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IRRADIATION DATA FOR THE MFF-3 AND MFF-5 TESTS IN THE FFTF

D.W. Wootan
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March 2011

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Pacific Northwest National Laboratory
Richland, Washington 99352

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Executive Summary

The Fast Flux Test Facility is the most recent Liquid Metal Reactor to be designed, constructed, and operated by the U.S. Department of Energy (DOE). A variety of fuel tests were irradiated in FFTF to provide performance data over a range of conditions. The MFF-3 and MFF-5 tests were U10Zr metal fuel tests with HT9 cladding. A group of fuel pins from these two tests have been selected by DOE for post irradiation examination at Idaho National Laboratory (INL) as part of the Fuel Cycle Research and Development Program. At the request of INL, this report provides a data package of key information on the irradiation environment for these tests that will be useful in interpreting the results of these examinations. Data provided for MFF-3 and MFF-5 for the beginning and end of each operating cycle include:

- assembly fission powers, fast neutron fluxes (> 0.1 MeV), total fluxes,
- spatial distributions of fast flux and fission power by pin, and fast flux at the duct walls,
- assembly average burnup dependant material compositions for six axial segments.
- assembly sodium outlet temperatures,
- subchannel sodium temperature distributions around the fuel pins at three axial elevations, and
- neutron flux, cross sections, and burnup dependent compositions for nineteen selected fuel pins for eighteen axial pin segments

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Acronyms

DOE	U. S. Department of Energy
FFTF	Fast Flux Test Facility
INL	Idaho National Laboratory
LMFBR	Liquid Metal Fast Breeder Reactor
LMR	Liquid Metal Reactor
PNNL	Pacific Northwest National Laboratory
WHC	Westinghouse Hanford Company

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1.0 Introduction

This report provides data relevant to the irradiation of the metal fuel experiments MFF-3 and MFF-5 during their residence in the Fast Flux Test Facility (FFTF) core. Detailed irradiation conditions for these tests are provided to help analysts and designers in evaluating these fuel tests. This information will allow a more detailed interpretation of test results and development of performance correlations and/or models for metal fuel assemblies. The MFF-3 and MFF-5 tests were both aggressive irradiation tests of U10Zr metal fuel pins with HT9 cladding that were prototypic of full scale liquid metal reactor (LMR) designs. MFF-3 was irradiated for 726 Effective Full Power Days (EFPD), starting from Cycle 10C1, and MFF-5 was irradiated for 503 EFPD starting from Cycle 11B1.

A brief description of the tests is provided, followed by a summary of the irradiation history. Key information on the irradiation environment provided for MFF-3 and MFF-5 for the beginning and end of each operating cycle falls into three categories:

Assembly Burnup Data

- assembly fission powers, fast neutron fluxes (> 0.1 MeV), total fluxes,
- spatial distributions of fast flux and fission power by pin, and fast flux at the duct walls,
- assembly average burnup dependant material compositions for six axial segments.

Sodium Temperature Data

- assembly sodium outlet temperatures,
- subchannel sodium temperature distributions around the fuel pins at three axial elevations

Detailed Pin Burnup Data

- neutron flux, cross sections, and burnup dependent compositions for nine selected pins in MFF-3 and ten selected pins in MFF-5, for eighteen axial pin segments in each pin.

Also included are powers, outlet temperatures, and flow rates for the assemblies adjacent to MFF-3 and MFF-5. Composition data are given for the end of each cycle. Most of the other data are provided for the beginning and end of each of the 1isted operating cycles, except for cycles less than 20 equivalent ful1 power days (EFPD) in length. For these short cycles, only beginning of cycle data are included. However, no data are given for Cycle 10C-2 because its length was only 2.9 EFPD. Data for the end of Cycle 10C-1 are very representative of the data for Cycle 10C-2.

The data are supplied in tabular form in this report or in electronic form on a CD.

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2.0 Test Description

The MFF-3 assembly contains 169 pins (0.270 in. diameter) in an HT9 duct. The HT9 clad and wire wrapped fuel pins contain U-10Zr fuel sodium bonded to the cladding. The fuel is enriched (32.4 wt% U-235) and was intended to operate at power levels representative of high (2-sigma) power and temperature conditions in an FFTF metal core (18.8 kW/ft and 1200°F peak cladding mid-wall temperature at beginning of life). The fuel column is bounded by an Inconel 600 lower reflector, and has no upper reflector or upper blanket.

The MFF-5 assembly also contains 169 pins (0.270 in. diameter) in an HT9 duct. The HT9 clad and wire wrapped fuel pins contain U-10Zr fuel sodium bonded to the cladding. The fuel is enriched (31.0 wt% U-235) and was intended to operate at power levels representative of peak conditions in a FFTF metal core (17 kW/ft and 1150°F peak cladding mid-wall temperature at beginning of life). The fuel column is bounded by an Inconel 600 lower reflector, and has no upper reflector or upper blanket. The MFF-5 test assembly is prototypic of a previously projected FFTF Series III driver fuel assembly. This design includes a 4 inch longer plenum than that of MFF-3. In order to increase fuel pin plenum size, the MFF-5 assembly includes a redesigned handling socket and lower shield assembly. This elevates the lower end of the fuel pins 4 inches and thus increases the plenum length relative to pins from MFF-3, but maintains the same pin length and axial fuel position as that of the Series I and II driver fuel assemblies in FFTF. A lower axial reflector of 2.5 in. in length is used to fix the elevation of the fuel in the pin. The balance of the lower shielding (compared to Series I and II drivers) is provided by the new assembly design.

The MFF-3 and MFF-5 design parameters are listed in Table 1.

Table 1. Assembly and Nominal Fuel Pin Specifications

Item		Specification	
		MFF-3	**MFF-5**
Assembly	Duct:		
	Material	HT9	HT9
	Shape	Hexagonal	Hexagonal
	Inner diameter across flats, in. (mm)	4.325 (109.9)	4.325 (109.9)
	Number of pins per assembly	169	169
	Wire wrap:		
	Material	HT9	HT9
	Outer diameter, in. (mm)	0.0535 (1.36)	0.0535 (1.36)
	Pitch, in. (mm)	6.0 (152)	6.0 (152)
	Pitch orientation	Clockwise	Clockwise
	Gas plenum volume, in^3 (cm^3)	1.77 (29.0)	1.93 (31.6)
	Gas plenum length (BOL*, at temperature) , in. (mm)	44.1 (1120)	48.1 (1222)
	Fill gas & pressure, atm absolute	Helium, 1	Helium, 1

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Item		Specification	
		MFF-3	**MFF-5**
Pin	Cladding tube:		
	Material	HT9	HT9
	Outer diameter, in. (mm)	0.27 (6.858)	0.27 (6.858)
	Thickness, in. (mm)	0.022 (0.559)	0.022 (0.559)
	Length, in. (m)	91.65 (2.33)	91.65 (2.33
	Length, in. (m)	93.75 (2.38)	93.75 (2.38)
Fuel	Material	U-10 wt% Zr	U-10 wt% Zr
	Uranium enrichment, wt% ^{235}U (^{235}U/total U)	32.4	31.0
	Fuel-cladding bond	Sodium	Sodium
	Nominal bond height above fuel top (BOL*, at temperature) , in. (mm)	1.0 (25.4)	1.0 (25.4)
	Column length, in. (mm)	36.0 (91.44)	36.0 (91.44)
	Column weight, g	281.2	281.2
	Geometry	Slugs	Slugs
	Slug outer diameter, in. (mm)	0.196 (4.98)	0.196 (4.98)
	Slug density, g/cm^2 (100% TD)	15.8	15.8
	Slug length, in. (mm)	12.0 (304.8)	12.0 (304.8)
	Fuel-to-cladding diametrical gap, in. (mm)	0.003 (0.76)	0.003 (0.76)
	Planar smear density, %	75	75
Lower Reflector	Material	Inconel ®600	Inconel 600
	Diameter, in. (mm)	0.1895 (4.8)	0.1895 (4.8)
	Height, in. (mm)	6.5 (165)	2.5 (63.5)
Upper Reflector	None		

* BOL = beginning of life

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3.0 Irradiation History

3.1 Operating Cycles

The irradiation time for a given irradiation cycle is normally given in EFPD, where one EFPD is one day at 100% reactor power, i.e., the total energy generated during the cycle normalized to the maximum reactor power. The lengths of the reactor cycles when MFF-3 and MFF-5 were in the FFTF core are given in Table 2. Also shown in Table 2 are the FFTF Reload Design Report (RDR) cycle names, cycle segments, and the cycle start and end dates based on when the reactor went critical or subcritical. MFF-3 was irradiated during operating Cycles 10C-1 through 12B-2, while MFF-5 was irradiated during Cycles 11B-1 through 12B-2.

Table 2. FFTF Cycle Lengths and Dates for MFF-3 and MFF-5 Irradiation Periods

Operating Cycle	Cycle Segment	Dates		Cycle Length (EFPD)	Accumulated EFPD
		BOC	EOC		
10C	1	11/09/88	1/08/89	56.9	56.9
	2	1/16/89	1/20/89	2.9	59.8
	3	1/24/89	3/13/89	47.0	106.8
11A	1	5/03/89	5/16/89	11.3	118.1
	2	5/21/89	6/02/89	10.5	128.6
	3	6/14/89	9/18/89	94.6	223.2
11B	1	1/04/90	4/08/90	85.5	308.7
	2	5/29/90	10/27/90	132.7	441.4
11C		12/20/90	3/19/91	81.5	522.9
12A	1	5/27/91	7/21/91	52.8	575.7
	2	7/30/91	9/22/91	48.6	624.3
12B	1	11/21/91	1/15/92	50.3	674.6
	2	1/26/92	3/19/92	51.6	726.2

3.2 Reactor Power History

The reactor thermal power for FFTF Cycles 10, 11, and 12 are shown as a function of time in Figures 1, 2, and 3, which were extracted from WHC-SP-0889 (N. J. Graves and A. E. Bridges 1992). The total heat deposition for a reactor core (including non-fueled components) is obtained by combining the local direct fission heat with other nuclear heat sources such as gamma ray absorption. The energy produced from the various sources is combined and adjusted so that the total is properly normalized to the maximum core thermal power at 100% reactor power. The thermal power is obtained from heat balance calculations of the three secondary heat exchange loops. During the MFF-3 and MFF-5 irradiation period, the maximum (100%) reactor power was 291 MW.

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Figure 1. FFTF Power History for Cycle 10

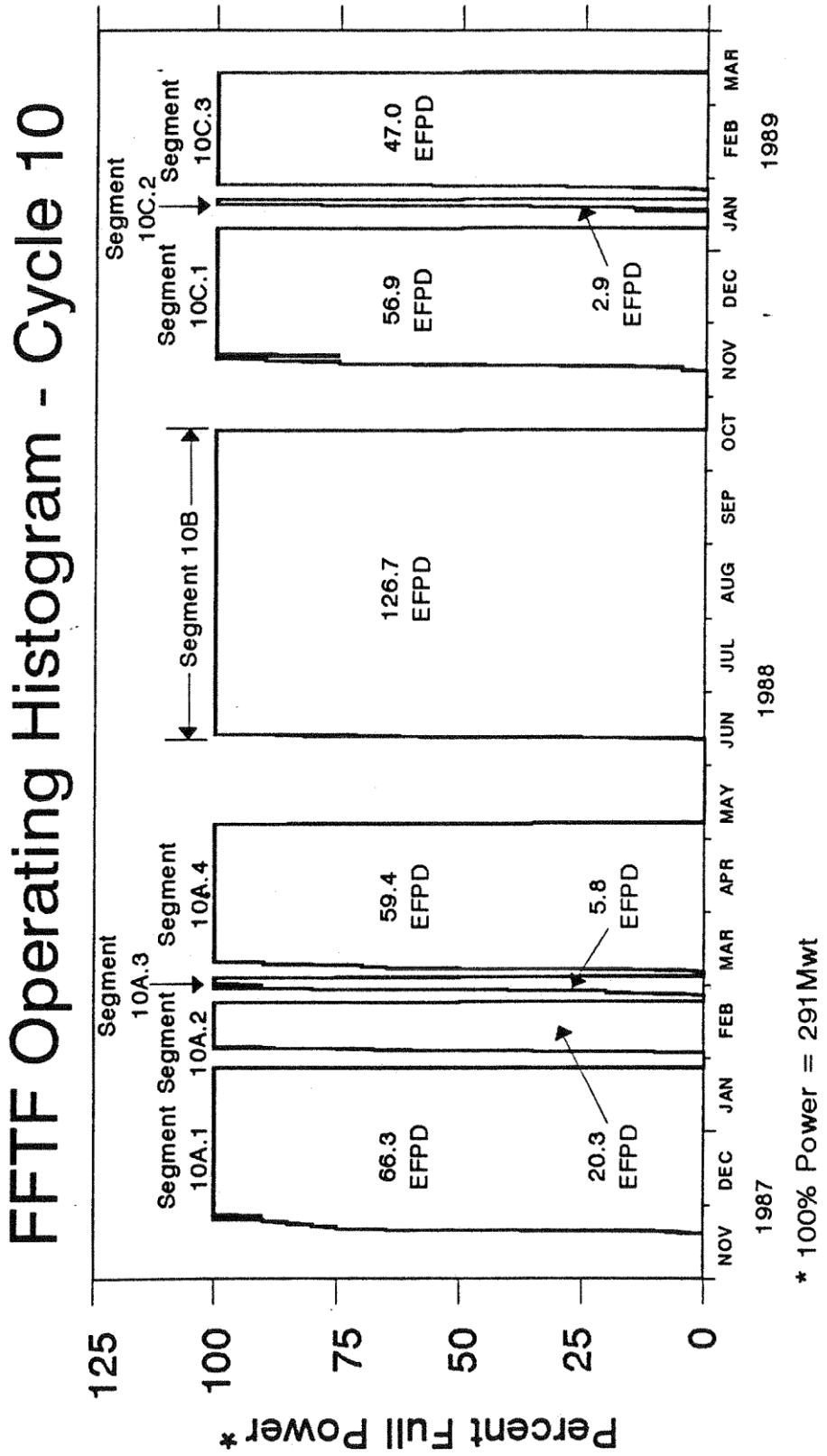

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Figure 2. FFTF Power History for Cycle 11

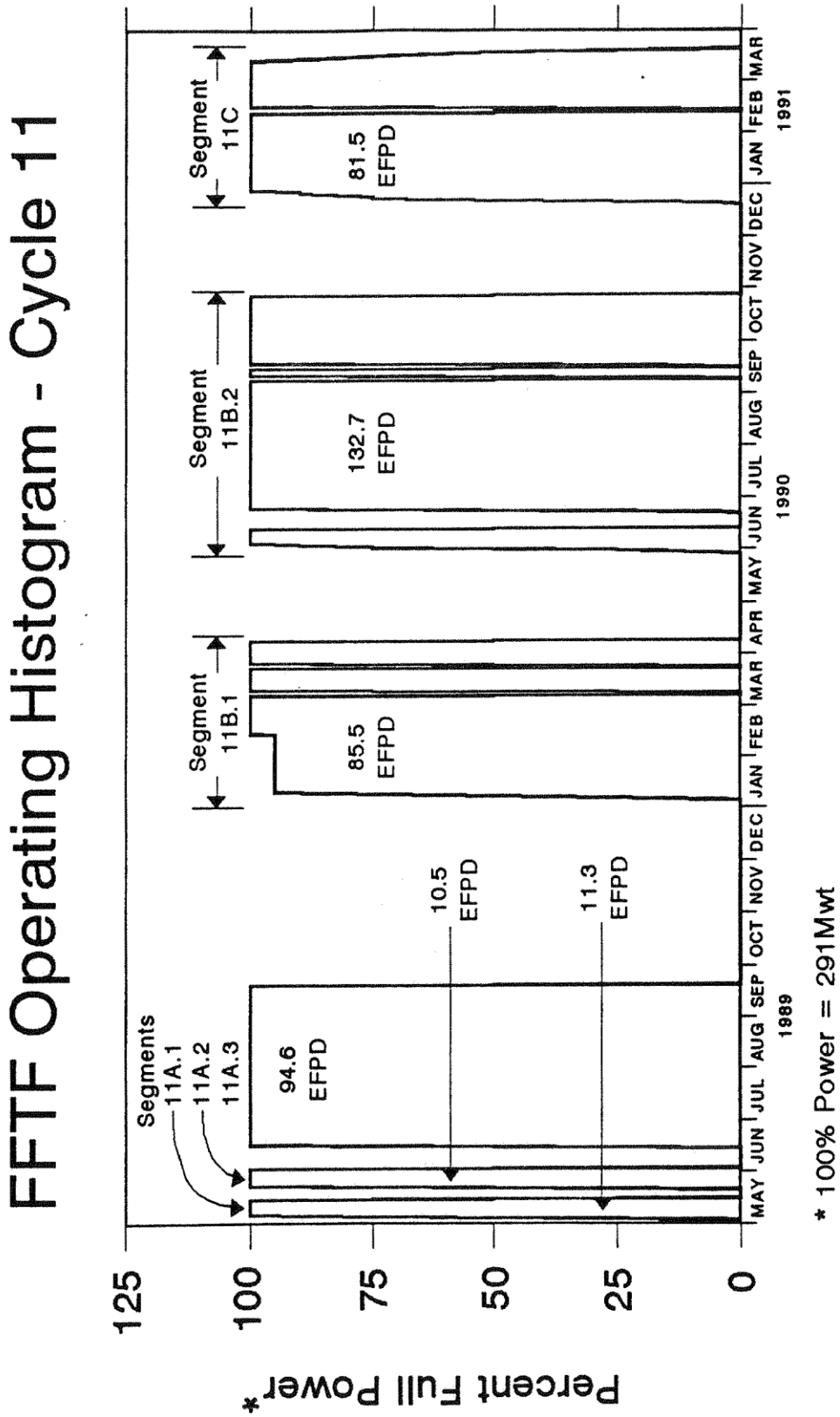

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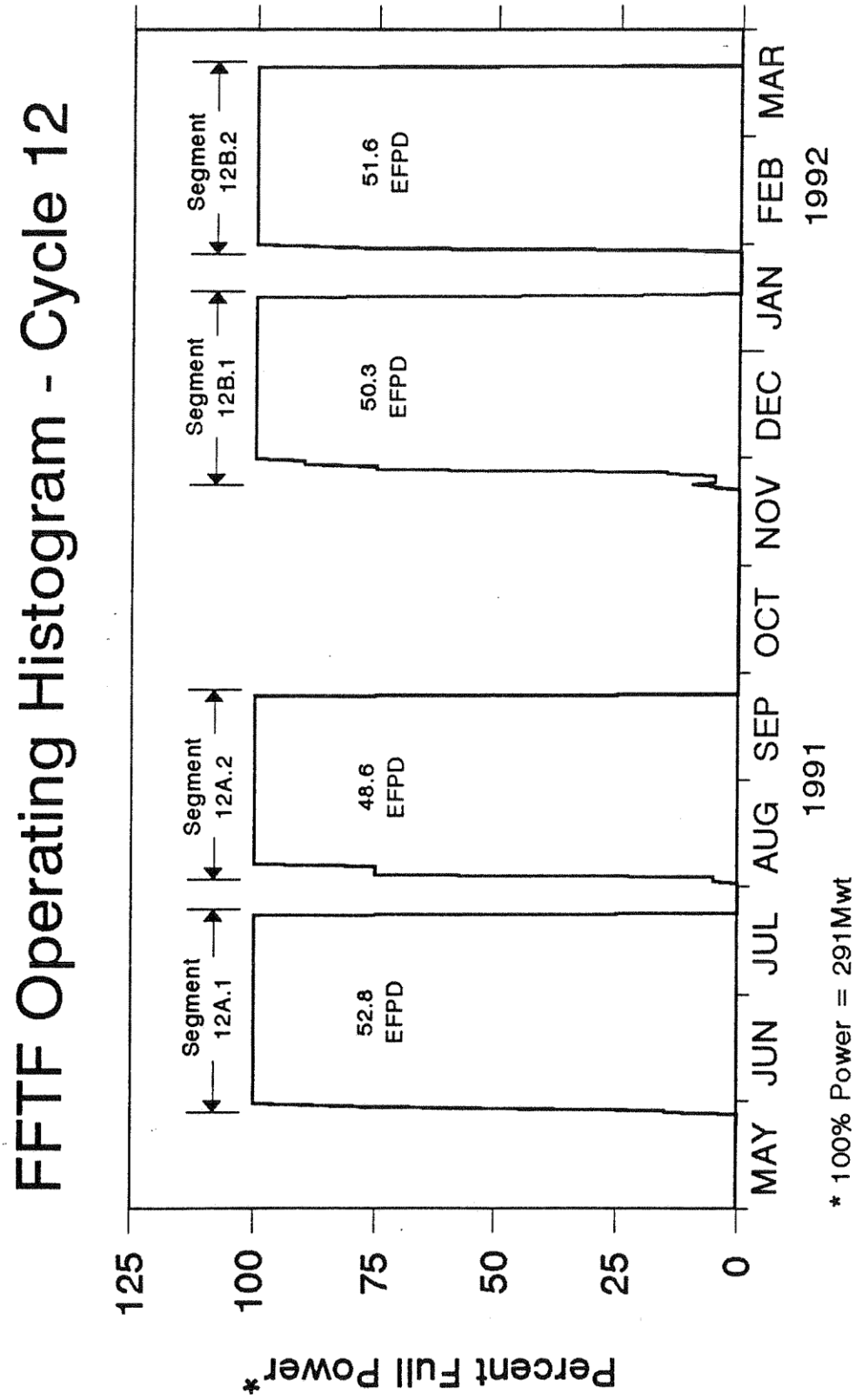
Figure 3. FFTF Power History for Cycle 12



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3.3 Assembly Irradiation History

The irradiation history and calculated assembly fission powers of MFF-3 and MFF-5 are listed in Table 3. The last column in Table 3 indicates the cycles (beginning and end) for which parameters described in Section 5.0 are given.

