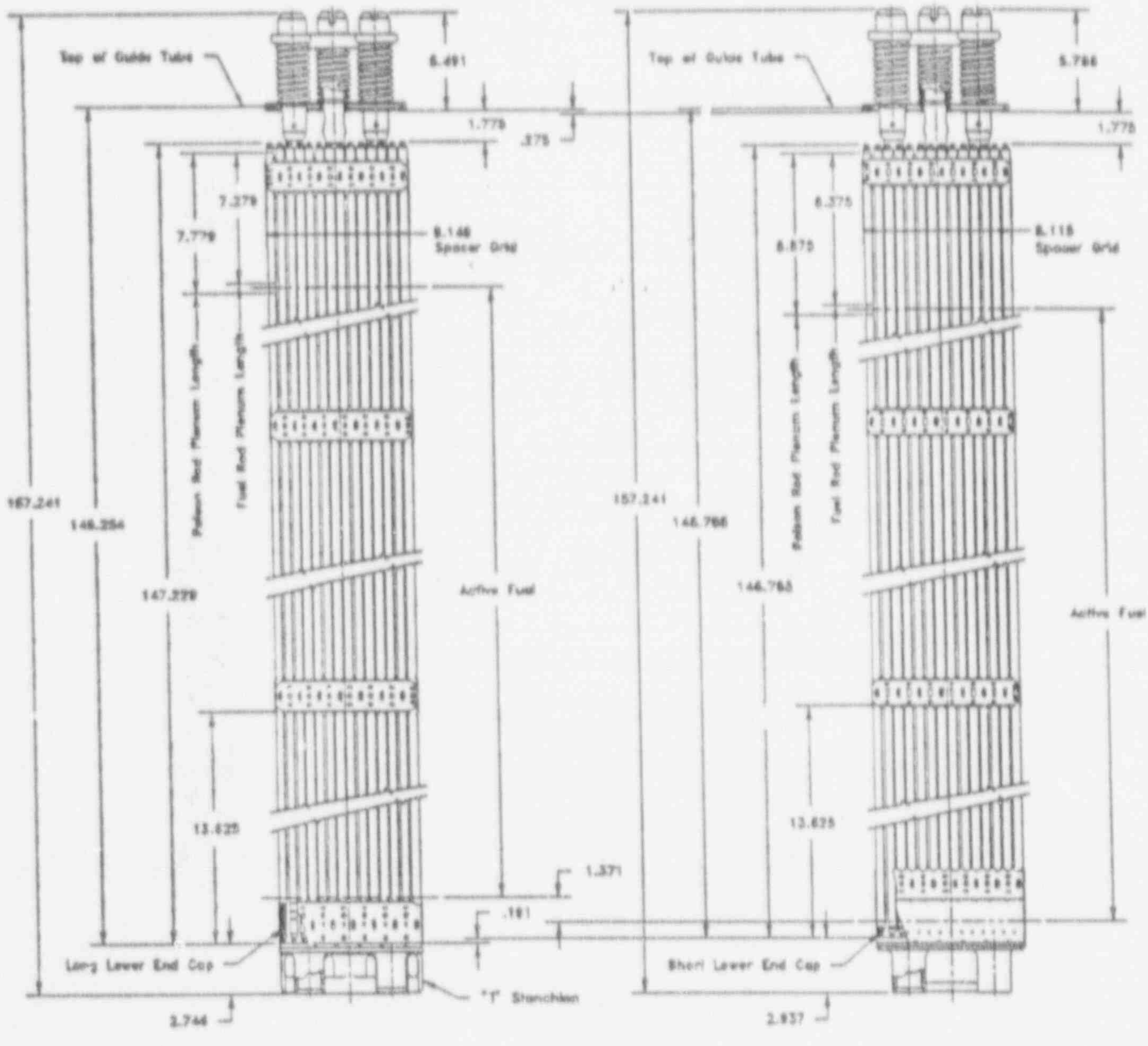
Reference 18 was approved in an NRC letter, Carl Aniel (NRC) to A. E. Scherer (C-E), "Evaluation of Topical Report CENPD-138, Supplement 2-P", dated April 10, 1978.

4) Provide a sketch showing the details of Batch N fuel versus Batch L fuel.

A sketch is provided in Attachment (3).