Table 3. Summary of Irradiation History and Data for MFF-3 and MFF-5

Reactor Cycle[a]	MFF-3 in core location 2404 Fission Power[b] (MW)	MFF-5 in core location 1304 Fission Power[b] (MW)	Other Data Provided
B10C-1	7.939		X
E10C-1	7.721		X
B/E10C-2[c]	7.728		
B10C-3	7.696		X
E10C-3	7.525		X
B11A-1[i]	7.389		X
B11A-2[d]	7.405		X
B11A-3	7.267		X
E11A-3	7.004		X
B11B-1	7.014	7.553	X
E11B-1	6.770	7.286	X
B11B-2	6.644	7.466	X
E11B-2	6.310	7.017	X
B11C	6.274	6.978	X
E11C	6.133	6.791	X
B12A-1	5.889	7.128	X
E12A-1	5.802	6.933	X
B12A-2	5.759	6.978	X
E12A-2	5.679	6.793	X
B12B-1	5.914	6.867	X
E12B-1	5.811	6.684	X
B12B-2	5.714	6.697	X
E12B-2	5.618	6.524	X

[a] The letter „B“ preceding the cycle number indicates the data in the row are for beginning-of-cycle conditions. The letter „E“ preceding the cycle number indicates the data in the row are for end-of-cycle conditions.

[b] Assembly power data in this table were obtained from three-dimensional (3DBF [Nelson 1990]) calculations .

[c] Because of the short length of cycle 10C-2, assembly power, outlet temperature and flow rates are essentially the same during the cycle.

[d] Because of the short length of cycles 11A-1 and 11A-2, no data are given in this report for E11A-1 and E11A-2. End-of-cycle data are essentially the same as beginning of cycle data.

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Figure 4 shows the FFTF core loading for Cycle 10C-1. Loading changes made in core locations adjacent to MFF-3 between Cycles 10C-1 and 11A-3 are identified in Table 4. Figure 5 shows the FFTF core loading for Cycle 11B-1, when MFF-5 was inserted into the reactor. Assemblies in six of the 12 core locations adjacent to MFF-3 and MFF-5 were changed during the Cycle 11B-2 outage, so the FFTF core loading for Cycle 11B-2 is also shown (Figure 6). Loading changes made in core locations adjacent to MFF-3 and MFF-5 between Cycles 11B-2 and 12B-2 are identified in Table 5.

Table 4. Loading Changes Made to Core Locations adjacent to MFF-3 for Cycles 10C-2 through 11A-3

Cycle[a]	Core Location	Assembly Removed (Serial No. & Type)	Assembly Inserted (Serial No. & Type)
11A-1	2303	2163, ABA-4[b]	16418, 4.2DFA[c]
	2403	16395, 4.2DFA[c]	16493, 4.2DFA[c]
	2505	8276, 4.1DFA[c]	8263, 4.1DFA[c]
	2506	8268, 4.1DFA[c]	2171, MFA-2[d]

[a] No loading changes adjacent to MFF-3 were made during the Cycle 10C-2, 10C-3, 11A-2 and 11A-3 outages.
[b] ABA-4 is a Core Demonstration Experiment (CDE) blanket assembly.
[c] 4.1DFA and 4.2DFA are standard FFTF series II driver fuel assemblies.
[d] MFA-2 is a Monju fuel test assembly.

Table 5. Loading Changes Made to Core Locations adjacent to MFF-3 and MFF-5 for Cycles 11C through 12B-2

Cycle[a]	Core Location	Assembly Removed (Serial No. & Type)	Assembly Inserted (Serial No. & Type)
11C	1303	16403, 3.2DFA[b]	16472, 4.2DFA[c]
	2304	16388, 3.2DFA[b]	16429, 4.2DFA[c]
	2505	8263, 4.1DFA[c]	8244, 4.1DFA[c]

[a] No loading changes adjacent to MFF-3 were made during the Cycle 12A-1, 12A-2, 12B-1 and 12B-2 outages.
[b] 3.2DFA is a standard FFTF series I driver fuel assembly.
[c] 4.1DFA and 4.2DFA are standard FFTF series II driver fuel assemblies.

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Figure 4. FFTF Cycle 10C-1 Core Loading

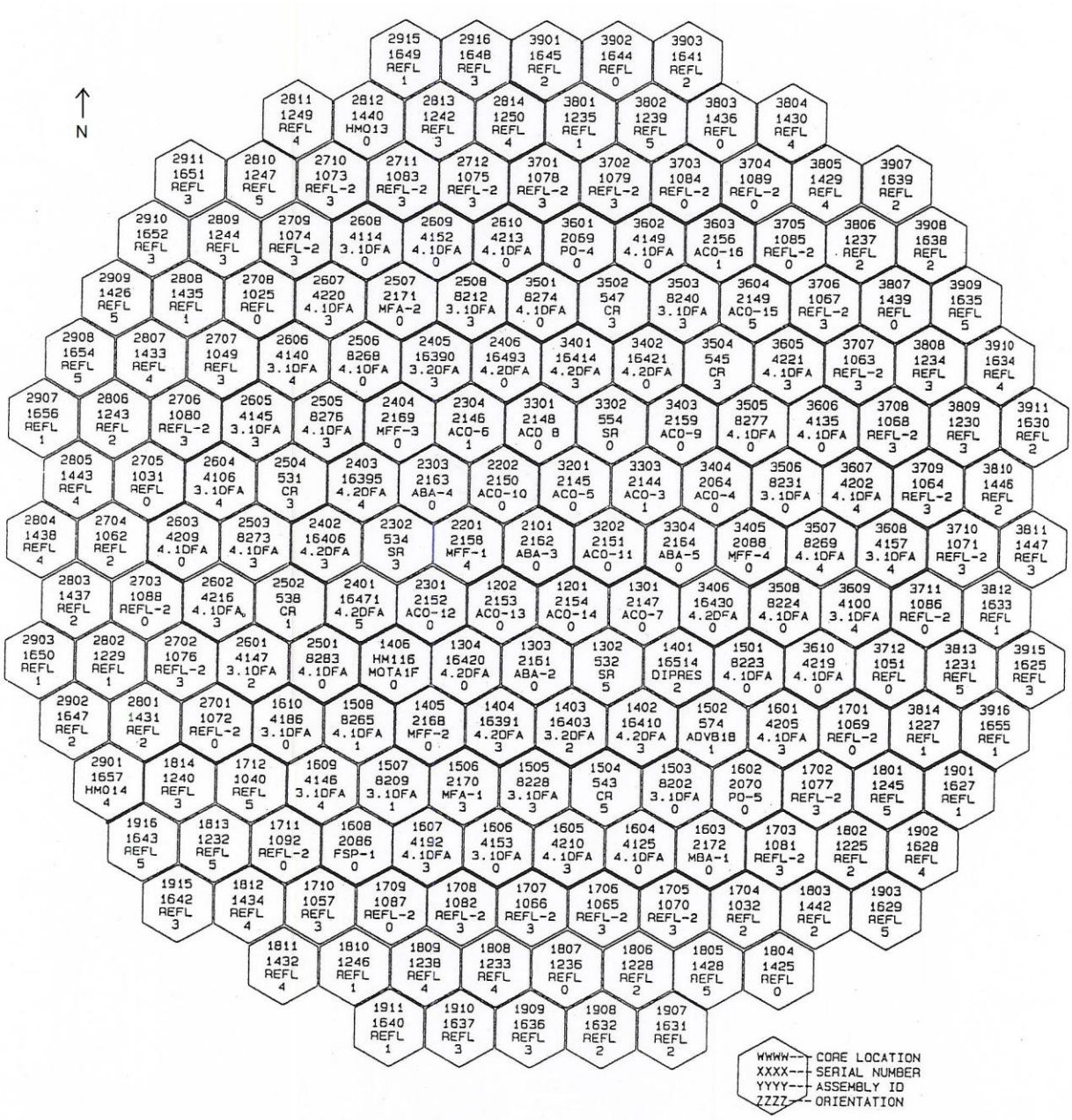

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Figure 5. FFTF Cycle 11B-1 Core Loading

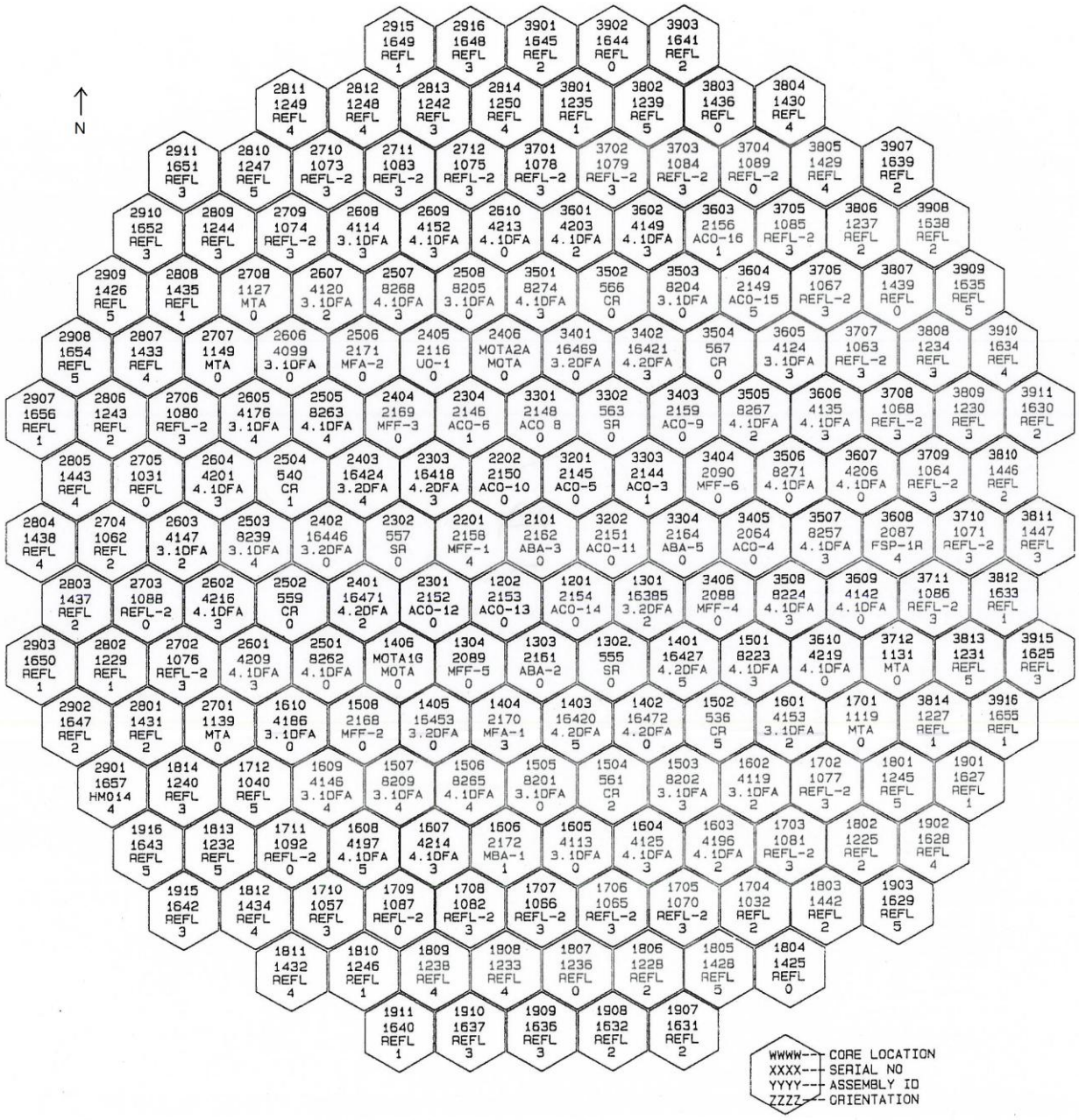

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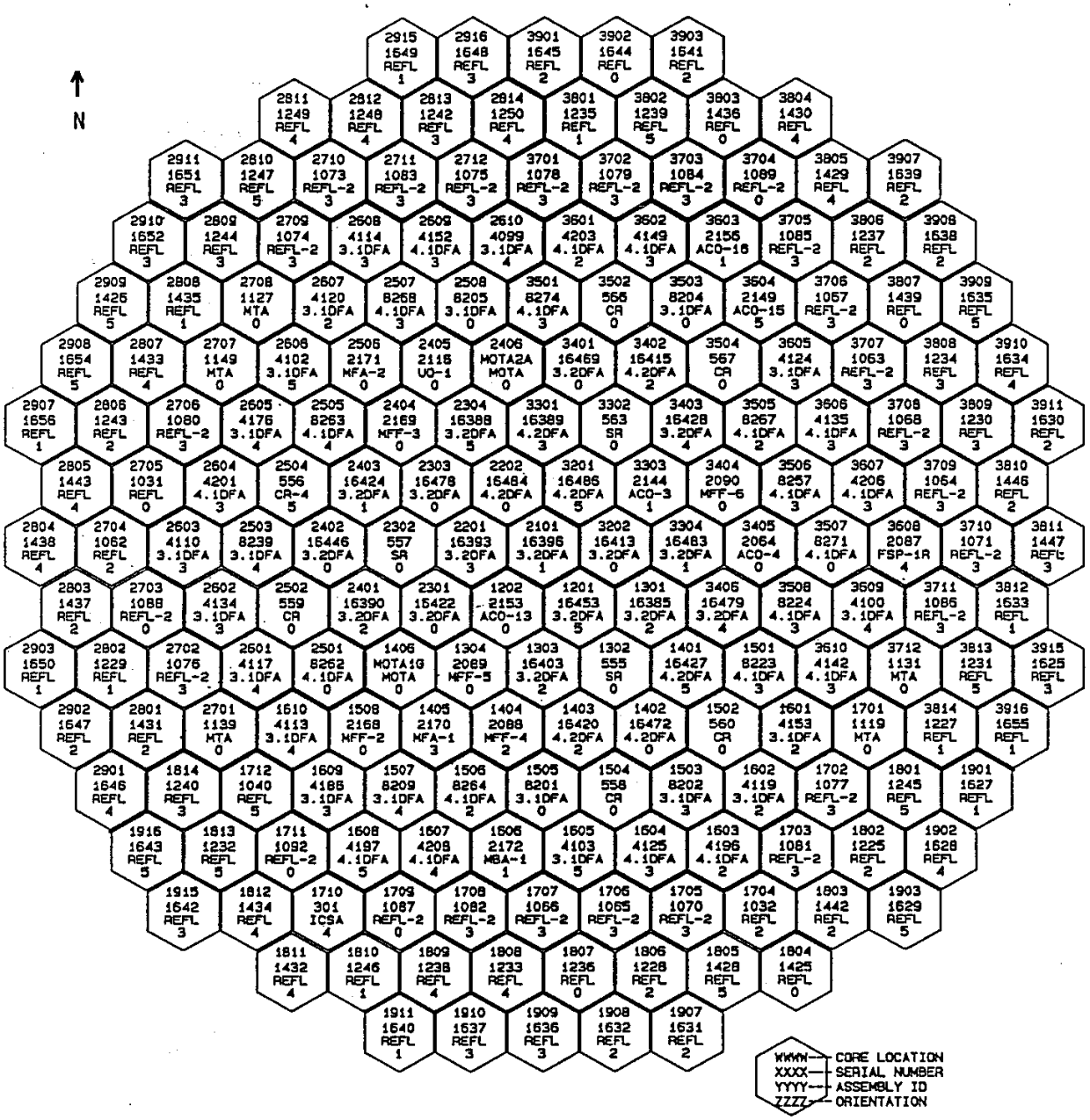
Figure 6. FFTF Cycle 11B-2 Core Loading



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4.0 Methods

The calculations of irradiation data for MFF-3 and MFF-5 fall into three categories:

- Assembly Burnup Calculations
- Sodium Temperature Calculations
- Detailed Pin Burnup Calculations.

The results of the assembly burnup calculations are presented in Section 5. The results of the sodium temperature calculations are presented in Section 6. The results of the detailed pin burnup calculations are presented in Section 7. Details on the methods can be found in Appendix A for the assembly burnup calculations, Appendix B for the sodium temperature calculations, and Appendix C for the detailed pin burnup calculations.

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5.0 Assembly Burnup Calculations

5.1 Methods

Details on the whole-core three dimensional burnup calculation methods can be found in Appendix A. Previous burnup calculations used in Core Reload Design Reports were based on two dimensional methods. Burnup calculations for this study for MFF-3 and MFF-5 were accomplished with a sequence of three-dimensional calculations to provide more accurate axial treatment. Starting with a beginning of cycle (BOC) NADB, completion of this sequence results in an end of cycle (EOC) NADB. The EOC NADB is updated to give an NADB for the beginning of the next cycle by accounting for decay of ^{241}Pu between cycles and manually updating the NADB loading file to include the core loading changes.

The burnup calculations were based on actual core loadings and irradiation histories, not predicted or planned values. Also, data presented in tables and figures in this section were based on three-dimensional (3D) models, whereas the RDR calculations were based on 2D models, with approximate 3D axial factors applied when needed.

The flux calculations that were part of the burnup calculation sequence were made with the control rod bank positioned at nominally the cycle averaged position. Sometimes for short cycles these calculations were the source of BOC flux and power distributions used in generating the data tables presented in the main part of this report. For the other cycles, separate runs for the BOC were made. In all cases where EOC data were reported, separate runs were made.

After all the runs to generate the required flux and power distributions were completed, six post-processing runs were made for the BOC or EOC of each cycle reported to generate the data tables. Data generated for MFF-3 and MFF-5 include:

- assembly fission powers, fast neutron fluxes (> 0.1 MeV), total fluxes,
- radial spatial distributions of fast flux and fission power by pin,
- axial power , total flux, and fast flux distributions
- fast flux at the duct walls, and
- burnup dependant material compositions for six axial segments.

5.2 Information in Data Tables

Included in Section 5.11 are 12 different tables for each cycle. As indicated above, some of these tables were generated for beginning of cycle (BOC) conditions, some were generated for end of cycle (EOC) conditions, and many were generated for both BOC and EOC conditions. Table 6 summarizes the information contained in each of the 12 data tables, and indicates whether this information is provided for BOC, EOC or both. Data tables are identified using the following notation: TCCC.M, where T is either the letter B (for beginning of cycle) or E (for end of cycle), CCC is a cycle name (i.e., 10C-1, 11A-1, ..., 12B-2), and N is a table number (1 - 12) identified in Table 6. For example, Table B10C-1.1 lists the fission power generated in MFF-3

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and neighboring assemblies at the beginning of Cycle 10C-1 (BOC 10C-1). The following sections explain the contents of each of the 12 types of tables.

Table 6. Summary of Data Included for each Cycle

Table No.	Description	Created for BOC or EOC?
1	Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies	BOC & EOC
2	Assembly Averaged Fast and Total Flux for MFF-3 and MF3-5	BOC & EOC
3	Axial Distribution of Total Flux, Fast Flux and Power in MFF-3	BOC & EOC
4	Axial Distribution of Total Flux, Fast Flux and Power in MFF-5	BOC & EOC
5	Fission Power Distribution by Pin in MFF-3	BOC & EOC
6	Fission Power Distribution by Pin in MFF-5	BOC & EOC
7	Fast Flux Distribution by Pin in MFF-3	BOC & EOC
8	Fast Flux Distribution by Pin in MFF-5	BOC & EOC
9	MFF-3 and MFF-5 Duct Wall Flux Greater than 0.1 MeV	BOC & EOC
10	Fission fractions by isotope in MFF-3 and MFF-5	BOC & EOC
11	Composition of MFF-3	EOC
12	Composition of MFF-5	EOC

5.3 Assembly Fission Power

The fission power generated in MFF-3 and each of its six adjacent assemblies, and in MFF-5 and each of its six adjacent assemblies are 1isted in Tables B10C-l.1, E10C-l.1, B10C-3.1, E10C-3.1, etc. In these tables, the total fission power is given for each assembly. Also, a breakdown of the power by axial material region (fuel, axial blankets and UO_2 insulator pellets) is included. Standard fuel assemblies that do not have axial blankets have insulator pellets between the fuel and the axial reflector regions.

Fission powers were computed using the three-dimensional diffusion theory program, 3DBF (Nelson 1990) with nuclear cross section data in 12 energy groups. The computed flux and power data were adjusted by applying row-dependant bias factor that ranged in value from 0.98 to 1.04. For rows 3 and 4 where MFF-3 and MFF-5 were located, the bias factor applied was 0.988. The bias factors were determined by comparing the results of measurements made as part of the FFTF reactor characterization program, diffusion theory calculations and Monte Carlo (MCNP) calculations.

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The bias factors listed above do not apply to in-core blanket assemblies. These assemblies have burnup dependent factors that are listed in each RDR. Applicable bias factors were applied to blanket assemblies. Bias factors for blanket assemblies adjacent to MFF-3 and MFF-5 are listed in Table 7.

Table 7. Flux and Power Bias Factors for In-Core Blanket Assemblies Adjacent to MFF-3 and MFF-5

Blanket Assembly	Cycles	Core Location	Bias Factor
ABA-4 (2163)	10C-1 – 10C-3	2303	0.939[a]
ABA-2 (2161)	11B-1	1303	0.949[b]

[a] Bias factor from Cycle 10C RDR (Dobbin et al 1989), Appendix G
[b] Bias factor from Cycle 11B-1 RDR (Campbell et al 1990), Appendix I

5.4 Assembly Averaged Fast and Total Flux

Assembly averaged fast flux (~ > 0.1 MeV) and total flux data for MFF-3 and MFF-5 at the beginning and end of each cycle (except those noted in Table 3) are given in Tables B10C-l.2, E10C-l.2, B10C-3.2, etc. In computing the data in these tables, only the fuel region of each assembly was included in the averaging process. The group flux data were obtained from the same 3DBF calculations used to produce the fission power data. Again, a bias factor (0.988) was applied to the 3DBF results.

5.5Axial Distributions of Total Flux, Fast Flux and Power

The axial distributions of total flux, fast flux (> 0.1 MeV) and fission power at the beginning and end of each cycle (except those noted in Table 3) are given for MFF-3 in Tables B10C-l.3, E10C-l.3, B10C-3.3, etc. Likewise, the axial distributions of total flux, fast flux and fission power are given for MFF-5 in Tables B11B-l.4, E11B-l.4, B11B-2.4, etc.

The axial locations relative to the core midplane in units of centimeters (cm) at hot, full power conditions are given in the first column of each table. Negative values indicate locations below the midplane and positive values indicate locations above the midplane. The flux and power data in the tables are normalized so that the axial average of each distribution over the active core region is 1.0. The active core region extended from -46.14 cm to 46.14 cm in the 3DBF models of the FFTF at hot, full power conditions.

Example Axial Power Distribution

Table 8 provides axial fission power profiles at beginning of life (BOL) for MFF-3 and MFF-5. At the beginning of each cycle the control rods are inserted approximately half-way from the top. Eighteen axial mesh intervals were used for the fuel column in the calculation. The axial fuel column dimensions were expanded to 92.28 cm to account for thermal expansion of the cladding at full power conditions. Figure 7 is a plot for MFF-3. The plot for MFF-5 would be similar.

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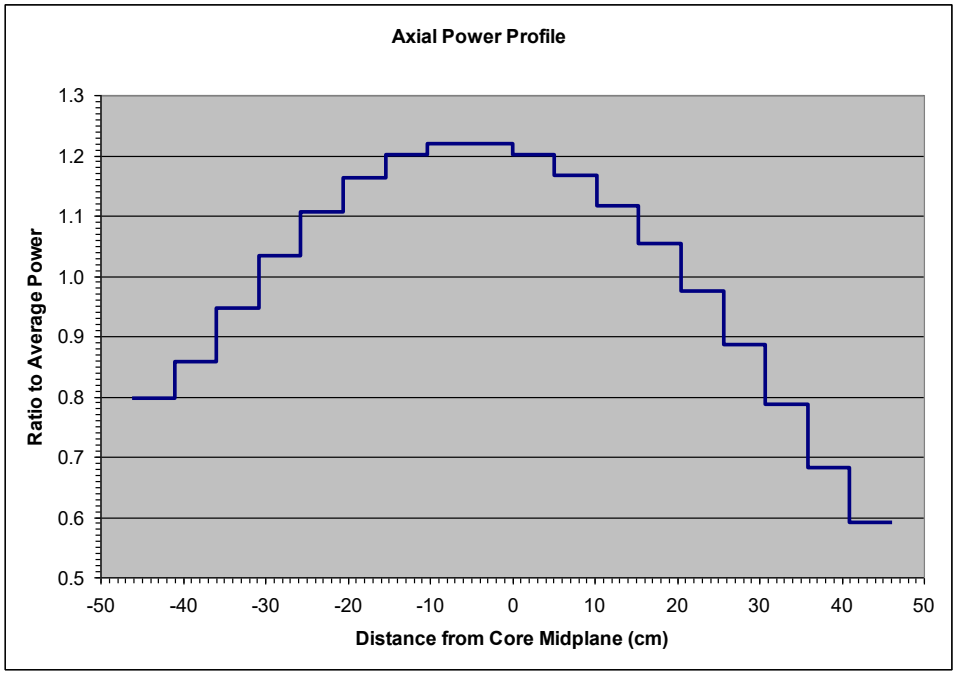
Table 8 Axial Power Distribution - Ratio to Axial Average Fission Power at BOL

Lower axial mesh point (cm)	Axial mesh midpoint (cm)	MFF-3 BOC10C-1	MFF-5 BOC11B-1
-46.1400	-43.5767	0.798	0.796
-41.0133	-38.4500	0.858	0.855
-35.8867	-33.3234	0.947	0.938
-30.7600	-28.1967	1.032	1.019
-25.6333	-23.0700	1.104	1.089
-20.5067	-17.9434	1.160	1.145
-15.3800	-12.8167	1.198	1.185
-10.2533	-7.6900	1.217	1.207
-5.1267	-2.5634	1.217	1.212
0.0000	2.5634	1.200	1.200
5.1267	7.6900	1.165	1.170
10.2533	12.8167	1.116	1.124
15.3800	17.9434	1.052	1.062
20.5067	23.0700	0.975	0.986
25.6333	28.1967	0.886	0.898
30.7600	33.3234	0.788	0.801
35.8867	38.4500	0.687	0.701
41.0133	43.5767	0.600	0.613
46.1400	x	x	x

Figure 7 Plot of Axial Power Distribution



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5.6Fission Power Distribution by Pin

The distribution of fission power by pin at the beginning and end of each cycle is given for MFF-3 in Tables B10C-l.5, E10C-l.5, B10C-3.5, etc. Likewise, the distribution of fission power by pin is given for MFF-5 in Tables B11B-l.6, E11B-l.6, B11B-2.6, etc. The direction north (N) is indicated in these tables.

The data in each table were based on a power distribution computed by 3DBF. These distributions had six data points per assembly at each axial elevation. Pin power data were generated by first axially averaging the 3DBF computed powers, and then using the HEDPIN computer program to interpolate the fission powers from the calculational mesh to the pin positions using a least-squares quadratic fit. The pin powers obtained were normalized so that the linear power averaged over the fuel region of an assembly is 1.0. These radial pin power distributions will be different for each cycle, and also vary with control rod elevation, but the overall shapes should be generally similar since the assemblies remained in the same locations throughout their irradiation. Note that in cycle 12A-1 the MOTA nonfuel assembly in core location 1406 adjacent to MFF-5 was replaced with a standard driver fuel assembly, which changed the local (and core-wide) power distributions. The 0° index notch on the handling socket is used to orient the assembly and pins relative to the core. For both MFF-3 and MFF-5 the index notch was oriented pointing south in the core. The pin loading by serial number is relative to the index notch.

Using the given assembly powers, the axial power distributions and the pin power distributions, the linear power in any MFF-3 or MFF-5 pin at any axial elevation can be easily determined.

5.7Fast Flux Distribution by Pin

The distribution of fast flux by pin is given at the beginning and end of each cycle for MFF-3 in Tables B10C-l.7, E10C-l.7, B10C-2.7, etc. Likewise, the distribution of fast flux by pin in MFF-5 is given in Tables B11B-l.8, E11B-l.8, B11B-2.8, etc. These data were generated using the same method, described above, that was used to obtain the pin powers. Again, the flux data were normalized so that the average fast flux in the fuel region of MFF-3 or MFF-5 is 1.0.

Using a given assembly averaged fast flux value, the corresponding axial fast flux distribution and pin distribution of fast flux, the fast flux at any axial level in any MFF-3 or MFF-5 pin can be easily determined.

Pin distributions of total flux are not given, but assembly-averaged total flux data and axial distributions of total flux are included in this report. Also, the pin distributions of total and fast flux are very similar. Thus, the total flux at any axial level in any MFF-3 or MFF-5 pin can be closely approximated.

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5.8Duct Wall Flux Greater than 0.1 MeV

The fluxes greater than 0.1 MeV at each of the six faces of the MFF-3 and MFF-5 ducts are given in Tables B10C-l.9, E10C-l.9, B10C-3.9, etc. The data given represent axial averages. To obtain the duct wal1 flux at a particular axial elevation, multiply by an axial factor from Tables B10C-1.3, B10C-l.4, E10C-l.3, E10C-l.4, etc.

Each of the six duct walls in each assembly is identified in the tables by the direction it faces - east (E), southeast (SE), southwest (SW), west (W), northwest (NW), or northeast (NE). Figures 3, 4, and 5 show the orientation of MFF-3 and MFF-5. For example, in Figure 5, the east (E) duct wall of MFF-3 in position 2404 is adjacent to the assembly in lattice position 2304, and the east duct wall of MFF-5 in 1304 is adjacent to the assembly in 1attice position 1303.

Duct wall fluxes were generated by axially averaging the flux distributions computed by 3DBF, integrating over energy to obtain the flux greater than 0.1 MeV at each space point, doing a 1inear interpolation between the two flux values on each side of a duct wal1 face, and finally applying the adjustment factor of 0.988 described earlier.

5.9Fission Fractions

The relative number of fissions occurring in each fissionable isotope in the calculational model (^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu and ^{241}Am) are given in Tables B10C-l.10, E10C-l.10, B10C-3.10, etc. Also given in these tables are the total fission rates in MFF-3 and MFF-5. The following procedure was used in generating these data.

First, the assembly-averaged fission rate, FR_i, (fissions/sec per cm^3) for each of the seven fissionable isotopes, i, was computed (approximately) using the equation:

$$FR_i = N_i \sum_{g=1}^{G} \sigma_{i,g}\theta_g$$

where, N_i is the average atom density (atoms per barn-cm) of isotope i in MFF-3 or MFF-5 at a particular point in time,
$\sigma_{i,g}$ is the fission cross section of isotope i in energy group g,
θ_g is the average neutron flux (neutrons/cm^2-sec) in MFF-3 or MFF-5 at a particular point in time, and
G is the number of neutron energy groups (12), and

Next, the total fission rate, FR_T , averaged over an assembly was computed as the sum of the seven values of RF_i computed using the equation above. Then the relative fission rate of each of the seven fissionable isotopes, RFR_i, was computed as:

$$RFR_i = FR_i/FR_T$$

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The equation used for computing the FR_i values is an approximation (except for BOL conditions) because of the axial variation in the buildup or depletion on the isotopes. Thus, the FR_T was not used to obtain the total fission rates listed in the tables. However, the RFR_i values tabulated are reasonably accurate because most of the effect of axial burnup variation is divided out in obtaining the relative values.

The total fission rate, TFR, (fissions/sec) in an assembly (MFF-3 or MFF-5) was computed from the adjusted fission power, P, (MW) produced in the assembly using the equation:

$$TFR = P \times C/FE$$

where: C is the factor for converting power in MW to units of MeV/sec.
$C = 6.24146 \times 10^{18}$ MeV per MW-sec, and
FE = fission energy (212 MeV/fission)

The energy dependence of the fission rates are shown in Table 9. These are typical values from a 3DBF calculation that used a 12 energy group structure. The values in each column sum to 1.0.

Table 9 Fission Response as a Function of Energy Group

Upper group energy, MeV	Normalized Fission Response by Energy Group					
	^{239}Pu	^{240}Pu	^{241}Pu	^{241}Am	^{235}U	^{238}U
1.69E+01	1.98E-02	6.44E-02	1.21E-02	9.56E-02	1.39E-02	1.96E-01
3.68E+00	1.09E-01	3.41E-01	7.38E-02	4.86E-01	7.57E-02	7.61E-01
1.35E+00	1.98E-01	4.46E-01	1.43E-01	3.69E-01	1.44E-01	4.24E-02
4.98E-01	9.99E-02	4.83E-02	8.15E-02	1.54E-02	8.12E-02	4.13E-04
3.02E-01	1.97E-01	4.15E-02	1.98E-01	1.30E-02	1.88E-01	3.25E-04
1.11E-01	1.59E-01	2.84E-02	1.80E-01	7.20E-03	1.77E-01	1.76E-04
4.09E-02	9.26E-02	1.50E-02	1.24E-01	4.18E-03	1.22E-01	1.30E-04
1.50E-02	5.27E-02	6.16E-03	7.91E-02	3.78E-03	8.05E-02	7.02E-05
5.53E-03	2.27E-02	2.71E-03	3.98E-02	2.03E-03	4.07E-02	5.12E-06
2.03E-03	3.30E-02	6.25E-03	4.87E-02	2.85E-03	5.22E-02	3.98E-05
7.49E-04	1.18E-02	1.18E-04	1.59E-02	8.28E-04	1.84E-02	5.29E-05
2.75E-04	4.94E-03	7.01E-06	5.73E-03	2.15E-04	5.44E-03	2.26E-08
1.00E-11	x	x	x	x	x	x

5.10 Material Compositions

Burnup-dependant material compositions for MFF-3 at the end of each cycle are given in Tables E10C-l.17, E10C-2.17, etc, while the compositions for MFF-5 are given in Tables E11B-l.18, E11B2.18, etc. Each table lists homogenized material compositions for 11 axial regions in MFF-3 or MFF-5. These 11 regions are identified in Table10. The axial extent of each region, as modeled in 3DBF, is 1isted in the material composition tables. The units are centimeters (cm)

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relative to the core midplane at hot, full power conditions. The compositions are in units of atoms/b-cm at hot, full power conditions. Both the fresh (beginning of life) and EOC compositions are included in each table. Compositions of MFF-3 at BOC 10C-1 and MFF-5 at BOC 11B-1 were the fresh values listed. Compositions at the beginning of any other cycle were essentially those 1isted for the end of the previous cycle. The only differences are due to decay of ^{241}Pu to ^{241}Am.

The burnup-dependant compositions for the fuel (axial regions 4 through 9) were computed using the three dimensional diffusion theory and burnup codes 3DBF and BURN3D (Nelson 1990). The fuel was subdivided into six axial regions to properly account for the effect that the axial flux distribution has on the fuel depletion rate.

The constituents of the materials listed in the composition tables are individual isotopes with three exceptions. The first exception is that the constituent labeled "FP" represents an average pseudo fission product pair. An atom density for FP specifies the concentration of fission product pairs, not individual fission product nuclides. The microscopic cross section data used for fission products in the 3DBF calculations were generated assuming all fissions were from ^{239}Pu.

The second exception is that the constituent labelled "SS-316" represents type 316 stainless steel. The third exception is that the constituent labelled "HT9" represents HT9 alloy, an advanced austenitic stainless steel. An atom density given for SS-316 or HT9 indicates the total number of atoms per unit volume. The compositions used in generating nuclear cross section sets for SS-316 and HT9 were based on RDT & ASTM standards.

Table10. Description of Axial Regions in Material Composition Tables

Axial Level	Axial range relative to Core Midplane (cm)[a]	Description
1	-100.28[b] to -75.28	Lower axial shield
2	-75.28 to -62.78 in MFF-3 -75.28 to -52.55 in MFF-5	Pin attachment region
3	-62.78 to -46.14 in MFF-3 -52.55 to -46.14 in MFF-5	Lower axial reflector
4 – 9	-46.14 to 46.14	Fuel region
10	46.14 to 62.78	Plenum region with sodium inside fuel pins
11	62.78 to 116.00[b]	Plenum region with inside of fuel pins voided

[a] Dimensions are representative of hot, full power conditions in standard FFTF fuel and components. Additional expansion of metal fuel was not modeled.

[b] The axial range in 3DBF models was 100.28 cm below the core midplane to 116.0 cm above the midplane.

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5.11 Data Tables for Each Cycle

The tables identified in Table 6 for the beginning of the 12 cycles and end of the 10 cycles specified in Table 3 are presented in the following sections.

5.11.1 Cycle 10C-1

Table B10C-1.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at BOC 10C-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	7.939E+00	0.000E+00	7.939E+00
2304	9.697E-02	4.385E+00	5.260E-02	4.535E+00
2303	1.329E-01	1.673E+00	6.243E-02	1.869E+00
2403	1.543E-02	3.705E+00	8.205E-03	3.728E+00
2505	1.343E-02	3.939E+00	7.797E-03	3.960E+00
2506	9.465E-03	4.704E+00	7.049E-03	4.720E+00
2405	1.374E-02	4.034E+00	9.658E-03	4.058E+00

Table B10C-1.2. Assembly Averaged Total and Fast Flux in MFF-3 at BOC 10C-1

	Core	Flux (n/cm^2-sec)	
Assembly	Pos.	Total	> 0.1 MeV
MFF-3	2404	3.717E+15	2.502E+15

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Table B10C-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 10C-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8692E-02	1.4216E-02	0.0000E+00
-92.78	6.1527E-02	2.7413E-02	0.0000E+00
-87.78	9.8531E-02	4.3824E-02	0.0000E+00
-82.78	1.4246E-01	6.5304E-02	0.0000E+00
-77.78	1.9603E-01	9.4101E-02	0.0000E+00
-72.15	2.5779E-01	1.3186E-01	0.0000E+00
-65.90	3.2341E-01	1.8113E-01	0.0000E+00
-60.35	4.0250E-01	2.4898E-01	0.0000E+00
-55.49	4.9506E-01	3.3901E-01	0.0000E+00
-50.62	5.8779E-01	4.4973E-01	0.0000E+00
-47.17	6.4960E-01	5.4767E-01	0.0000E+00
-43.58	7.2069E-01	6.7373E-01	7.9783E-01
-38.45	8.3611E-01	8.1839E-01	8.5817E-01
-33.32	9.4370E-01	9.3999E-01	9.4664E-01
-28.20	1.0373E+00	1.0409E+00	1.0317E+00
-23.07	1.1142E+00	1.1218E+00	1.1041E+00
-17.94	1.1728E+00	1.1824E+00	1.1602E+00
-12.82	1.2122E+00	1.2228E+00	1.1982E+00
-7.69	1.2322E+00	1.2432E+00	1.2173E+00
-2.56	1.2330E+00	1.2442E+00	1.2174E+00
2.56	1.2155E+00	1.2267E+00	1.1996E+00
7.69	1.1810E+00	1.1921E+00	1.1652E+00
12.82	1.1308E+00	1.1417E+00	1.1156E+00
17.94	1.0659E+00	1.0762E+00	1.0520E+00
23.07	9.8704E-01	9.9563E-01	9.7504E-01
28.20	8.9501E-01	9.0053E-01	8.8633E-01
33.32	7.9109E-01	7.9102E-01	7.8835E-01
38.45	6.7679E-01	6.6607E-01	6.8662E-01
43.58	5.5483E-01	5.2260E-01	5.9982E-01
47.17	4.7569E-01	4.0921E-01	0.0000E+00
50.62	4.1555E-01	3.3156E-01	0.0000E+00
55.49	3.3156E-01	2.4273E-01	0.0000E+00
60.35	2.5484E-01	1.7255E-01	0.0000E+00
64.98	1.9998E-01	1.2757E-01	0.0000E+00
69.39	1.6657E-01	1.0183E-01	0.0000E+00
76.46	1.2339E-01	7.0406E-02	0.0000E+00
86.80	7.9476E-02	4.1917E-02	0.0000E+00
98.14	4.6062E-02	2.2882E-02	0.0000E+00
110.00	2.0013E-02	1.0335E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B10C-1.5. Fission Power Distribution by Pin in MFF-3 at BOC 10C-1

0°Index Notch

CORE POSITION 2404 X

1.028 1.015 1.002 0.991 0.982 0.973 0.965 0.959

1.031 1.018 1.005 0.994 0.984 0.975 0.968 0.961 0.956

1.036 1.022 1.009 0.997 0.987 0.978 0.970 0.964 0.958 0.954

1.041 1.027 1.013 1.001 0.991 0.981 0.973 0.966 0.961 0.957 0.953

1.047 1.032 1.019 1.006 0.995 0.985 0.977 0.970 0.964 0.960 0.956 0.953

1.053 1.039 1.025 1.012 1.001 0.990 0.981 0.974 0.968 0.963 0.960 0.957 0.954

1.061 1.047 1.032 1.019 1.007 0.996 0.987 0.979 0.973 0.968 0.964 0.961 0.958 0.956