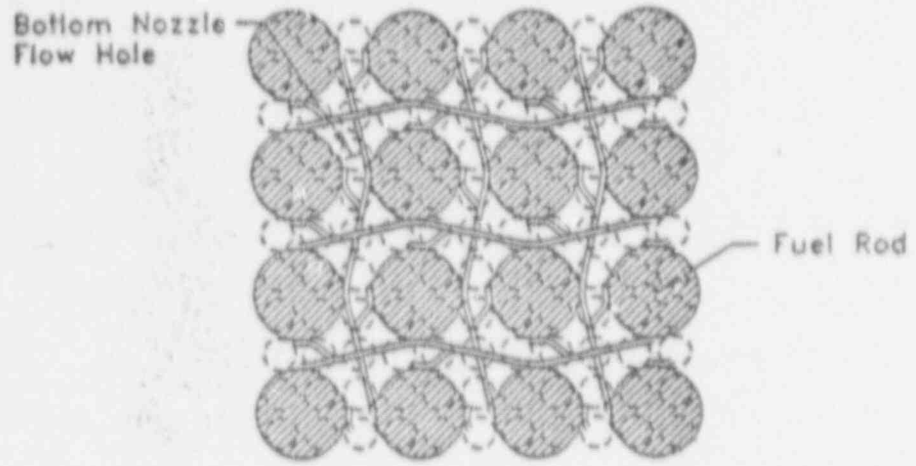
ATTACHMENT (3)