1.070 1.055 1.041 1.027 1.015 1.004 0.994 0.986 0.979 0.973 0.969 0.965 0.963 0.961 0.959

1.065 1.051 1.037 1.024 1.012 1.002 0.993 0.985 0.979 0.974 0.971 0.968 0.966 0.964

1.061 1.047 1.034 1.022 1.011 1.002 0.994 0.987 0.981 0.977 0.974 0.971 0.969

1.059 1.045 1.033 1.022 1.012 1.003 0.996 0.989 0.984 0.980 0.977 0.975

1.057 1.045 1.034 1.023 1.014 1.005 0.999 0.993 0.988 0.984 0.981

1.058 1.046 1.035 1.025 1.016 1.009 1.002 0.997 0.993 0.989

1.059 1.048 1.038 1.028 1.020 1.013 1.007 1.002 0.997

1.061 1.051 1.041 1.032 1.024 1.017 1.011 1.006

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Table B10C-1.7. Fast Flux Distribution by Pin in MFF-3 at BOC 10C-1

CORE POSITION 2404

0.948 0.952 0.953 0.953 0.952 0.948 0.942 0.935

0.960 0.963 0.966 0.966 0.965 0.962 0.957 0.950 0.942

0.970 0.974 0.977 0.979 0.978 0.976 0.971 0.965 0.957 0.947

0.980 0.984 0.988 0.990 0.990 0.988 0.984 0.978 0.971 0.962 0.951

0.988 0.993 0.997 0.999 1.000 0.999 0.996 0.991 0.984 0.975 0.965 0.953

0.996 1.001 1.005 1.008 1.009 1.008 1.006 1.002 0.996 0.988 0.978 0.967 0.955

1.003 1.008 1.012 1.015 1.017 1.017 1.015 1.011 1.006 0.999 0.990 0.979 0.968 0.955

1.008 1.013 1.018 1.021 1.023 1.023 1.022 1.019 1.015 1.008 1.000 0.990 0.979 0.967 0.953

1.017 1.022 1.025 1.028 1.029 1.028 1.026 1.022 1.016 1.009 1.000 0.990 0.978 0.965

1.025 1.028 1.031 1.032 1.032 1.030 1.027 1.023 1.016 1.008 0.999 0.988 0.976

1.030 1.032 1.034 1.035 1.034 1.031 1.027 1.022 1.015 1.006 0.996 0.985

1.033 1.035 1.036 1.035 1.033 1.030 1.026 1.019 1.012 1.003 0.993

1.034 1.035 1.035 1.034 1.031 1.028 1.023 1.016 1.008 0.999

1.033 1.034 1.033 1.031 1.028 1.024 1.018 1.012 1.003

1.031 1.031 1.030 1.027 1.024 1.019 1.013 1.006

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Table B10C-1.9. MFF-3 Duct Wall Fast Flux Data at BOC 10C-1

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5779E+15
SE	2.4273E+15
SW	2.3375E+15
W	2.3281E+15
NW	2.4426E+15
NE	2.5506E+15

Table B10C-1.10. Relative Fission Rates in MFF-3 at BOC 10C-1

Isotope	Fission Rate*
U-235	9.294E-01
U-238	7.060E-02
Pu-239	0.000E+00
Pu-240	0.000E+00
Pu-241	0.000E+00
Pu-242	0.000E+00
Am-241	0.000E+00
Total	2.337E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E10C-1.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at EOC 10C-1

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	ABOVE CORE	* * * * * * TOTAL PWR
2404	0.000E+00	7.721E+00	0.000E+00	7.721E+00
2304	9.991E-02	4.260E+00	5.581E-02	4.416E+00
2303	1.373E-01	1.736E+00	6.638E-02	1.939E+00
2403	1.593E-02	3.699E+00	8.718E-03	3.724E+00
2505	1.380E-02	3.922E+00	8.237E-03	3.944E+00
2506	9.939E-03	4.573E+00	7.520E-03	4.590E+00
2405	1.416E-02	3.925E+00	1.020E-02	3.949E+00

Table E10C-1.2. Assembly Averaged Total and Fast Flux in MFF-3 EOC 10C-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.707E+15	2.479E+15

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Table E10C-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 10C-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8240E-02	1.4073E-02	0.0000E+00
-92.78	6.0555E-02	2.7133E-02	0.0000E+00
-87.78	9.6971E-02	4.3367E-02	0.0000E+00
-82.78	1.4020E-01	6.4609E-02	0.0000E+00
-77.78	1.9288E-01	9.3067E-02	0.0000E+00
-72.15	2.5362E-01	1.3036E-01	0.0000E+00
-65.90	3.1806E-01	1.7894E-01	0.0000E+00
-60.35	3.9559E-01	2.4568E-01	0.0000E+00
-55.49	4.8623E-01	3.3399E-01	0.0000E+00
-50.62	5.7692E-01	4.4232E-01	0.0000E+00
-47.17	6.3723E-01	5.3793E-01	0.0000E+00
-43.58	7.0647E-01	6.6103E-01	7.8473E-01
-38.45	8.1972E-01	8.0286E-01	8.4435E-01
-33.32	9.2598E-01	9.2274E-01	9.3232E-01
-28.20	1.0193E+00	1.0229E+00	1.0117E+00
-23.07	1.0973E+00	1.1046E+00	1.0853E+00
-17.94	1.1585E+00	1.1678E+00	1.1440E+00
-12.82	1.2021E+00	1.2121E+00	1.1825E+00
-7.69	1.2276E+00	1.2380E+00	1.2072E+00
-2.56	1.2348E+00	1.2454E+00	1.2140E+00
2.56	1.2236E+00	1.2343E+00	1.2045E+00
7.69	1.1939E+00	1.2046E+00	1.1750E+00
12.82	1.1463E+00	1.1568E+00	1.1280E+00
17.94	1.0820E+00	1.0921E+00	1.0701E+00
23.07	1.0021E+00	1.0107E+00	9.9178E-01
28.20	9.0836E-01	9.1409E-01	9.0108E-01
33.32	8.0261E-01	8.0298E-01	8.0696E-01
38.45	6.8649E-01	6.7621E-01	7.0259E-01
43.58	5.6290E-01	5.3071E-01	6.1387E-01
47.17	4.8295E-01	4.1590E-01	0.0000E+00
50.62	4.2213E-01	3.3727E-01	0.0000E+00
55.49	3.3701E-01	2.4719E-01	0.0000E+00
60.35	2.5914E-01	1.7590E-01	0.0000E+00
64.98	2.0341E-01	1.3016E-01	0.0000E+00
69.39	1.6942E-01	1.0393E-01	0.0000E+00
76.46	1.2539E-01	7.1870E-02	0.0000E+00
86.80	8.0410E-02	4.2722E-02	0.0000E+00
98.14	4.6008E-02	2.3187E-02	0.0000E+00
110.00	1.9802E-02	1.0400E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E10C-1.5. Fission Power Distribution by Pin in MFF-3 at EOC 10C-1

CORE POSITION 2404

1.031 1.019 1.007 0.997 0.988 0.979 0.972 0.966

1.034 1.021 1.009 0.998 0.989 0.980 0.973 0.967 0.962

1.037 1.024 1.012 1.001 0.991 0.982 0.975 0.969 0.964 0.960

1.042 1.028 1.015 1.003 0.993 0.984 0.976 0.970 0.965 0.961 0.958

1.047 1.033 1.019 1.007 0.997 0.987 0.979 0.972 0.967 0.963 0.960 0.957

1.053 1.038 1.025 1.012 1.001 0.991 0.983 0.976 0.970 0.965 0.962 0.960 0.958

1.060 1.045 1.032 1.019 1.007 0.996 0.987 0.980 0.974 0.969 0.965 0.962 0.960 0.959

1.068 1.053 1.039 1.026 1.014 1.003 0.993 0.985 0.979 0.973 0.969 0.966 0.964 0.962 0.960

1.062 1.048 1.035 1.022 1.011 1.001 0.992 0.985 0.979 0.974 0.970 0.968 0.966 0.964

1.058 1.045 1.032 1.020 1.009 1.000 0.992 0.985 0.980 0.976 0.973 0.970 0.968

1.055 1.042 1.030 1.019 1.009 1.001 0.993 0.987 0.982 0.979 0.976 0.973

1.054 1.042 1.030 1.020 1.011 1.003 0.996 0.990 0.986 0.982 0.979

1.054 1.042 1.031 1.022 1.013 1.005 0.999 0.994 0.990 0.986

1.054 1.044 1.033 1.024 1.016 1.009 1.003 0.998 0.994

1.056 1.046 1.036 1.028 1.020 1.013 1.007 1.002

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Table E10C-1.7. Fast Flux Distribution by Pin in MFF-3 at EOC 10C-1

CORE POSITION 2404

0.953 0.956 0.958 0.958 0.957 0.953 0.948 0.941

0.963 0.967 0.970 0.970 0.970 0.967 0.962 0.955 0.947

0.973 0.977 0.980 0.982 0.981 0.979 0.975 0.969 0.961 0.952

0.982 0.986 0.990 0.992 0.992 0.990 0.987 0.981 0.974 0.965 0.955

0.990 0.995 0.998 1.001 1.001 1.000 0.998 0.993 0.986 0.978 0.968 0.957

0.997 1.002 1.006 1.009 1.010 1.009 1.007 1.003 0.997 0.989 0.980 0.969 0.957

1.002 1.008 1.012 1.015 1.017 1.017 1.015 1.012 1.006 0.999 0.991 0.981 0.969 0.956

1.007 1.012 1.017 1.020 1.022 1.023 1.022 1.019 1.014 1.008 1.000 0.991 0.980 0.968 0.955

1.016 1.020 1.024 1.026 1.027 1.027 1.025 1.021 1.015 1.008 1.000 0.989 0.978 0.965

1.023 1.026 1.029 1.030 1.030 1.029 1.026 1.021 1.015 1.007 0.998 0.987 0.975

1.027 1.030 1.032 1.032 1.031 1.029 1.025 1.020 1.013 1.004 0.995 0.984

1.030 1.032 1.033 1.032 1.030 1.027 1.023 1.017 1.009 1.001 0.991

1.031 1.032 1.032 1.031 1.028 1.024 1.019 1.013 1.005 0.996

1.030 1.030 1.029 1.028 1.025 1.020 1.015 1.008 1.000

1.027 1.027 1.026 1.023 1.020 1.015 1.009 1.002

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Table E10C-1.9. MFF-3 Duct Wall Fast Flux Data at EOC 10C-1

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5474E+15
SE	2.4106E+15
SW	2.3324E+15
W	2.3187E+15
NW	2.4150E+15
NE	2.5163E+15

Table E10C-1.10. Relative Fission Rates in MFF-3 at EOC 10C-1

Isotope	Fission Rate*
U-235	9.212E-01
U-238	7.085E-02
Pu-239	7.928E-03
Pu-240	6.953E-06
Pu-241	7.506E-08
Pu-242	2.220E-11
Am-241	2.393E-11
Total	2.273E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

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Table E10C-1.11. Composition of MFF-3 at EOC 10C-1

Axial Level	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
1	-128.05	-75.28			
			Na-23	5.3150E-03	5.3150E-03
			SS-316	6.4090E-02	6.4090E-02
2	-75.28	-62.78			
			Na-23	1.2240E-02	1.2240E-02
			HT-9	3.7700E-02	3.7700E-02
3	-62.78	-46.14			
			Na-23	1.0614E-02	1.0614E-02
			HT-9	2.2539E-02	2.2539E-02
			Inconel	2.1456E-02	2.1456E-02
4	-46.14	-30.76			
			U-235	3.0870E-03	2.9856E-03
			U-238	6.3240E-03	6.2964E-03
			Pu-239	0.0000E+00	2.1543E-05
			Pu-240	0.0000E+00	6.4154E-08
			Pu-241	0.0000E+00	1.2913E-10
			Pu-242	0.0000E+00	1.5756E-13
			Am-241	0.0000E+00	2.3589E-13
			FP	0.0000E+00	8.6335E-05
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.9614E-03
			U-238	6.3240E-03	6.2891E-03
			Pu-239	0.0000E+00	2.6373E-05
			Pu-240	0.0000E+00	8.7413E-08
			Pu-241	0.0000E+00	2.0534E-10
			Pu-242	0.0000E+00	2.9417E-13
			Am-241	0.0000E+00	3.7510E-13
			FP	0.0000E+00	1.0903E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.9490E-03
			U-238	6.3240E-03	6.2856E-03
			Pu-239	0.0000E+00	2.8937E-05
			Pu-240	0.0000E+00	1.0486E-07
			Pu-241	0.0000E+00	2.6994E-10
			Pu-242	0.0000E+00	4.2433E-13
			Am-241	0.0000E+00	4.9308E-13
			FP	0.0000E+00	1.1999E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.9547E-03
			U-238	6.3240E-03	6.2872E-03
			Pu-239	0.0000E+00	2.7738E-05

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			Pu-240	0.0000E+00	9.5996E-08
			Pu-241	0.0000E+00	2.3638E-10
			Pu-242	0.0000E+00	3.5533E-13
			Am-241	0.0000E+00	4.3180E-13
			FP	0.0000E+00	1.1504E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.9759E-03
			U-238	6.3240E-03	6.2932E-03
			Pu-239	0.0000E+00	2.3334E-05
			Pu-240	0.0000E+00	6.7781E-08
			Pu-241	0.0000E+00	1.4015E-10
			Pu-242	0.0000E+00	1.7658E-13
			Am-241	0.0000E+00	2.5604E-13
			FP	0.0000E+00	9.6543E-05
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	3.0062E-03
			U-238	6.3240E-03	6.3020E-03
			Pu-239	0.0000E+00	1.7172E-05
			Pu-240	0.0000E+00	3.9351E-08
			Pu-241	0.0000E+00	6.1955E-11
			Pu-242	0.0000E+00	5.9093E-14
			Am-241	0.0000E+00	1.1319E-13
			FP	0.0000E+00	6.9002E-05
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
10	46.14	62.78			
			Na-23	1.5970E-02	1.5970E-02
			HT-9	2.2539E-02	2.2539E-02
11	62.78	169.18			
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

5.11.2 Cycle 10C-3

Table B10C-3.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at BOC 10C-3

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *	
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	7.696E+00	0.000E+00	7.696E+00
2304	1.000E-01	4.249E+00	5.583E-02	4.405E+00
2303	1.372E-01	1.736E+00	6.634E-02	1.939E+00
2403	1.591E-02	3.689E+00	8.706E-03	3.714E+00
2505	1.379E-02	3.908E+00	8.228E-03	3.930E+00
2506	9.952E-03	4.557E+00	7.521E-03	4.574E+00
2405	1.418E-02	3.914E+00	1.021E-02	3.939E+00

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Table B10C-3.2. Assembly Averaged Total and Fast Flux in MFF-3 at BOC 10C-3

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.699E+15	2.473E+15

Table B10C-3.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 10C-3

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8179E-02	1.4039E-02	0.0000E+00
-92.78	6.0439E-02	2.7072E-02	0.0000E+00
-87.78	9.6806E-02	4.3279E-02	0.0000E+00
-82.78	1.3999E-01	6.4493E-02	0.0000E+00
-77.78	1.9265E-01	9.2930E-02	0.0000E+00
-72.15	2.5337E-01	1.3020E-01	0.0000E+00
-65.90	3.1782E-01	1.7880E-01	0.0000E+00
-60.35	3.9537E-01	2.4557E-01	0.0000E+00
-55.49	4.8609E-01	3.3392E-01	0.0000E+00
-50.62	5.7683E-01	4.4230E-01	0.0000E+00
-47.17	6.3718E-01	5.3794E-01	0.0000E+00
-43.58	7.0646E-01	6.6103E-01	7.8485E-01
-38.45	8.1974E-01	8.0294E-01	8.4453E-01
-33.32	9.2608E-01	9.2283E-01	9.3259E-01
-28.20	1.0194E+00	1.0230E+00	1.0117E+00
-23.07	1.0975E+00	1.1048E+00	1.0854E+00
-17.94	1.1587E+00	1.1679E+00	1.1441E+00
-12.82	1.2022E+00	1.2122E+00	1.1824E+00
-7.69	1.2277E+00	1.2381E+00	1.2071E+00
-2.56	1.2349E+00	1.2454E+00	1.2139E+00
2.56	1.2237E+00	1.2343E+00	1.2043E+00
7.69	1.1939E+00	1.2046E+00	1.1749E+00
12.82	1.1463E+00	1.1568E+00	1.1278E+00
17.94	1.0819E+00	1.0920E+00	1.0701E+00
23.07	1.0019E+00	1.0106E+00	9.9173E-01
28.20	9.0819E-01	9.1396E-01	9.0098E-01
33.32	8.0244E-01	8.0286E-01	8.0710E-01
38.45	6.8627E-01	6.7605E-01	7.0267E-01
43.58	5.6270E-01	5.3055E-01	6.1390E-01
47.17	4.8275E-01	4.1577E-01	0.0000E+00
50.62	4.2194E-01	3.3716E-01	0.0000E+00
55.49	3.3680E-01	2.4707E-01	0.0000E+00
60.35	2.5894E-01	1.7578E-01	0.0000E+00
64.98	2.0320E-01	1.3004E-01	0.0000E+00
69.39	1.6922E-01	1.0381E-01	0.0000E+00
76.46	1.2520E-01	7.1752E-02	0.0000E+00
86.80	8.0249E-02	4.2628E-02	0.0000E+00
98.14	4.5895E-02	2.3121E-02	0.0000E+00
110.00	1.9745E-02	1.0365E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B10C-3.5. Fission Power Distribution by Pin in MFF-3 at BOC 10C-3

CORE POSITION 2404

1.032 1.019 1.007 0.997 0.988 0.979 0.972 0.966

1.034 1.021 1.009 0.999 0.989 0.981 0.973 0.967 0.962

1.038 1.024 1.012 1.001 0.991 0.982 0.975 0.969 0.964 0.959

1.042 1.028 1.015 1.004 0.993 0.984 0.976 0.970 0.965 0.961 0.958

1.047 1.033 1.020 1.007 0.997 0.987 0.979 0.972 0.967 0.963 0.960 0.957

1.053 1.039 1.025 1.013 1.001 0.991 0.983 0.976 0.970 0.965 0.962 0.959 0.957

1.060 1.046 1.032 1.019 1.007 0.996 0.987 0.980 0.974 0.969 0.965 0.962 0.960 0.958

1.068 1.054 1.040 1.026 1.014 1.003 0.993 0.985 0.978 0.973 0.969 0.966 0.963 0.962 0.960

1.063 1.048 1.035 1.022 1.011 1.001 0.992 0.985 0.979 0.974 0.970 0.968 0.966 0.964

1.058 1.045 1.032 1.020 1.009 1.000 0.992 0.985 0.980 0.976 0.973 0.970 0.968

1.055 1.043 1.030 1.019 1.009 1.001 0.993 0.987 0.982 0.979 0.976 0.973

1.054 1.042 1.030 1.020 1.011 1.003 0.996 0.990 0.986 0.982 0.979

1.054 1.042 1.031 1.022 1.013 1.005 0.999 0.994 0.989 0.986

1.055 1.044 1.033 1.024 1.016 1.009 1.003 0.998 0.993

1.056 1.046 1.036 1.028 1.020 1.013 1.007 1.002

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Table B10C-3.7. Fast Flux Distribution by Pin in MFF-3 at BOC 10C-3

CORE POSITION 2404

0.953 0.956 0.958 0.958 0.957 0.953 0.948 0.941

0.963 0.967 0.970 0.970 0.969 0.967 0.962 0.955 0.947

0.973 0.977 0.980 0.982 0.981 0.979 0.975 0.969 0.961 0.952

0.982 0.987 0.990 0.992 0.992 0.990 0.987 0.981 0.974 0.965 0.955

0.990 0.995 0.999 1.001 1.001 1.000 0.997 0.993 0.986 0.978 0.968 0.956

0.997 1.002 1.006 1.009 1.010 1.009 1.007 1.003 0.997 0.989 0.980 0.969 0.957

1.003 1.008 1.012 1.015 1.017 1.017 1.015 1.012 1.006 0.999 0.991 0.980 0.969 0.956

1.007 1.013 1.017 1.020 1.022 1.023 1.022 1.019 1.014 1.008 1.000 0.991 0.980 0.968 0.954

1.016 1.021 1.024 1.026 1.027 1.027 1.025 1.021 1.015 1.008 0.999 0.989 0.978 0.965

1.023 1.026 1.029 1.030 1.030 1.029 1.026 1.021 1.015 1.007 0.998 0.987 0.975

1.027 1.030 1.032 1.032 1.031 1.029 1.025 1.020 1.013 1.004 0.994 0.983

1.030 1.032 1.033 1.032 1.031 1.027 1.023 1.017 1.009 1.001 0.990

1.031 1.032 1.032 1.031 1.028 1.024 1.019 1.013 1.005 0.996

1.030 1.030 1.029 1.028 1.025 1.020 1.015 1.008 1.000

1.027 1.027 1.026 1.023 1.020 1.015 1.009 1.002

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Table B10C-3.9. MFF-3 Duct Wall Fast Flux Data at BOC 10C-3

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5416E+15
SE	2.4053E+15
SW	2.3265E+15
W	2.3124E+15
NW	2.4085E+15
NE	2.5104E+15

Table B10C-3.10. Relative Fission Rates in MFF-3 at BOC 10C-3

Isotope	Fission Rate*
U-235	9.208E-01
U-238	7.084E-02
Pu-239	8.333E-03
Pu-240	7.680E-06
Pu-241	8.701E-08
Pu-242	2.706E-11
Am-241	5.558E-11
Total	2.266E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E10C-3.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at EOC 10C-3

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	ABOVE CORE	* * * * * * TOTAL PWR
2404	0.000E+00	7.525E+00	0.000E+00	7.525E+00
2304	1.009E-01	4.155E+00	6.042E-02	4.317E+00
2303	1.385E-01	1.783E+00	7.199E-02	1.994E+00
2403	1.605E-02	3.683E+00	9.560E-03	3.709E+00
2505	1.387E-02	3.896E+00	8.998E-03	3.919E+00
2506	1.017E-02	4.459E+00	8.177E-03	4.478E+00
2405	1.430E-02	3.834E+00	1.099E-02	3.859E+00

Table E10C-3.2. Assembly Averaged Total and Fast Flux in MFF-3 at EOC 10C-3

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.693E+15	2.457E+15

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Table E10C-3.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 10C-3

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.7426E-02	1.3723E-02	0.0000E+00
-92.78	5.8825E-02	2.6462E-02	0.0000E+00
-87.78	9.4218E-02	4.2299E-02	0.0000E+00
-82.78	1.3624E-01	6.3026E-02	0.0000E+00
-77.78	1.8749E-01	9.0803E-02	0.0000E+00
-72.15	2.4659E-01	1.2720E-01	0.0000E+00
-65.90	3.0925E-01	1.7460E-01	0.0000E+00
-60.35	3.8459E-01	2.3965E-01	0.0000E+00
-55.49	4.7270E-01	3.2555E-01	0.0000E+00
-50.62	5.6083E-01	4.3075E-01	0.0000E+00
-47.17	6.1934E-01	5.2345E-01	0.0000E+00
-43.58	6.8646E-01	6.4281E-01	7.6487E-01
-38.45	7.9691E-01	7.8095E-01	8.2356E-01
-33.32	9.0122E-01	8.9834E-01	9.1053E-01
-28.20	9.9363E-01	9.9719E-01	9.8469E-01
-23.07	1.0721E+00	1.0791E+00	1.0588E+00
-17.94	1.1351E+00	1.1438E+00	1.1193E+00
-12.82	1.1818E+00	1.1911E+00	1.1576E+00
-7.69	1.2119E+00	1.2216E+00	1.1868E+00
-2.56	1.2252E+00	1.2352E+00	1.1996E+00
2.56	1.2214E+00	1.2316E+00	1.1982E+00
7.69	1.2000E+00	1.2105E+00	1.1772E+00
12.82	1.1612E+00	1.1717E+00	1.1391E+00
17.94	1.1048E+00	1.1153E+00	1.0945E+00
23.07	1.0307E+00	1.0399E+00	1.0219E+00
28.20	9.3988E-01	9.4612E-01	9.3383E-01
33.32	8.3407E-01	8.3488E-01	8.4514E-01
38.45	7.1549E-01	7.0518E-01	7.3790E-01
43.58	5.8803E-01	5.5466E-01	6.4633E-01
47.17	5.0531E-01	4.3530E-01	0.0000E+00
50.62	4.4225E-01	3.5350E-01	0.0000E+00
55.49	3.5356E-01	2.5950E-01	0.0000E+00
60.35	2.7223E-01	1.8494E-01	0.0000E+00
64.98	2.1393E-01	1.3701E-01	0.0000E+00
69.39	1.7831E-01	1.0948E-01	0.0000E+00
76.46	1.3208E-01	7.5766E-02	0.0000E+00
86.80	8.4723E-02	4.5058E-02	0.0000E+00
98.14	4.8444E-02	2.4445E-02	0.0000E+00
110.00	2.0785E-02	1.0942E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E10C-3.5. Fission Power Distribution by Pin in MFF-3 at EOC 10C-3

CORE POSITION 2404

1.034 1.022 1.011 1.001 0.992 0.984 0.978 0.972

1.036 1.023 1.012 1.001 0.992 0.984 0.978 0.972 0.968

1.039 1.026 1.014 1.003 0.993 0.985 0.978 0.972 0.968 0.964

1.042 1.029 1.016 1.005 0.995 0.986 0.979 0.973 0.968 0.964 0.962

1.047 1.033 1.020 1.008 0.998 0.988 0.981 0.974 0.969 0.965 0.962 0.960

1.052 1.038 1.025 1.013 1.002 0.992 0.984 0.977 0.971 0.967 0.964 0.962 0.960

1.059 1.045 1.031 1.018 1.007 0.996 0.988 0.980 0.974 0.970 0.966 0.964 0.962 0.960

1.066 1.052 1.038 1.025 1.013 1.002 0.993 0.985 0.978 0.973 0.969 0.966 0.964 0.963 0.961

1.061 1.047 1.033 1.021 1.010 1.000 0.991 0.984 0.978 0.974 0.970 0.968 0.966 0.964

1.056 1.043 1.030 1.018 1.008 0.999 0.991 0.984 0.979 0.975 0.972 0.970 0.968

1.053 1.040 1.028 1.017 1.007 0.999 0.992 0.986 0.981 0.977 0.975 0.972

1.051 1.039 1.028 1.018 1.008 1.000 0.994 0.988 0.984 0.980 0.978

1.051 1.039 1.029 1.019 1.010 1.003 0.997 0.992 0.987 0.984

1.051 1.040 1.030 1.021 1.013 1.006 1.000 0.995 0.991

1.053 1.042 1.033 1.024 1.017 1.010 1.004 0.999

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Table E10C-3.7. Fast Flux Distribution by Pin in MFF-3 at EOC 10C-3

CORE POSITION 2404

0.956 0.960 0.962 0.962 0.961 0.957 0.952 0.945

0.966 0.970 0.973 0.973 0.973 0.970 0.965 0.959 0.951

0.975 0.979 0.982 0.984 0.984 0.982 0.978 0.972 0.964 0.955

0.983 0.988 0.991 0.993 0.994 0.992 0.989 0.984 0.977 0.968 0.958

0.991 0.996 0.999 1.002 1.003 1.002 0.999 0.994 0.988 0.980 0.970 0.959

0.997 1.002 1.006 1.009 1.010 1.010 1.008 1.004 0.998 0.990 0.981 0.971 0.959

1.002 1.008 1.012 1.015 1.017 1.017 1.015 1.012 1.007 1.000 0.991 0.981 0.970 0.957

1.007 1.012 1.016 1.020 1.022 1.022 1.021 1.018 1.014 1.008 1.000 0.991 0.980 0.968 0.955

1.015 1.019 1.023 1.025 1.026 1.026 1.024 1.020 1.015 1.008 0.999 0.989 0.978 0.965

1.021 1.025 1.027 1.029 1.029 1.027 1.024 1.020 1.014 1.006 0.997 0.986 0.975

1.026 1.028 1.030 1.030 1.029 1.027 1.023 1.018 1.011 1.003 0.993 0.982

1.028 1.030 1.031 1.030 1.028 1.025 1.021 1.015 1.007 0.999 0.989

1.028 1.029 1.029 1.028 1.026 1.022 1.017 1.011 1.003 0.994

1.027 1.027 1.027 1.025 1.022 1.018 1.012 1.005 0.997

1.024 1.024 1.023 1.020 1.017 1.012 1.006 0.999

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Table E10C-3.9. MFF-3 Duct Wall Fast Flux Data at EOC 10C-3

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5195E+15
SE	2.3931E+15
SW	2.3232E+15
W	2.3163E+15
NW	2.3889E+15
NE	2.4857E+15

Table E10C-3.10. Relative Fission Rates in MFF-3 at EOC 10C-3

Isotope	Fission Rate*
U-235	9.139E-01
U-238	7.111E-02
Pu-239	1.495E-02
Pu-240	2.456E-05
Pu-241	5.006E-07
Pu-242	2.754E-10
Am-241	3.209E-10
Total	2.215E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E10C-3.11. Composition of MFF-3 at EOC 10C-3

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.9011E-03
			U-238	6.3240E-03	6.2728E-03
			Pu-239	0.0000E+00	3.9479E-05
			Pu-240	0.0000E+00	2.1987E-07
			Pu-241	0.0000E+00	8.1825E-10
			Pu-242	0.0000E+00	1.8632E-12
			Am-241	0.0000E+00	3.0851E-12
			FP	0.0000E+00	1.5870E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.8570E-03
			U-238	6.3240E-03	6.2592E-03
			Pu-239	0.0000E+00	4.8274E-05
			Pu-240	0.0000E+00	3.0049E-07
			Pu-241	0.0000E+00	1.3078E-09
			Pu-242	0.0000E+00	3.5068E-12
			Am-241	0.0000E+00	4.9100E-12
			FP	0.0000E+00	2.0038E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.8334E-03
			U-238	6.3240E-03	6.2523E-03
			Pu-239	0.0000E+00	5.3148E-05
			Pu-240	0.0000E+00	3.6416E-07
			Pu-241	0.0000E+00	1.7460E-09
			Pu-242	0.0000E+00	5.1675E-12
			Am-241	0.0000E+00	6.5112E-12
			FP	0.0000E+00	2.2142E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.8421E-03
			U-238	6.3240E-03	6.2548E-03
			Pu-239	0.0000E+00	5.1323E-05
			Pu-240	0.0000E+00	3.3845E-07
			Pu-241	0.0000E+00	1.5635E-09
			Pu-242	0.0000E+00	4.4568E-12
			Am-241	0.0000E+00	5.7804E-12
			FP	0.0000E+00	2.1379E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.8803E-03
			U-238	6.3240E-03	6.2659E-03
			Pu-239	0.0000E+00	4.3389E-05
			Pu-240	0.0000E+00	2.4017E-07
			Pu-241	0.0000E+00	9.3385E-10
			Pu-242	0.0000E+00	2.2330E-12
			Am-241	0.0000E+00	3.4502E-12
			FP	0.0000E+00	1.8013E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.9362E-03
			U-238	6.3240E-03	6.2825E-03
			Pu-239	0.0000E+00	3.2056E-05
			Pu-240	0.0000E+00	1.3957E-07
			Pu-241	0.0000E+00	4.1324E-10
			Pu-242	0.0000E+00	7.4668E-13
			Am-241	0.0000E+00	1.5302E-12
			FP	0.0000E+00	1.2908E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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5.11.3 Cycle 11A-1

Table B11A-1.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at BOC 11A-1

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	ABOVE CORE	* * * * * * TOTAL PWR
2404	0.000E+00	7.389E+00	0.000E+00	7.389E+00
2304	1.074E-01	4.083E+00	5.701E-02	4.247E+00
2303	1.527E-02	4.361E+00	9.801E-03	4.386E+00
2403	1.489E-02	3.775E+00	8.331E-03	3.798E+00
2505	1.330E-02	4.057E+00	6.871E-03	4.077E+00
2506	6.286E-02	3.949E+00	3.810E-02	4.050E+00
2405	1.469E-02	3.724E+00	1.003E-02	3.749E+00

Table B11A-1.2. Assembly Averaged Total and Fast Flux in MFF-3 at BOC 11A-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.655E+15	2.477E+15

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Table B11A-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11A-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9206E-02	1.4397E-02	0.0000E+00
-92.78	6.2607E-02	2.7772E-02	0.0000E+00
-87.78	1.0025E-01	4.4419E-02	0.0000E+00
-82.78	1.4494E-01	6.6225E-02	0.0000E+00
-77.78	1.9947E-01	9.5483E-02	0.0000E+00
-72.15	2.6270E-01	1.3401E-01	0.0000E+00
-65.90	3.3044E-01	1.8473E-01	0.0000E+00
-60.35	4.1095E-01	2.5404E-01	0.0000E+00
-55.49	5.0415E-01	3.4524E-01	0.0000E+00
-50.62	5.9717E-01	4.5723E-01	0.0000E+00
-47.17	6.5900E-01	5.5591E-01	0.0000E+00
-43.58	7.3004E-01	6.8263E-01	8.1643E-01
-38.45	8.4506E-01	8.2747E-01	8.7466E-01
-33.32	9.5159E-01	9.4801E-01	9.6235E-01
-28.20	1.0435E+00	1.0466E+00	1.0350E+00
-23.07	1.1185E+00	1.1252E+00	1.1056E+00
-17.94	1.1750E+00	1.1834E+00	1.1596E+00
-12.82	1.2122E+00	1.2212E+00	1.1883E+00
-7.69	1.2301E+00	1.2393E+00	1.2051E+00
-2.56	1.2289E+00	1.2386E+00	1.2031E+00
2.56	1.2099E+00	1.2201E+00	1.1862E+00
7.69	1.1745E+00	1.1851E+00	1.1509E+00
12.82	1.1243E+00	1.1351E+00	1.1014E+00
17.94	1.0602E+00	1.0711E+00	1.0485E+00
23.07	9.8244E-01	9.9220E-01	9.7232E-01
28.20	8.9185E-01	8.9894E-01	8.8460E-01
33.32	7.8959E-01	7.9169E-01	7.9876E-01
38.45	6.7665E-01	6.6812E-01	6.9682E-01
43.58	5.5565E-01	5.2524E-01	6.1028E-01
47.17	4.7674E-01	4.1200E-01	0.0000E+00
50.62	4.1676E-01	3.3423E-01	0.0000E+00
55.49	3.3315E-01	2.4508E-01	0.0000E+00
60.35	2.5679E-01	1.7458E-01	0.0000E+00
64.98	2.0194E-01	1.2919E-01	0.0000E+00
69.39	1.6806E-01	1.0285E-01	0.0000E+00
76.46	1.2402E-01	7.0565E-02	0.0000E+00
86.80	7.9381E-02	4.1547E-02	0.0000E+00
98.14	4.5698E-02	2.2434E-02	0.0000E+00
110.00	1.9702E-02	1.0021E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11A-1.5. Fission Power Distribution by Pin in MFF-3 at BOC 11A-1

CORE POSITION 2404

1.037 1.024 1.012 1.001 0.991 0.982 0.975 0.967

1.039 1.026 1.014 1.003 0.993 0.984 0.976 0.969 0.963

1.042 1.029 1.017 1.005 0.995 0.986 0.978 0.971 0.965 0.960

1.046 1.033 1.020 1.008 0.997 0.988 0.979 0.972 0.966 0.961 0.957

1.051 1.037 1.024 1.012 1.000 0.991 0.982 0.975 0.968 0.963 0.959 0.956

1.057 1.042 1.029 1.016 1.005 0.994 0.985 0.978 0.971 0.966 0.962 0.958 0.955

1.063 1.049 1.035 1.022 1.010 0.999 0.990 0.981 0.975 0.969 0.964 0.961 0.958 0.955

1.071 1.056 1.042 1.029 1.016 1.005 0.995 0.986 0.979 0.973 0.968 0.964 0.961 0.959 0.956

1.064 1.050 1.037 1.024 1.012 1.002 0.993 0.985 0.978 0.973 0.968 0.965 0.962 0.960

1.059 1.046 1.033 1.021 1.010 1.000 0.991 0.984 0.978 0.973 0.969 0.966 0.964

1.055 1.042 1.030 1.019 1.008 0.999 0.991 0.985 0.979 0.975 0.971 0.968

1.053 1.040 1.029 1.018 1.008 1.000 0.993 0.987 0.981 0.977 0.974

1.052 1.040 1.029 1.019 1.010 1.002 0.995 0.989 0.984 0.980

1.051 1.040 1.030 1.020 1.011 1.004 0.997 0.992 0.987

1.052 1.041 1.031 1.022 1.014 1.007 1.000 0.995

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Table B11A-1.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11A-1

CORE POSITION 2404

0.988 0.986 0.982 0.977 0.971 0.964 0.956 0.946

0.998 0.996 0.993 0.989 0.984 0.977 0.969 0.961 0.950

1.007 1.005 1.003 1.000 0.995 0.989 0.982 0.974 0.964 0.953

1.014 1.013 1.011 1.009 1.005 1.000 0.993 0.985 0.976 0.966 0.955

1.019 1.019 1.018 1.016 1.013 1.009 1.003 0.996 0.987 0.978 0.967 0.955

1.023 1.024 1.023 1.022 1.020 1.016 1.011 1.004 0.997 0.988 0.978 0.966 0.954

1.025 1.026 1.027 1.026 1.024 1.022 1.017 1.012 1.005 0.996 0.987 0.976 0.964 0.952

1.026 1.028 1.029 1.029 1.028 1.025 1.022 1.017 1.011 1.003 0.994 0.984 0.973 0.961 0.948

1.027 1.029 1.029 1.029 1.027 1.025 1.021 1.015 1.009 1.001 0.991 0.981 0.969 0.956

1.027 1.028 1.029 1.028 1.026 1.023 1.018 1.012 1.005 0.996 0.987 0.976 0.964

1.026 1.027 1.027 1.025 1.023 1.019 1.014 1.008 1.000 0.991 0.981 0.970

1.023 1.024 1.023 1.021 1.018 1.014 1.009 1.002 0.994 0.984 0.974

1.019 1.019 1.018 1.016 1.013 1.008 1.002 0.995 0.986 0.977

1.014 1.014 1.012 1.010 1.006 1.001 0.994 0.987 0.978

1.008 1.007 1.005 1.002 0.998 0.993 0.986 0.978

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Table B11A-1.9. MFF-3 Duct Wall Fast Flux Data at BOC 11A-1

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5254E+15
SE	2.5070E+15
SW	2.3746E+15
W	2.3167E+15
NW	2.3702E+15
NE	2.4530E+15

Table B11A-1.10. Relative Fission Rates in MFF-3 at BOC 11A-1

Isotope	Fission Rate*
U-235	9.107E-01
U-238	7.420E-02
Pu-239	1.504E-02
Pu-240	2.539E-05
Pu-241	4.956E-07
Pu-242	2.847E-10
Am-241	9.416E-10
Total	2.175E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

5.11.4 Cycle 11A-2

Table B11A-2.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at BOC 11A-2

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	* * * * * * ABOVE CORE	TOTAL PWR
2404	0.000E+00	7.405E+00	0.000E+00	7.405E+00
2304	1.057E-01	4.052E+00	5.786E-02	4.215E+00
2303	1.515E-02	4.361E+00	9.980E-03	4.386E+00
2403	1.490E-02	3.856E+00	8.546E-03	3.880E+00
2505	1.328E-02	4.155E+00	7.053E-03	4.176E+00
2506	6.270E-02	3.953E+00	3.899E-02	4.055E+00
2405	1.448E-02	3.705E+00	1.019E-02	3.730E+00

Table B11A-2.2. Assembly Averaged Total and Fast Flux in MFF-3 at BOC 11A-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.676E+15	2.483E+15

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Table B11A-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11A-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8430E-02	1.4046E-02	0.0000E+00
-92.78	6.0959E-02	2.7098E-02	0.0000E+00
-87.78	9.7637E-02	4.3348E-02	0.0000E+00
-82.78	1.4120E-01	6.4641E-02	0.0000E+00
-77.78	1.9439E-01	9.3221E-02	0.0000E+00
-72.15	2.5613E-01	1.3086E-01	0.0000E+00
-65.90	3.2233E-01	1.8045E-01	0.0000E+00
-60.35	4.0102E-01	2.4820E-01	0.0000E+00
-55.49	4.9220E-01	3.3734E-01	0.0000E+00
-50.62	5.8320E-01	4.4677E-01	0.0000E+00
-47.17	6.4364E-01	5.4317E-01	0.0000E+00
-43.58	7.1303E-01	6.6694E-01	7.9774E-01
-38.45	8.2636E-01	8.0936E-01	8.5560E-01
-33.32	9.3232E-01	9.2899E-01	9.4321E-01
-28.20	1.0249E+00	1.0281E+00	1.0160E+00
-23.07	1.1022E+00	1.1088E+00	1.0888E+00
-17.94	1.1624E+00	1.1708E+00	1.1466E+00
-12.82	1.2048E+00	1.2136E+00	1.1800E+00
-7.69	1.2291E+00	1.2382E+00	1.2034E+00
-2.56	1.2350E+00	1.2443E+00	1.2088E+00
2.56	1.2224E+00	1.2321E+00	1.1990E+00
7.69	1.1912E+00	1.2012E+00	1.1680E+00
12.82	1.1422E+00	1.1526E+00	1.1193E+00
17.94	1.0767E+00	1.0874E+00	1.0658E+00
23.07	9.9617E-01	1.0059E+00	9.8634E-01
28.20	9.0244E-01	9.0958E-01	8.9527E-01
33.32	7.9731E-01	7.9950E-01	8.0770E-01
38.45	6.8204E-01	6.7362E-01	7.0333E-01
43.58	5.5941E-01	5.2897E-01	6.1527E-01
47.17	4.7995E-01	4.1491E-01	0.0000E+00
50.62	4.1951E-01	3.3658E-01	0.0000E+00
55.49	3.3518E-01	2.4676E-01	0.0000E+00
60.35	2.5819E-01	1.7573E-01	0.0000E+00
64.98	2.0288E-01	1.3000E-01	0.0000E+00
69.39	1.6872E-01	1.0345E-01	0.0000E+00
76.46	1.2427E-01	7.0907E-02	0.0000E+00
86.80	7.9110E-02	4.1634E-02	0.0000E+00
98.14	4.4926E-02	2.2326E-02	0.0000E+00
110.00	1.9176E-02	9.8954E-03	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11A-2.5. Fission Power Distribution by Pin in MFF-3 at BOC 11A-2