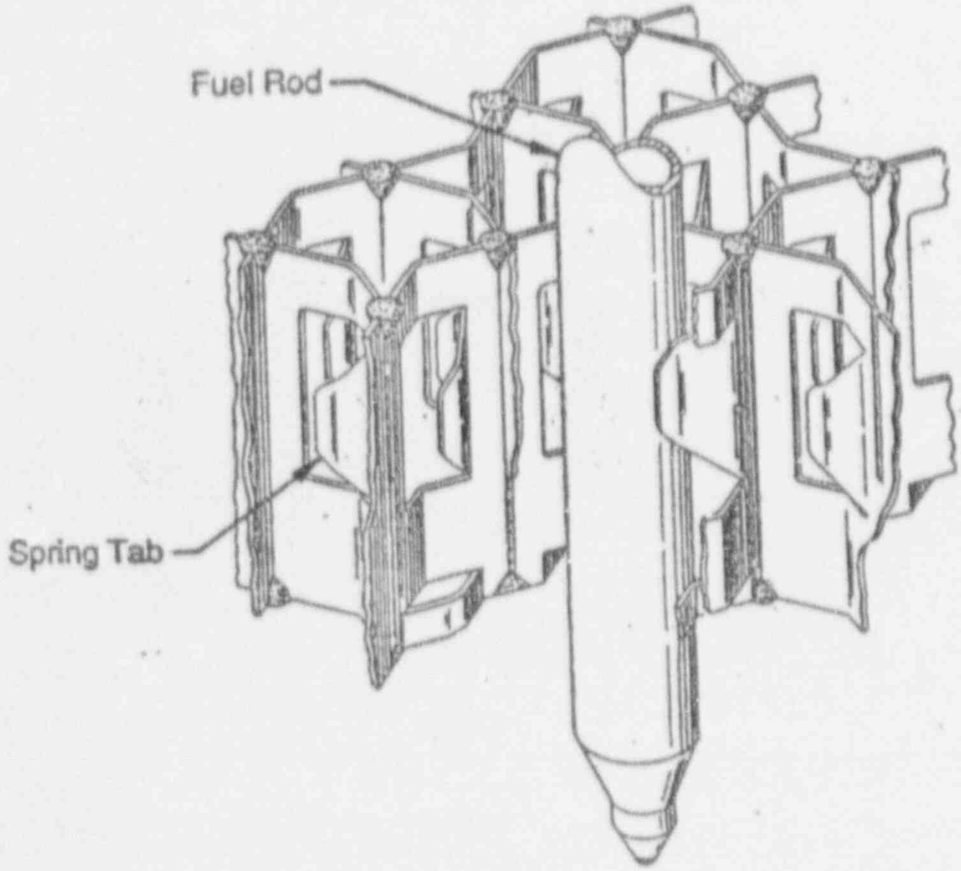
SKETCHES OF BATCH N VERSUS BATCH L FUEL



Unit 1 Cycle 11
Batch N
Guardian Design

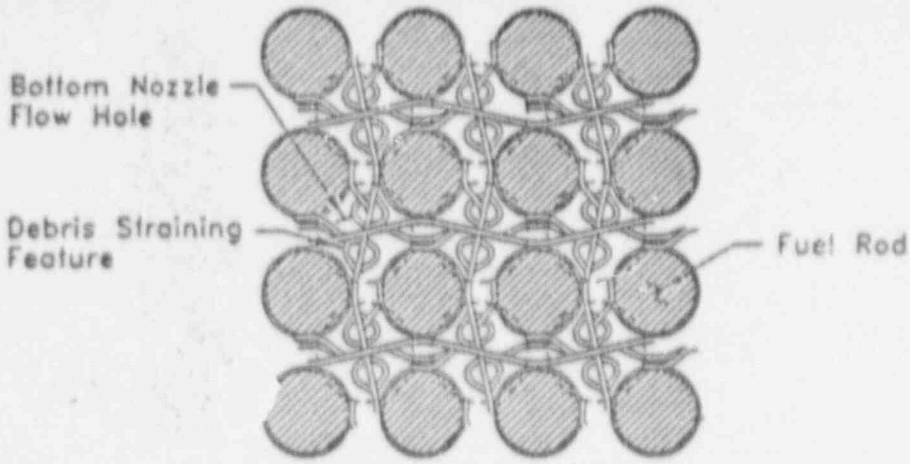
Unit 2 Cycle 9
Batch L

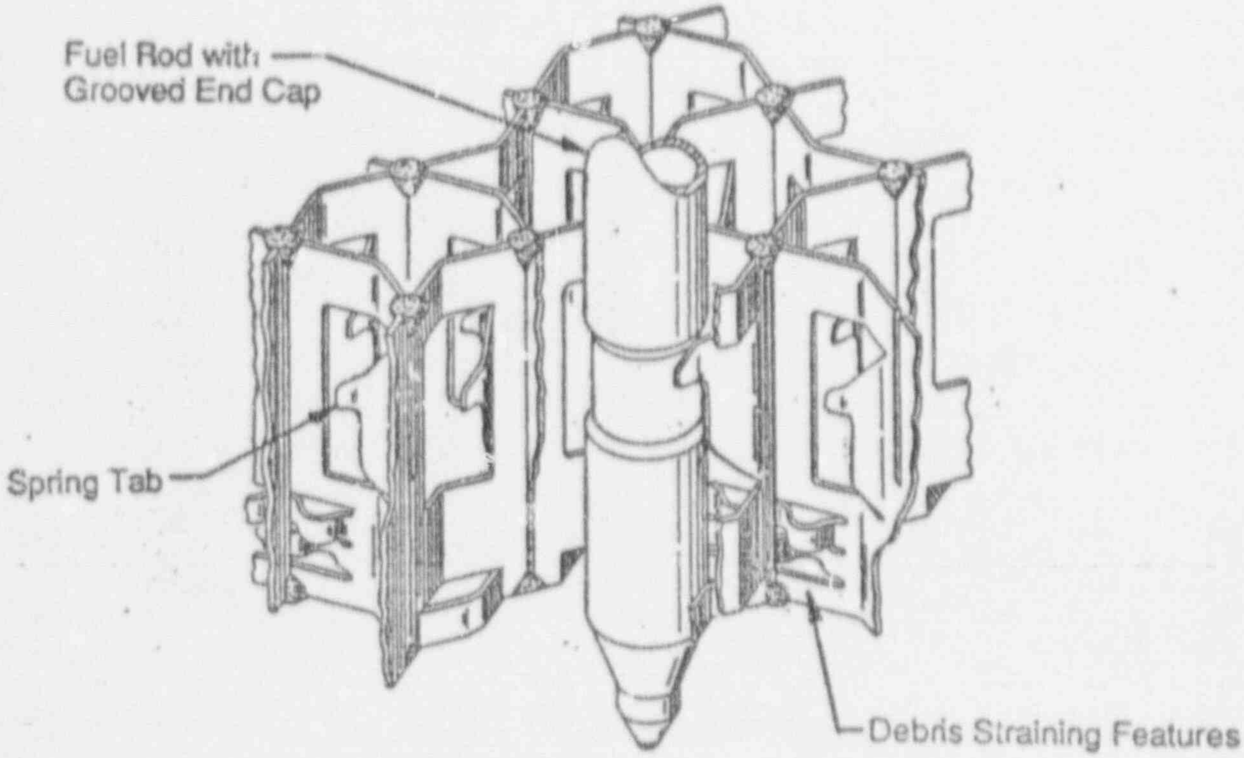




Unit 2 Cycle 9

Batch L





<u>Unit 1 Cycle 11</u>

<u>Batch N</u>

Guardian Design