CORE POSITION 2404

1.040 1.028 1.017 1.007 0.998 0.990 0.983 0.977

1.041 1.029 1.018 1.008 0.998 0.990 0.983 0.977 0.972

1.043 1.031 1.019 1.008 0.999 0.990 0.983 0.977 0.972 0.968

1.046 1.033 1.021 1.010 1.000 0.991 0.983 0.977 0.972 0.968 0.964

1.049 1.036 1.024 1.012 1.002 0.992 0.984 0.978 0.972 0.968 0.965 0.962

1.054 1.040 1.027 1.015 1.005 0.995 0.986 0.979 0.974 0.969 0.966 0.963 0.961

1.060 1.046 1.032 1.020 1.009 0.999 0.990 0.982 0.976 0.971 0.967 0.964 0.962 0.960

1.066 1.052 1.039 1.026 1.014 1.003 0.994 0.986 0.979 0.974 0.969 0.966 0.964 0.962 0.960

1.059 1.046 1.033 1.021 1.010 1.000 0.991 0.984 0.978 0.973 0.969 0.966 0.964 0.962

1.054 1.041 1.029 1.017 1.007 0.997 0.989 0.983 0.977 0.973 0.970 0.967 0.965

1.050 1.037 1.026 1.015 1.005 0.996 0.989 0.983 0.978 0.974 0.971 0.969

1.047 1.035 1.024 1.014 1.005 0.997 0.990 0.984 0.980 0.976 0.973

1.046 1.034 1.024 1.014 1.006 0.998 0.992 0.986 0.982 0.978

1.045 1.034 1.024 1.015 1.007 1.000 0.994 0.989 0.984

1.046 1.035 1.026 1.017 1.009 1.003 0.997 0.991

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Table B11A-2.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11A-2

CORE POSITION 2404

0.991 0.989 0.986 0.982 0.977 0.970 0.963 0.954

1.000 0.999 0.996 0.993 0.988 0.982 0.975 0.967 0.957

1.007 1.007 1.005 1.002 0.998 0.993 0.986 0.979 0.970 0.960

1.013 1.013 1.012 1.010 1.007 1.002 0.996 0.989 0.981 0.971 0.961

1.018 1.018 1.018 1.017 1.014 1.010 1.005 0.998 0.991 0.982 0.971 0.960

1.021 1.022 1.022 1.022 1.020 1.016 1.012 1.006 0.999 0.991 0.981 0.970 0.958

1.022 1.024 1.025 1.025 1.024 1.021 1.017 1.012 1.006 0.998 0.989 0.979 0.968 0.955

1.022 1.024 1.026 1.026 1.026 1.024 1.021 1.017 1.011 1.004 0.996 0.986 0.975 0.964 0.951

1.023 1.025 1.026 1.026 1.025 1.023 1.020 1.015 1.008 1.001 0.992 0.982 0.971 0.959

1.023 1.025 1.025 1.025 1.023 1.021 1.017 1.011 1.004 0.996 0.987 0.977 0.965

1.021 1.023 1.023 1.022 1.020 1.017 1.012 1.006 0.999 0.990 0.981 0.970

1.018 1.019 1.019 1.018 1.015 1.012 1.006 1.000 0.992 0.984 0.973

1.014 1.015 1.014 1.012 1.009 1.005 1.000 0.993 0.985 0.976

1.009 1.009 1.008 1.006 1.002 0.998 0.992 0.985 0.976

1.003 1.002 1.001 0.998 0.994 0.989 0.983 0.976

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Table B11A-2.9. MFF-3 Duct Wall Fast Flux Data at BOC 11A-2

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.5209E+15
SE	2.5110E+15
SW	2.3968E+15
W	2.3395E+15
NW	2.3759E+15
NE	2.4483E+15

Table B11A-2.10. Relative Fission Rates in MFF-3 at BOC 11A-2

Isotope	Fission Rate*
U-235	9.096E-01
U-238	7.359E-02
Pu-239	1.658E-02
Pu-240	3.036E-05
Pu-241	6.647E-07
Pu-242	4.169E-10
Am-241	1.189`E-09
Total	2.180E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

5.11.5 Cycle 11A-3

Table B11A-3.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at BOC 11A-3

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	* * * * * * ABOVE CORE	TOTAL PWR
2404	0.000E+00	7.267E+00	0.000E+00	7.267E+00
2304	1.059E-01	3.998E+00	5.781E-02	4.162E+00
2303	1.515E-02	4.290E+00	9.950E-03	4.315E+00
2403	1.483E-02	3.782E+00	8.474E-03	3.805E+00
2505	1.318E-02	4.068E+00	6.983E-03	4.088E+00
2506	6.279E-02	3.874E+00	3.882E-02	3.975E+00
2405	1.447E-02	3.649E+00	1.014E-02	3.673E+00

Table B11A-3.2. Assembly Averaged Total and Fast Flux in MFF-3 at BOC 11A-3

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.623E+15	2.444E+15

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Table B11A-3.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11A-3

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8597E-02	1.4140E-02	0.0000E+00
-92.78	6.1317E-02	2.7277E-02	0.0000E+00
-87.78	9.8200E-02	4.3623E-02	0.0000E+00
-82.78	1.4199E-01	6.5034E-02	0.0000E+00
-77.78	1.9544E-01	9.3759E-02	0.0000E+00
-72.15	2.5743E-01	1.3157E-01	0.0000E+00
-65.90	3.2379E-01	1.8131E-01	0.0000E+00
-60.35	4.0260E-01	2.4921E-01	0.0000E+00
-55.49	4.9381E-01	3.3847E-01	0.0000E+00
-50.62	5.8472E-01	4.4795E-01	0.0000E+00
-47.17	6.4504E-01	5.4434E-01	0.0000E+00
-43.58	7.1422E-01	6.6813E-01	7.9975E-01
-38.45	8.2736E-01	8.1044E-01	8.5729E-01
-33.32	9.3314E-01	9.2991E-01	9.4471E-01
-28.20	1.0255E+00	1.0288E+00	1.0162E+00
-23.07	1.1025E+00	1.1092E+00	1.0888E+00
-17.94	1.1625E+00	1.1709E+00	1.1464E+00
-12.82	1.2047E+00	1.2134E+00	1.1789E+00
-7.69	1.2288E+00	1.2378E+00	1.2020E+00
-2.56	1.2345E+00	1.2438E+00	1.2073E+00
2.56	1.2218E+00	1.2314E+00	1.1976E+00
7.69	1.1906E+00	1.2005E+00	1.1666E+00
12.82	1.1416E+00	1.1519E+00	1.1180E+00
17.94	1.0762E+00	1.0868E+00	1.0655E+00
23.07	9.9569E-01	1.0054E+00	9.8612E-01
28.20	9.0211E-01	9.0929E-01	8.9515E-01
33.32	7.9715E-01	7.9944E-01	8.0880E-01
38.45	6.8207E-01	6.7375E-01	7.0446E-01
43.58	5.5964E-01	5.2922E-01	6.1654E-01
47.17	4.8034E-01	4.1521E-01	0.0000E+00
50.62	4.1999E-01	3.3696E-01	0.0000E+00
55.49	3.3576E-01	2.4717E-01	0.0000E+00
60.35	2.5879E-01	1.7613E-01	0.0000E+00
64.98	2.0347E-01	1.3037E-01	0.0000E+00
69.39	1.6928E-01	1.0379E-01	0.0000E+00
76.46	1.2476E-01	7.1196E-02	0.0000E+00
86.80	7.9480E-02	4.1840E-02	0.0000E+00
98.14	4.5157E-02	2.2450E-02	0.0000E+00
110.00	1.9279E-02	9.9536E-03	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11A-3.5. Fission Power Distribution by Pin in MFF-3 at BOC 11A-3

CORE POSITION 2404

1.040 1.028 1.017 1.007 0.997 0.989 0.982 0.976

1.042 1.029 1.018 1.007 0.998 0.989 0.982 0.976 0.970

1.044 1.031 1.019 1.008 0.998 0.989 0.982 0.976 0.970 0.966

1.047 1.033 1.021 1.010 0.999 0.990 0.983 0.976 0.971 0.966 0.963

1.050 1.037 1.024 1.012 1.001 0.992 0.984 0.977 0.971 0.967 0.963 0.960

1.055 1.041 1.028 1.016 1.005 0.995 0.986 0.979 0.973 0.968 0.964 0.961 0.959

1.061 1.047 1.033 1.021 1.009 0.999 0.990 0.982 0.975 0.970 0.966 0.963 0.960 0.958

1.068 1.054 1.040 1.027 1.015 1.004 0.994 0.986 0.979 0.973 0.969 0.965 0.962 0.960 0.958

1.061 1.047 1.034 1.022 1.010 1.000 0.991 0.984 0.977 0.972 0.968 0.965 0.963 0.961

1.056 1.043 1.030 1.018 1.007 0.998 0.990 0.983 0.977 0.972 0.969 0.966 0.964

1.052 1.039 1.027 1.016 1.006 0.997 0.989 0.983 0.978 0.974 0.970 0.968

1.049 1.037 1.025 1.015 1.005 0.997 0.990 0.984 0.979 0.975 0.972

1.048 1.036 1.025 1.015 1.006 0.998 0.992 0.986 0.982 0.978

1.047 1.036 1.026 1.016 1.008 1.000 0.994 0.989 0.984

1.048 1.037 1.027 1.018 1.010 1.003 0.997 0.991

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Table B11A-3.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11A-3

CORE POSITION 2404

0.991 0.989 0.986 0.981 0.976 0.969 0.961 0.952

1.000 0.999 0.996 0.992 0.987 0.981 0.974 0.966 0.956

1.008 1.007 1.005 1.002 0.998 0.992 0.986 0.978 0.968 0.958

1.014 1.014 1.012 1.010 1.007 1.002 0.996 0.988 0.980 0.970 0.959

1.019 1.019 1.018 1.017 1.014 1.010 1.004 0.998 0.990 0.981 0.970 0.959

1.022 1.023 1.023 1.022 1.020 1.016 1.012 1.006 0.998 0.990 0.980 0.969 0.957

1.023 1.025 1.026 1.025 1.024 1.021 1.017 1.012 1.005 0.997 0.988 0.978 0.966 0.954

1.024 1.026 1.027 1.027 1.026 1.024 1.021 1.017 1.011 1.004 0.995 0.985 0.974 0.962 0.950

1.025 1.026 1.027 1.027 1.026 1.024 1.020 1.015 1.008 1.000 0.991 0.981 0.970 0.957

1.024 1.026 1.026 1.026 1.024 1.021 1.017 1.011 1.004 0.996 0.986 0.976 0.964

1.023 1.024 1.024 1.023 1.021 1.017 1.012 1.006 0.999 0.990 0.980 0.969

1.020 1.021 1.020 1.019 1.016 1.012 1.007 1.000 0.992 0.983 0.973

1.016 1.016 1.015 1.013 1.010 1.005 1.000 0.993 0.984 0.975

1.011 1.010 1.009 1.007 1.003 0.998 0.992 0.984 0.976

1.004 1.004 1.002 0.999 0.995 0.989 0.983 0.975

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Table B11A-3.9. MFF-3 Duct Wall Fast Flux Data at BOC 11A-3

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.4858E+15
SE	2.4752E+15
SW	2.3566E+15
W	2.2983E+15
NW	2.3356E+15
NE	2.4114E+15

Table B11A-3.10. Relative Fission Rates in MFF-3 at BOC 11A-3

Isotope	Fission Rate*
U-235	9.082E-01
U-238	7.376E-02
Pu-239	1.803E-02
Pu-240	3.618E-05
Pu-241	8.502E-07
Pu-242	5.806E-10
Am-241	1.619E-09
Total	2.140E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11A-3.1. Fission Power Generated in MFF-3 and Neighboring Assemblies at EOC 11A-3

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	7.004E+00	0.000E+00	7.004E+00
2304	1.079E-01	3.857E+00	6.854E-02	4.034E+00
2303	1.583E-02	4.167E+00	1.185E-02	4.195E+00
2403	1.539E-02	3.774E+00	1.065E-02	3.800E+00
2505	1.348E-02	4.059E+00	8.834E-03	4.082E+00
2506	6.721E-02	3.748E+00	4.791E-02	3.863E+00
2405	1.479E-02	3.540E+00	1.191E-02	3.566E+00

Table E11A-3.2. Assembly Averaged Total and Fast Flux in MFF-3 at EOC 11A-3

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.633E+15	2.428E+15

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Table E11A-3.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 11A-3

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.7173E-02	1.3550E-02	0.0000E+00
-92.78	5.8265E-02	2.6134E-02	0.0000E+00
-87.78	9.3312E-02	4.1790E-02	0.0000E+00
-82.78	1.3492E-01	6.2283E-02	0.0000E+00
-77.78	1.8571E-01	8.9762E-02	0.0000E+00
-72.15	2.4460E-01	1.2591E-01	0.0000E+00
-65.90	3.0756E-01	1.7341E-01	0.0000E+00
-60.35	3.8221E-01	2.3807E-01	0.0000E+00
-55.49	4.6862E-01	3.2277E-01	0.0000E+00
-50.62	5.5469E-01	4.2633E-01	0.0000E+00
-47.17	6.1169E-01	5.1731E-01	0.0000E+00
-43.58	6.7699E-01	6.3426E-01	7.6157E-01
-38.45	7.8477E-01	7.6964E-01	8.1730E-01
-33.32	8.8665E-01	8.8423E-01	9.0246E-01
-28.20	9.7705E-01	9.8031E-01	9.6468E-01
-23.07	1.0544E+00	1.0606E+00	1.0377E+00
-17.94	1.1172E+00	1.1248E+00	1.0980E+00
-12.82	1.1646E+00	1.1723E+00	1.1302E+00
-7.69	1.1967E+00	1.2046E+00	1.1609E+00
-2.56	1.2129E+00	1.2212E+00	1.1764E+00
2.56	1.2132E+00	1.2221E+00	1.1814E+00
7.69	1.1969E+00	1.2064E+00	1.1653E+00
12.82	1.1640E+00	1.1743E+00	1.1332E+00
17.94	1.1145E+00	1.1256E+00	1.1063E+00
23.07	1.0474E+00	1.0578E+00	1.0405E+00
28.20	9.6328E-01	9.7123E-01	9.5891E-01
33.32	8.6296E-01	8.6600E-01	8.8883E-01
38.45	7.4716E-01	7.3856E-01	7.8348E-01
43.58	6.1925E-01	5.8592E-01	6.9293E-01
47.17	5.3457E-01	4.6218E-01	0.0000E+00
50.62	4.6949E-01	3.7692E-01	0.0000E+00
55.49	3.7699E-01	2.7799E-01	0.0000E+00
60.35	2.9173E-01	1.9904E-01	0.0000E+00
64.98	2.3014E-01	1.4792E-01	0.0000E+00
69.39	1.9187E-01	1.1805E-01	0.0000E+00
76.46	1.4181E-01	8.1233E-02	0.0000E+00
86.80	9.0536E-02	4.7858E-02	0.0000E+00
98.14	5.1479E-02	2.5714E-02	0.0000E+00
110.00	2.1928E-02	1.1388E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11A-3.5. Fission Power Distribution by Pin in MFF-3 at EOC 11A-3

CORE POSITION 2404

1.044 1.033 1.022 1.013 1.005 0.998 0.992 0.986

1.044 1.032 1.022 1.012 1.003 0.996 0.990 0.984 0.980

1.045 1.033 1.021 1.011 1.002 0.994 0.988 0.982 0.978 0.974

1.046 1.034 1.022 1.012 1.002 0.994 0.987 0.981 0.976 0.973 0.970

1.049 1.036 1.024 1.013 1.003 0.994 0.987 0.981 0.976 0.972 0.969 0.966

1.053 1.040 1.027 1.015 1.005 0.996 0.988 0.981 0.976 0.971 0.968 0.966 0.964

1.058 1.044 1.031 1.019 1.008 0.998 0.990 0.983 0.977 0.972 0.968 0.966 0.964 0.962

1.064 1.050 1.037 1.024 1.013 1.002 0.993 0.985 0.979 0.974 0.970 0.967 0.965 0.963 0.961

1.057 1.044 1.031 1.019 1.008 0.998 0.990 0.983 0.977 0.972 0.969 0.966 0.964 0.962

1.051 1.038 1.026 1.015 1.004 0.995 0.988 0.981 0.976 0.972 0.968 0.966 0.964

1.047 1.035 1.023 1.012 1.002 0.994 0.987 0.981 0.976 0.972 0.969 0.967

1.044 1.032 1.021 1.011 1.002 0.994 0.987 0.981 0.977 0.973 0.970

1.042 1.031 1.020 1.010 1.002 0.995 0.988 0.983 0.978 0.975

1.041 1.030 1.020 1.011 1.003 0.996 0.990 0.985 0.980

1.041 1.031 1.021 1.013 1.005 0.998 0.992 0.987

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Table E11A-3.7. Fast Flux Distribution by Pin in MFF-3 at EOC 11A-3

CORE POSITION 2404

0.995 0.993 0.991 0.987 0.982 0.976 0.969 0.961

1.002 1.001 0.999 0.996 0.992 0.987 0.980 0.972 0.963

1.009 1.009 1.007 1.005 1.001 0.996 0.990 0.983 0.974 0.965

1.014 1.014 1.014 1.012 1.009 1.005 0.999 0.992 0.984 0.975 0.965

1.018 1.019 1.019 1.017 1.015 1.011 1.007 1.000 0.993 0.984 0.974 0.964

1.020 1.022 1.022 1.022 1.020 1.017 1.013 1.007 1.000 0.992 0.983 0.972 0.961

1.021 1.023 1.024 1.024 1.023 1.021 1.017 1.012 1.006 0.999 0.990 0.980 0.969 0.957

1.021 1.023 1.025 1.025 1.025 1.023 1.020 1.016 1.011 1.004 0.996 0.986 0.976 0.965 0.952

1.022 1.024 1.025 1.025 1.024 1.022 1.018 1.014 1.008 1.000 0.991 0.982 0.971 0.959

1.021 1.023 1.023 1.023 1.022 1.019 1.015 1.010 1.003 0.995 0.986 0.976 0.964

1.019 1.020 1.021 1.020 1.018 1.015 1.010 1.004 0.997 0.989 0.979 0.968

1.016 1.017 1.017 1.015 1.013 1.009 1.004 0.998 0.990 0.981 0.971

1.012 1.012 1.011 1.010 1.007 1.002 0.997 0.990 0.982 0.973

1.006 1.006 1.005 1.003 0.999 0.994 0.988 0.981 0.973

1.000 0.999 0.997 0.995 0.991 0.986 0.979 0.972

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Table E11A-3.9. MFF-3 Duct Wall Fast Flux Data at EOC 11A-3

Side	Flux > 0.1 MeV (n/cm^2-sec)
E	2.4597E+15
SE	2.4572E+15
SW	2.3591E+15
W	2.3003E+15
NW	2.3177E+15
NE	2.3851E+15

Table E11A-3.10. Relative Fission Rates in MFF-3 at EOC 11A-3

Isotope	Fission Rate*
U-235	8.943E-01
U-238	7.438E-02
Pu-239	3.121E-02
Pu-240	1.065E-04
Pu-241	4.386E-06
Pu-242	5.028E-09
Am-241	6.423E-09
Total	2.062E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11A-3.11. Composition of MFF-3 at EOC 11A-3

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.7145E-03
			U-238	6.3240E-03	6.2185E-03
			Pu-239	0.0000E+00	7.8592E-05
			Pu-240	0.0000E+00	9.1045E-07
			Pu-241	0.0000E+00	6.9019E-09
			Pu-242	0.0000E+00	3.2643E-11
			Am-241	0.0000E+00	5.8576E-11
			FP	0.0000E+00	3.2101E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.6305E-03
			U-238	6.3240E-03	6.1909E-03
			Pu-239	0.0000E+00	9.5061E-05
			Pu-240	0.0000E+00	1.2264E-06
			Pu-241	0.0000E+00	1.0815E-08
			Pu-242	0.0000E+00	6.0187E-11
			Am-241	0.0000E+00	9.1980E-11
			FP	0.0000E+00	4.0243E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.5853E-03
			U-238	6.3240E-03	6.1767E-03
			Pu-239	0.0000E+00	1.0425E-04
			Pu-240	0.0000E+00	1.4836E-06
			Pu-241	0.0000E+00	1.4409E-08
			Pu-242	0.0000E+00	8.8717E-11
			Am-241	0.0000E+00	1.2217E-10
			FP	0.0000E+00	4.4368E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.6013E-03
			U-238	6.3240E-03	6.1816E-03
			Pu-239	0.0000E+00	1.0092E-04
			Pu-240	0.0000E+00	1.3827E-06
			Pu-241	0.0000E+00	1.2959E-08
			Pu-242	0.0000E+00	7.6876E-11
			Am-241	0.0000E+00	1.0965E-10
			FP	0.0000E+00	4.2931E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.6749E-03
			U-238	6.3240E-03	6.2045E-03
			Pu-239	0.0000E+00	8.5819E-05
			Pu-240	0.0000E+00	9.8228E-07
			Pu-241	0.0000E+00	7.7466E-09
			Pu-242	0.0000E+00	3.8422E-11
			Am-241	0.0000E+00	6.5800E-11
			FP	0.0000E+00	3.6309E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.7834E-03
			U-238	6.3240E-03	6.2386E-03
			Pu-239	0.0000E+00	6.4099E-05
			Pu-240	0.0000E+00	5.7658E-07
			Pu-241	0.0000E+00	3.4728E-09
			Pu-242	0.0000E+00	1.2985E-11
			Am-241	0.0000E+00	2.9551E-11
			FP	0.0000E+00	2.6196E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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5.11.6 Cycle 11B-1

Table B11B-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 11B-1

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	ABOVE CORE	* * * * * * TOTAL PWR
2404	0.000E+00	7.014E+00	0.000E+00	7.014E+00
2304	1.164E-01	3.895E+00	6.322E-02	4.075E+00
2303	1.686E-02	4.174E+00	1.085E-02	4.201E+00
2403	1.447E-02	3.682E+00	7.910E-03	3.705E+00
2505	1.430E-02	3.951E+00	7.535E-03	3.972E+00
2506	7.236E-02	3.783E+00	4.381E-02	3.899E+00
2405	8.216E-03	5.352E+00	6.550E-03	5.367E+00
1304	0.000E+00	7.553E+00	0.000E+00	7.553E+00
1303	1.516E-01	1.839E+00	7.043E-02	2.061E+00
1404	7.546E-02	4.005E+00	4.112E-02	4.122E+00
1405	9.206E-03	3.756E+00	6.806E-03	3.772E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	1.187E-01	3.742E+00	5.474E-02	3.916E+00
1202	1.114E-01	3.813E+00	5.977E-02	3.984E+00

Table B11B-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 11B-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.660E+15	2.470E+15
MFF-5	1304	3.649E+15	2.404E+15

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Table B11B-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9189E-02	1.4490E-02	0.0000E+00
-92.78	6.2541E-02	2.7939E-02	0.0000E+00
-87.78	1.0009E-01	4.4660E-02	0.0000E+00
-82.78	1.4461E-01	6.6530E-02	0.0000E+00
-77.78	1.9882E-01	9.5825E-02	0.0000E+00
-72.15	2.6153E-01	1.3430E-01	0.0000E+00
-65.90	3.2839E-01	1.8470E-01	0.0000E+00
-60.35	4.0738E-01	2.5316E-01	0.0000E+00
-55.49	4.9852E-01	3.4274E-01	0.0000E+00
-50.62	5.8915E-01	4.5224E-01	0.0000E+00
-47.17	6.4916E-01	5.4837E-01	0.0000E+00
-43.58	7.1803E-01	6.7170E-01	8.0867E-01
-38.45	8.3053E-01	8.1360E-01	8.6623E-01
-33.32	9.3544E-01	9.3229E-01	9.5352E-01
-28.20	1.0268E+00	1.0300E+00	1.0153E+00
-23.07	1.1029E+00	1.1094E+00	1.0868E+00
-17.94	1.1620E+00	1.1702E+00	1.1434E+00
-12.82	1.2034E+00	1.2118E+00	1.1691E+00
-7.69	1.2269E+00	1.2355E+00	1.1915E+00
-2.56	1.2323E+00	1.2412E+00	1.1963E+00
2.56	1.2194E+00	1.2288E+00	1.1885E+00
7.69	1.1883E+00	1.1980E+00	1.1577E+00
12.82	1.1396E+00	1.1498E+00	1.1097E+00
17.94	1.0748E+00	1.0856E+00	1.0665E+00
23.07	9.9496E-01	1.0050E+00	9.8760E-01
28.20	9.0204E-01	9.0961E-01	8.9704E-01
33.32	7.9781E-01	8.0068E-01	8.2063E-01
38.45	6.8334E-01	6.7554E-01	7.1530E-01
43.58	5.6134E-01	5.3133E-01	6.2626E-01
47.17	4.8219E-01	4.1756E-01	0.0000E+00
50.62	4.2204E-01	3.3944E-01	0.0000E+00
55.49	3.3800E-01	2.4962E-01	0.0000E+00
60.35	2.6113E-01	1.7841E-01	0.0000E+00
64.98	2.0581E-01	1.3246E-01	0.0000E+00
69.39	1.7153E-01	1.0568E-01	0.0000E+00
76.46	1.2677E-01	7.2747E-02	0.0000E+00
86.80	8.0979E-02	4.2908E-02	0.0000E+00
98.14	4.6110E-02	2.3101E-02	0.0000E+00
110.00	1.9737E-02	1.0275E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11B-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 11B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	3.0799E-02	1.5593E-02	0.0000E+00
-92.78	6.6171E-02	3.0133E-02	0.0000E+00
-87.78	1.0605E-01	4.8222E-02	0.0000E+00
-82.78	1.5332E-01	7.1907E-02	0.0000E+00
-77.78	2.1058E-01	1.0363E-01	0.0000E+00
-72.15	2.7529E-01	1.4494E-01	0.0000E+00
-65.90	3.4313E-01	1.9902E-01	0.0000E+00
-60.35	4.1799E-01	2.7065E-01	0.0000E+00
-55.49	5.0024E-01	3.5530E-01	0.0000E+00
-50.62	5.9102E-01	4.5966E-01	0.0000E+00
-47.17	6.5391E-01	5.5466E-01	0.0000E+00
-43.58	7.2262E-01	6.7552E-01	7.9556E-01
-38.45	8.3206E-01	8.1379E-01	8.5511E-01
-33.32	9.3442E-01	9.3045E-01	9.3833E-01
-28.20	1.0243E+00	1.0279E+00	1.0191E+00
-23.07	1.0994E+00	1.1072E+00	1.0893E+00
-17.94	1.1581E+00	1.1681E+00	1.1452E+00
-12.82	1.1993E+00	1.2104E+00	1.1848E+00
-7.69	1.2228E+00	1.2344E+00	1.2073E+00
-2.56	1.2282E+00	1.2400E+00	1.2124E+00
2.56	1.2157E+00	1.2275E+00	1.1999E+00
7.69	1.1855E+00	1.1971E+00	1.1700E+00
12.82	1.1383E+00	1.1496E+00	1.1235E+00
17.94	1.0751E+00	1.0855E+00	1.0617E+00
23.07	9.9699E-01	1.0056E+00	9.8567E-01
28.20	9.0548E-01	9.1069E-01	8.9770E-01
33.32	8.0238E-01	8.0171E-01	8.0091E-01
38.45	6.8957E-01	6.7790E-01	7.0065E-01
43.58	5.6982E-01	5.3658E-01	6.1283E-01
47.17	4.9166E-01	4.2522E-01	0.0000E+00
50.62	4.3123E-01	3.4850E-01	0.0000E+00
55.49	3.4654E-01	2.5893E-01	0.0000E+00
60.35	2.6978E-01	1.8699E-01	0.0000E+00
64.98	2.1488E-01	1.3980E-01	0.0000E+00
69.39	1.7997E-01	1.1200E-01	0.0000E+00
76.46	1.3379E-01	7.7664E-02	0.0000E+00
86.80	8.6062E-02	4.6319E-02	0.0000E+00
98.14	4.9345E-02	2.5220E-02	0.0000E+00
110.00	2.1196E-02	1.1312E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11B-1.5. Fission Power Distribution by Pin in MFF-3 at BOC 11B-1

CORE POSITION 2404

1.038 1.026 1.015 1.005 0.996 0.988 0.980 0.974

1.040 1.028 1.016 1.006 0.996 0.988 0.981 0.974 0.969

1.042 1.030 1.018 1.007 0.997 0.989 0.981 0.975 0.969 0.964

1.045 1.032 1.020 1.009 0.999 0.990 0.982 0.975 0.970 0.965 0.961

1.049 1.036 1.023 1.012 1.001 0.992 0.984 0.977 0.971 0.966 0.962 0.959

1.054 1.040 1.027 1.016 1.005 0.995 0.986 0.979 0.973 0.968 0.964 0.960 0.958

1.059 1.046 1.033 1.021 1.009 0.999 0.990 0.982 0.976 0.970 0.966 0.962 0.960 0.957

1.066 1.052 1.039 1.027 1.015 1.004 0.995 0.987 0.980 0.974 0.969 0.965 0.962 0.959 0.957

1.060 1.047 1.034 1.022 1.011 1.001 0.992 0.985 0.978 0.973 0.969 0.965 0.963 0.960

1.055 1.042 1.030 1.019 1.008 0.999 0.991 0.984 0.978 0.973 0.970 0.966 0.964

1.051 1.039 1.027 1.017 1.007 0.998 0.991 0.984 0.979 0.975 0.971 0.968

1.049 1.037 1.026 1.016 1.007 0.999 0.992 0.986 0.981 0.977 0.973

1.048 1.036 1.026 1.016 1.008 1.000 0.994 0.988 0.983 0.979

1.047 1.037 1.027 1.018 1.010 1.002 0.996 0.990 0.986

1.048 1.038 1.028 1.020 1.012 1.005 0.999 0.993

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Table B11B-1.6. Fission Power Distribution by Pin in MFF-5 at BOC 11B-1

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CORE POSITION 1304 X

0.974 0.972 0.972 0.973 0.976 0.981 0.987 0.994

0.976 0.973 0.972 0.972 0.973 0.977 0.982 0.988 0.996

0.980 0.976 0.973 0.972 0.972 0.974 0.978 0.984 0.991 0.999

0.984 0.979 0.975 0.973 0.972 0.973 0.975 0.980 0.986 0.994 1.003

0.990 0.984 0.979 0.976 0.973 0.973 0.974 0.978 0.983 0.989 0.998 1.007

0.997 0.991 0.985 0.980 0.977 0.975 0.975 0.977 0.981 0.987 0.994 1.002 1.012

1.005 0.998 0.992 0.986 0.982 0.979 0.978 0.979 0.981 0.986 0.992 0.999 1.008 1.018

1.014 1.007 1.000 0.994 0.989 0.985 0.983 0.982 0.984 0.987 0.992 0.998 1.006 1.015 1.024

1.016 1.009 1.002 0.997 0.992 0.989 0.988 0.988 0.990 0.994 0.999 1.006 1.014 1.022

1.019 1.012 1.006 1.001 0.997 0.995 0.994 0.995 0.998 1.002 1.008 1.015 1.023

1.022 1.016 1.010 1.006 1.003 1.002 1.002 1.003 1.007 1.012 1.018 1.024

1.027 1.021 1.016 1.013 1.011 1.010 1.011 1.013 1.017 1.022 1.028

1.032 1.027 1.024 1.021 1.020 1.020 1.021 1.024 1.029 1.034

1.039 1.035 1.032 1.030 1.030 1.031 1.033 1.037 1.041

1.046 1.043 1.041 1.041 1.041 1.043 1.046 1.049

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Table B11B-1.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11B-1

CORE POSITION 2404

0.985 0.982 0.979 0.974 0.969 0.962 0.954 0.945

0.994 0.992 0.989 0.986 0.981 0.974 0.967 0.958 0.949

1.002 1.001 0.999 0.996 0.991 0.986 0.979 0.971 0.962 0.951

1.008 1.008 1.007 1.004 1.001 0.996 0.990 0.982 0.974 0.964 0.953

1.014 1.014 1.014 1.012 1.009 1.005 0.999 0.993 0.984 0.975 0.965 0.953

1.017 1.019 1.019 1.018 1.016 1.012 1.008 1.002 0.994 0.985 0.975 0.964 0.952

1.020 1.022 1.023 1.023 1.021 1.019 1.015 1.009 1.003 0.994 0.985 0.974 0.962 0.950

1.021 1.023 1.025 1.026 1.025 1.023 1.020 1.016 1.010 1.002 0.993 0.983 0.972 0.960 0.946

1.023 1.026 1.027 1.027 1.026 1.024 1.020 1.015 1.009 1.000 0.991 0.980 0.968 0.956

1.025 1.027 1.028 1.028 1.026 1.024 1.019 1.014 1.006 0.998 0.988 0.976 0.964

1.025 1.027 1.028 1.027 1.025 1.022 1.017 1.011 1.003 0.994 0.983 0.971

1.025 1.026 1.027 1.026 1.023 1.019 1.014 1.007 0.998 0.988 0.977

1.024 1.025 1.024 1.023 1.020 1.015 1.009 1.002 0.993 0.982

1.021 1.022 1.021 1.019 1.015 1.010 1.004 0.996 0.986

1.018 1.018 1.017 1.014 1.010 1.005 0.998 0.989

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Table B11B-1.8. Fast Flux Distribution by Pin in MFF-5 at BOC 11B-1

CORE POSITION 1304

0.976 0.979 0.980 0.980 0.977 0.973 0.967 0.959

0.981 0.985 0.988 0.988 0.987 0.984 0.978 0.971 0.963

0.984 0.990 0.993 0.995 0.995 0.993 0.989 0.983 0.975 0.966

0.986 0.992 0.997 1.001 1.002 1.001 0.998 0.993 0.987 0.978 0.969

0.985 0.993 1.000 1.004 1.007 1.007 1.006 1.002 0.997 0.989 0.981 0.970

0.983 0.992 1.000 1.006 1.010 1.012 1.012 1.010 1.005 0.999 0.991 0.982 0.972

0.979 0.989 0.998 1.005 1.011 1.014 1.016 1.015 1.012 1.008 1.001 0.993 0.983 0.972

0.973 0.984 0.995 1.003 1.010 1.015 1.018 1.019 1.018 1.014 1.009 1.002 0.993 0.983 0.973

0.978 0.989 0.999 1.007 1.014 1.018 1.020 1.021 1.019 1.015 1.009 1.002 0.993 0.983

0.982 0.993 1.002 1.010 1.016 1.020 1.022 1.022 1.019 1.015 1.009 1.001 0.992

0.985 0.996 1.005 1.012 1.018 1.021 1.022 1.021 1.019 1.014 1.008 1.000

0.988 0.998 1.007 1.013 1.018 1.021 1.022 1.021 1.017 1.012 1.006

0.990 0.999 1.007 1.014 1.018 1.020 1.020 1.019 1.015 1.010

0.991 1.000 1.007 1.013 1.017 1.019 1.018 1.016 1.013

0.992 1.000 1.007 1.012 1.015 1.016 1.016 1.013

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Table B11B-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 11B-1

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5196E+15	2.3384E+15
SE	2.4873E+15	2.3397E+15
SW	2.3635E+15	2.3237E+15
W	2.3071E+15	2.2897E+15
NW	2.3673E+15	2.3978E+15
NE	2.4855E+15	2.4281E+15

Table B11B-1.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 11B-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.921E-01	9.307E-01
U-238	7.648E-02	6.930E-02
Pu-239	3.131E-02	0.000E+00
Pu-240	1.087E-04	0.000E+00
Pu-241	4.315E-06	0.000E+00
Pu-242	5.131E-09	0.000E+00
Am-241	1.738E-08	0.000E+00
Total	2.065E+17	2.224E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11B-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 11B-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
404	0.000E+00	6.770E+00	0.000E+00	6.770E+00
2304	1.167E-01	3.768E+00	7.379E-02	3.958E+00
2303	1.721E-02	4.057E+00	1.269E-02	4.087E+00
2403	1.494E-02	3.673E+00	9.905E-03	3.698E+00
2505	1.438E-02	3.942E+00	9.379E-03	3.966E+00
2506	7.509E-02	3.663E+00	5.277E-02	3.791E+00
2405	9.090E-03	5.136E+00	8.020E-03	5.153E+00
1304	0.000E+00	7.286E+00	0.000E+00	7.286E+00
1303	1.588E-01	1.993E+00	8.623E-02	2.238E+00
1404	7.963E-02	3.918E+00	5.043E-02	4.048E+00
1405	9.891E-03	3.676E+00	8.220E-03	3.694E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	1.193E-01	3.655E+00	6.427E-02	3.839E+00
1202	1.120E-01	3.699E+00	6.917E-02	3.881E+00

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Table E11B-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 11B-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.658E+15	2.447E+15
MFF-5	1304	3.655E+15	2.389E+15

Table E11B-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 11B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.7724E-02	1.3869E-02	0.0000E+00
-92.78	5.9404E-02	2.6740E-02	0.0000E+00
-87.78	9.5076E-02	4.2734E-02	0.0000E+00
-82.78	1.3736E-01	6.3649E-02	0.0000E+00
-77.78	1.8887E-01	9.1650E-02	0.0000E+00
-72.15	2.4843E-01	1.2840E-01	0.0000E+00
-65.90	3.1186E-01	1.7648E-01	0.0000E+00
-60.35	3.8673E-01	2.4164E-01	0.0000E+00
-55.49	4.7307E-01	3.2665E-01	0.0000E+00
-50.62	5.5888E-01	4.3025E-01	0.0000E+00
-47.17	6.1559E-01	5.2102E-01	0.0000E+00
-43.58	6.8060E-01	6.3758E-01	7.6927E-01
-38.45	7.8782E-01	7.7264E-01	8.2498E-01
-33.32	8.8899E-01	8.8666E-01	9.1000E-01
-28.20	9.7861E-01	9.8183E-01	9.6402E-01
-23.07	1.0552E+00	1.0613E+00	1.0361E+00
-17.94	1.1172E+00	1.1247E+00	1.0955E+00
-12.82	1.1640E+00	1.1715E+00	1.1220E+00
-7.69	1.1955E+00	1.2032E+00	1.1520E+00
-2.56	1.2113E+00	1.2194E+00	1.1670E+00
2.56	1.2113E+00	1.2201E+00	1.1734E+00
7.69	1.1949E+00	1.2043E+00	1.1573E+00
12.82	1.1621E+00	1.1723E+00	1.1254E+00
17.94	1.1128E+00	1.1241E+00	1.1068E+00
23.07	1.0462E+00	1.0567E+00	1.0411E+00
28.20	9.6251E-01	9.7069E-01	9.5989E-01
33.32	8.6285E-01	8.6627E-01	8.9954E-01
38.45	7.4769E-01	7.3941E-01	7.9344E-01
43.58	6.2040E-01	5.8727E-01	7.0206E-01
47.17	5.3603E-01	4.6396E-01	0.0000E+00
50.62	4.7123E-01	3.7898E-01	0.0000E+00
55.49	3.7911E-01	2.8018E-01	0.0000E+00
60.35	2.9404E-01	2.0120E-01	0.0000E+00
64.98	2.3251E-01	1.4995E-01	0.0000E+00
69.39	1.9417E-01	1.1992E-01	0.0000E+00
76.46	1.4388E-01	8.2800E-02	0.0000E+00
86.80	9.2081E-02	4.8960E-02	0.0000E+00
98.14	5.2457E-02	2.6388E-02	0.0000E+00
110.00	2.2401E-02	1.1723E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11B-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 11B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9331E-02	1.4969E-02	0.0000E+00
-92.78	6.3016E-02	2.8928E-02	0.0000E+00
-87.78	1.0100E-01	4.6297E-02	0.0000E+00
-82.78	1.4604E-01	6.9034E-02	0.0000E+00
-77.78	2.0060E-01	9.9493E-02	0.0000E+00
-72.15	2.6226E-01	1.3916E-01	0.0000E+00
-65.90	3.2691E-01	1.9107E-01	0.0000E+00
-60.35	3.9818E-01	2.5973E-01	0.0000E+00
-55.49	4.7655E-01	3.4053E-01	0.0000E+00
-50.62	5.6304E-01	4.3973E-01	0.0000E+00
-47.17	6.2300E-01	5.2984E-01	0.0000E+00
-43.58	6.8841E-01	6.4452E-01	7.6119E-01
-38.45	7.9340E-01	7.7682E-01	8.1960E-01
-33.32	8.9276E-01	8.8951E-01	9.0143E-01
-28.20	9.8139E-01	9.8492E-01	9.7379E-01
-23.07	1.0574E+00	1.0647E+00	1.0450E+00
-17.94	1.1191E+00	1.1284E+00	1.1041E+00
-12.82	1.1658E+00	1.1758E+00	1.1437E+00
-7.69	1.1969E+00	1.2074E+00	1.1737E+00
-2.56	1.2121E+00	1.2230E+00	1.1883E+00
2.56	1.2111E+00	1.2222E+00	1.1890E+00
7.69	1.1935E+00	1.2048E+00	1.1717E+00
12.82	1.1593E+00	1.1706E+00	1.1383E+00
17.94	1.1084E+00	1.1194E+00	1.0969E+00
23.07	1.0406E+00	1.0501E+00	1.0311E+00
28.20	9.5658E-01	9.6267E-01	9.5054E-01
33.32	8.5743E-01	8.5742E-01	8.6722E-01
38.45	7.4458E-01	7.3261E-01	7.6682E-01
43.58	6.2129E-01	5.8534E-01	6.7772E-01
47.17	5.3944E-01	4.6661E-01	0.0000E+00
50.62	4.7560E-01	3.8453E-01	0.0000E+00
55.49	3.8459E-01	2.8765E-01	0.0000E+00
60.35	3.0120E-01	2.0910E-01	0.0000E+00
64.98	2.4118E-01	1.5720E-01	0.0000E+00
69.39	2.0268E-01	1.2638E-01	0.0000E+00
76.46	1.5136E-01	8.8058E-02	0.0000E+00
86.80	9.7720E-02	5.2720E-02	0.0000E+00
98.14	5.6131E-02	2.8768E-02	0.0000E+00
110.00	2.4105E-02	1.2908E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11B-1.5. Fission Power Distribution by Pin in MFF-3 at EOC 11B-1

CORE POSITION 2404

1.042 1.031 1.021 1.011 1.003 0.996 0.989 0.984

1.042 1.031 1.020 1.010 1.002 0.994 0.988 0.982 0.978

1.043 1.031 1.020 1.010 1.001 0.993 0.987 0.981 0.976 0.972

1.045 1.033 1.021 1.011 1.001 0.993 0.986 0.980 0.975 0.971 0.968

1.048 1.035 1.023 1.012 1.002 0.994 0.986 0.980 0.975 0.971 0.967 0.965

1.052 1.039 1.027 1.015 1.005 0.996 0.988 0.981 0.975 0.971 0.967 0.965 0.962

1.057 1.044 1.031 1.019 1.008 0.999 0.990 0.983 0.977 0.972 0.968 0.965 0.963 0.961

1.063 1.049 1.037 1.024 1.013 1.003 0.994 0.986 0.980 0.974 0.970 0.967 0.964 0.962 0.960

1.056 1.043 1.031 1.019 1.009 0.999 0.991 0.984 0.978 0.973 0.969 0.966 0.964 0.961

1.051 1.039 1.027 1.016 1.006 0.997 0.989 0.982 0.977 0.973 0.969 0.966 0.964

1.047 1.035 1.024 1.013 1.004 0.996 0.988 0.982 0.977 0.973 0.970 0.967

1.044 1.033 1.022 1.012 1.003 0.996 0.989 0.983 0.978 0.974 0.971

1.043 1.032 1.022 1.012 1.004 0.997 0.990 0.985 0.980 0.976

1.042 1.032 1.022 1.013 1.005 0.998 0.992 0.987 0.982

1.042 1.033 1.023 1.015 1.007 1.000 0.994 0.989

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Table E11B-1.6. Fission Power Distribution by Pin in MFF-5 at EOC 11B-1

CORE POSITION 1304

0.975 0.973 0.973 0.974 0.977 0.982 0.988 0.996

0.977 0.974 0.972 0.973 0.974 0.978 0.983 0.990 0.999

0.980 0.976 0.973 0.972 0.973 0.975 0.979 0.985 0.993 1.002

0.985 0.980 0.976 0.973 0.972 0.973 0.976 0.981 0.988 0.996 1.005

0.991 0.985 0.980 0.976 0.974 0.974 0.975 0.979 0.984 0.991 0.999 1.009

0.998 0.991 0.985 0.980 0.977 0.975 0.976 0.978 0.982 0.988 0.995 1.004 1.014

1.006 0.999 0.992 0.986 0.982 0.979 0.978 0.979 0.982 0.986 0.993 1.001 1.010 1.020

1.015 1.007 1.000 0.994 0.988 0.985 0.982 0.982 0.984 0.987 0.992 0.999 1.007 1.016 1.026

1.016 1.009 1.002 0.996 0.992 0.989 0.987 0.987 0.990 0.994 0.999 1.006 1.015 1.024

1.019 1.012 1.005 1.000 0.996 0.994 0.993 0.994 0.997 1.002 1.008 1.015 1.023

1.022 1.015 1.009 1.005 1.002 1.001 1.001 1.003 1.006 1.011 1.017 1.024

1.026 1.020 1.015 1.011 1.009 1.009 1.010 1.012 1.016 1.021 1.028

1.031 1.026 1.022 1.019 1.018 1.018 1.020 1.023 1.027 1.033

1.037 1.033 1.030 1.028 1.028 1.029 1.031 1.035 1.039

1.044 1.041 1.039 1.038 1.039 1.040 1.043 1.047

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Table E11B-1.7. Fast Flux Distribution by Pin in MFF-3 at EOC 11B-1

CORE POSITION 2404

0.988 0.986 0.983 0.979 0.974 0.968 0.961 0.953

0.996 0.995 0.993 0.989 0.985 0.979 0.973 0.965 0.956

1.003 1.003 1.001 0.998 0.995 0.990 0.983 0.976 0.967 0.957

1.009 1.009 1.008 1.006 1.003 0.999 0.993 0.986 0.978 0.969 0.958

1.013 1.014 1.014 1.013 1.010 1.006 1.001 0.995 0.988 0.979 0.969 0.958

1.016 1.018 1.018 1.018 1.016 1.013 1.009 1.003 0.996 0.988 0.978 0.967 0.956

1.018 1.020 1.021 1.022 1.021 1.018 1.015 1.010 1.003 0.996 0.987 0.976 0.965 0.953

1.018 1.021 1.023 1.024 1.024 1.022 1.019 1.015 1.009 1.002 0.994 0.984 0.973 0.961 0.949

1.021 1.023 1.025 1.025 1.024 1.022 1.019 1.014 1.008 1.000 0.991 0.981 0.969 0.957

1.022 1.024 1.025 1.025 1.024 1.022 1.018 1.012 1.005 0.997 0.987 0.976 0.964

1.022 1.024 1.025 1.024 1.023 1.019 1.015 1.009 1.001 0.992 0.982 0.970

1.021 1.023 1.023 1.022 1.020 1.016 1.011 1.004 0.996 0.987 0.976

1.020 1.021 1.021 1.019 1.016 1.012 1.006 0.999 0.990 0.980

1.017 1.018 1.017 1.015 1.012 1.007 1.000 0.992 0.983

1.014 1.014 1.013 1.010 1.006 1.001 0.994 0.985

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Table E11B-1.8. Fast Flux Distribution by Pin in MFF-5 at EOC 11B-1

CORE POSITION 1304

0.977 0.980 0.981 0.980 0.978 0.974 0.968 0.961

0.982 0.986 0.988 0.989 0.987 0.984 0.979 0.972 0.964

0.985 0.990 0.994 0.996 0.995 0.993 0.989 0.983 0.976 0.967

0.987 0.993 0.998 1.001 1.002 1.001 0.998 0.994 0.987 0.979 0.970

0.987 0.994 1.000 1.004 1.007 1.007 1.006 1.002 0.997 0.990 0.981 0.972

0.984 0.993 1.000 1.006 1.010 1.012 1.011 1.009 1.005 0.999 0.992 0.983 0.973

0.981 0.990 0.999 1.006 1.011 1.014 1.015 1.015 1.012 1.007 1.001 0.993 0.984 0.974

0.975 0.986 0.995 1.003 1.010 1.015 1.017 1.018 1.017 1.014 1.009 1.002 0.993 0.984 0.974

0.980 0.990 0.999 1.007 1.013 1.017 1.020 1.020 1.018 1.014 1.009 1.002 0.993 0.984

0.983 0.994 1.003 1.010 1.016 1.019 1.021 1.021 1.018 1.014 1.008 1.001 0.993

0.986 0.996 1.005 1.012 1.017 1.020 1.021 1.020 1.018 1.013 1.007 1.000

0.989 0.998 1.006 1.013 1.017 1.020 1.021 1.019 1.016 1.012 1.005

0.990 0.999 1.007 1.013 1.017 1.019 1.019 1.017 1.014 1.009

0.991 1.000 1.007 1.012 1.015 1.017 1.017 1.015 1.011

0.992 1.000 1.006 1.011 1.014 1.015 1.014 1.012

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Table E11B-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 11B-1

	Flux > 0.1 MeV (n/cm--sec)	
Side	MFF-3	MFF-5
E	2.4876E+15	2.3277E+15
SE	2.4646E+15	2.3293E+15
SW	2.3588E+15	2.3107E+15
W	2.3019E+15	2.2801E+15
NW	2.3424E+15	2.3821E+15
NE	2.4512E+15	2.4089E+15

Table E11B-1.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 11B-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.794E-01	9.172E-01
U-238	7.692E-02	6.989E-02
Pu-239	4.346E-02	1.293E-02
Pu-240	2.056E-04	1.695E-05
Pu-241	1.148E-05	3.015E-07
Pu-242	1.828E-08	1.293E-10
Am-241	3.116E-08	1.333E-10
Total	1.993E+17	2.145E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11B-1.11. Composition of MFF-3 at EOC 11B-1

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.5837E-03
			U-238	6.3240E-03	6.1785E-03
			Pu-239	0.0000E+00	1.0577E-04
			Pu-240	0.0000E+00	1.7001E-06
			Pu-241	0.0000E+00	1.7558E-08
			Pu-242	0.0000E+00	1.1533E-10
			Am-241	0.0000E+00	2.7516E-10
			FP	0.0000E+00	4.3665E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.4744E-03
			U-238	6.3240E-03	6.1408E-03
			Pu-239	0.0000E+00	1.2693E-04
			Pu-240	0.0000E+00	2.2695E-06
			Pu-241	0.0000E+00	2.7167E-08
			Pu-242	0.0000E+00	2.0977E-10
			Am-241	0.0000E+00	4.2707E-10
			FP	0.0000E+00	5.4468E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.4157E-03
			U-238	6.3240E-03	6.1213E-03
			Pu-239	0.0000E+00	1.3873E-04
			Pu-240	0.0000E+00	2.7378E-06
			Pu-241	0.0000E+00	3.6063E-08
			Pu-242	0.0000E+00	3.0824E-10
			Am-241	0.0000E+00	5.6597E-10
			FP	0.0000E+00	5.9925E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.4361E-03
			U-238	6.3240E-03	6.1280E-03
			Pu-239	0.0000E+00	1.3451E-04
			Pu-240	0.0000E+00	2.5564E-06
			Pu-241	0.0000E+00	3.2523E-08
			Pu-242	0.0000E+00	2.6795E-10
			Am-241	0.0000E+00	5.0981E-10
			FP	0.0000E+00	5.8057E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.5321E-03
			U-238	6.3240E-03	6.1594E-03
			Pu-239	0.0000E+00	1.1500E-04
			Pu-240	0.0000E+00	1.8230E-06
			Pu-241	0.0000E+00	1.9536E-08
			Pu-242	0.0000E+00	1.3439E-10
			Am-241	0.0000E+00	3.0719E-10
			FP	0.0000E+00	4.9272E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.6752E-03
			U-238	6.3240E-03	6.2062E-03
			Pu-239	0.0000E+00	8.6643E-05
			Pu-240	0.0000E+00	1.0787E-06
			Pu-241	0.0000E+00	8.8530E-09
			Pu-242	0.0000E+00	4.5875E-11
			Am-241	0.0000E+00	1.3936E-10
			FP	0.0000E+00	3.5741E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E11B-1.12. Composition of MFF-5 at EOC 11B-1

Axial Level	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
1	-128.05	-75.28			
			Na-23	5.3150E-03	5.3150E-03
			SS-316	6.4090E-02	6.4090E-02
2	-75.28	-52.55			
			Na-23	1.2240E-02	1.2240E-02
			HT-9	3.7700E-02	3.7700E-02
3	-52.55	-46.14			
			Na-23	1.0614E-02	1.0614E-02
			HT-9	2.2539E-02	2.2539E-02
			Inconel	2.1456E-02	2.1456E-02
4	-46.14	-30.76			
			U-235	2.9371E-03	2.7927E-03
			U-238	6.4484E-03	6.4063E-03
			Pu-239	0.0000E+00	3.3246E-05
			Pu-240	0.0000E+00	1.5405E-07
			Pu-241	0.0000E+00	4.7526E-10
			Pu-242	0.0000E+00	8.9276E-13
			Am-241	0.0000E+00	1.3009E-12
			FP	0.0000E+00	1.2259E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.7598E-03
			U-238	6.4484E-03	6.3957E-03
			Pu-239	0.0000E+00	4.0377E-05
			Pu-240	0.0000E+00	2.0861E-07
			Pu-241	0.0000E+00	7.4870E-10
			Pu-242	0.0000E+00	1.6467E-12
			Am-241	0.0000E+00	2.0492E-12
			FP	0.0000E+00	1.5345E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.7415E-03
			U-238	6.4484E-03	6.3901E-03
			Pu-239	0.0000E+00	4.4470E-05
			Pu-240	0.0000E+00	2.5251E-07
			Pu-241	0.0000E+00	9.9761E-10
			Pu-242	0.0000E+00	2.4201E-12
			Am-241	0.0000E+00	2.7302E-12
			FP	0.0000E+00	1.6961E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.7474E-03

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			U-238	6.4484E-03	6.3919E-03
			Pu-239	0.0000E+00	4.3138E-05
			Pu-240	0.0000E+00	2.3711E-07
			Pu-241	0.0000E+00	9.0765E-10
			Pu-242	0.0000E+00	2.1324E-12
			Am-241	0.0000E+00	2.4841E-12
			FP	0.0000E+00	1.6450E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			
			U-235	2.9371E-03	2.7763E-03
			U-238	6.4484E-03	6.4007E-03
			Pu-239	0.0000E+00	3.6624E-05
			Pu-240	0.0000E+00	1.7031E-07
			Pu-241	0.0000E+00	5.5206E-10
			Pu-242	0.0000E+00	1.0953E-12
			Am-241	0.0000E+00	1.5111E-12
			FP	0.0000E+00	1.3919E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.8190E-03
			U-238	6.4484E-03	6.4140E-03
			Pu-239	0.0000E+00	2.7208E-05
			Pu-240	0.0000E+00	9.9672E-08
			Pu-241	0.0000E+00	2.4701E-10
			Pu-242	0.0000E+00	3.7214E-13
			Am-241	0.0000E+00	6.7623E-13
			FP	0.0000E+00	1.0046E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
10	46.14	62.78			
			Na-23	1.5970E-02	1.5970E-02
			HT-9	2.2539E-02	2.2539E-02
11	62.78	169.18			
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

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5.11.7 Cycle 11B-2

Table B11B-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 11B-2

CORE POS.	* * * * * * BELOW CORE	POWER IN MEGAWATTS IN CORE	ABOVE CORE	* * * * * * TOTAL PWR
2404	0.000E+00	6.644E+00	0.000E+00	6.644E+00
2304	1.689E-02	4.244E+00	1.085E-02	4.271E+00
2303	1.606E-02	4.192E+00	9.569E-03	4.218E+00
2403	1.591E-02	3.499E+00	8.324E-03	3.523E+00
2505	1.483E-02	3.618E+00	7.655E-03	3.640E+00
2506	7.864E-02	3.507E+00	4.626E-02	3.632E+00
2405	9.716E-03	5.072E+00	7.305E-03	5.090E+00
1304	0.000E+00	7.466E+00	0.000E+00	7.466E+00
1303	1.908E-02	4.025E+00	1.115E-02	4.055E+00
1404	0.000E+00	6.404E+00	0.000E+00	6.404E+00
1405	8.719E-02	3.831E+00	4.891E-02	3.967E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	1.988E-02	4.081E+00	1.136E-02	4.112E+00
1202	1.442E-01	4.063E+00	7.547E-02	4.283E+00

Table B11B-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 11B-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.596E+15	2.418E+15
MFF-5	1304	3.829E+15	2.604E+15

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Table B11B-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9600E-02	1.4698E-02	0.0000E+00
-92.78	6.3443E-02	2.8359E-02	0.0000E+00
-87.78	1.0159E-01	4.5346E-02	0.0000E+00
-82.78	1.4696E-01	6.7562E-02	0.0000E+00
-77.78	2.0267E-01	9.7327E-02	0.0000E+00
-72.15	2.6806E-01	1.3648E-01	0.0000E+00
-65.90	3.3785E-01	1.8776E-01	0.0000E+00
-60.35	4.1953E-01	2.5694E-01	0.0000E+00
-55.49	5.1187E-01	3.4752E-01	0.0000E+00
-50.62	6.0154E-01	4.5837E-01	0.0000E+00
-47.17	6.6001E-01	5.5568E-01	0.0000E+00
-43.58	7.2762E-01	6.8056E-01	8.3343E-01
-38.45	8.4051E-01	8.2346E-01	8.8361E-01
-33.32	9.4593E-01	9.4259E-01	9.6975E-01
-28.20	1.0373E+00	1.0401E+00	1.0227E+00
-23.07	1.1124E+00	1.1185E+00	1.0929E+00
-17.94	1.1696E+00	1.1772E+00	1.1472E+00
-12.82	1.2078E+00	1.2156E+00	1.1643E+00
-7.69	1.2270E+00	1.2351E+00	1.1821E+00
-2.56	1.2275E+00	1.2361E+00	1.1818E+00
2.56	1.2102E+00	1.2196E+00	1.1710E+00
7.69	1.1764E+00	1.1864E+00	1.1377E+00
12.82	1.1275E+00	1.1380E+00	1.0900E+00
17.94	1.0645E+00	1.0757E+00	1.0566E+00
23.07	9.8750E-01	9.9786E-01	9.8073E-01
28.20	8.9738E-01	9.0537E-01	8.9309E-01
33.32	7.9548E-01	7.9903E-01	8.2779E-01
38.45	6.8284E-01	6.7586E-01	7.2434E-01
43.58	5.6253E-01	5.3317E-01	6.4111E-01
47.17	4.8522E-01	4.1988E-01	0.0000E+00
50.62	4.2640E-01	3.4216E-01	0.0000E+00
55.49	3.4337E-01	2.5267E-01	0.0000E+00
60.35	2.6638E-01	1.8155E-01	0.0000E+00
64.98	2.1037E-01	1.3553E-01	0.0000E+00
69.39	1.7553E-01	1.0851E-01	0.0000E+00
76.46	1.3002E-01	7.5042E-02	0.0000E+00
86.80	8.3543E-02	4.4472E-02	0.0000E+00
98.14	4.8247E-02	2.4105E-02	0.0000E+00
110.00	2.0865E-02	1.0790E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11B-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 11B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-92.78	6.5415E-02	2.9106E-02	0.0000E+00
-87.78	1.0491E-01	4.6688E-02	0.0000E+00
-82.78	1.5199E-01	6.9829E-02	0.0000E+00
-77.78	2.0976E-01	1.0106E-01	0.0000E+00
-72.15	2.7689E-01	1.4232E-01	0.0000E+00
-65.90	3.4918E-01	1.9750E-01	0.0000E+00
-60.35	4.2757E-01	2.6936E-01	0.0000E+00
-55.49	5.1000E-01	3.5416E-01	0.0000E+00
-50.62	5.9908E-01	4.6035E-01	0.0000E+00
-47.17	6.6011E-01	5.5756E-01	0.0000E+00
-43.58	7.2831E-01	6.8068E-01	8.1847E-01
-38.45	8.3907E-01	8.2126E-01	8.6922E-01
-33.32	9.4242E-01	9.3888E-01	9.5144E-01
-28.20	1.0324E+00	1.0357E+00	1.0237E+00
-23.07	1.1065E+00	1.1136E+00	1.0928E+00
-17.94	1.1632E+00	1.1723E+00	1.1467E+00
-12.82	1.2017E+00	1.2114E+00	1.1782E+00
-7.69	1.2220E+00	1.2321E+00	1.1974E+00
-2.56	1.2243E+00	1.2348E+00	1.1993E+00
2.56	1.2094E+00	1.2201E+00	1.1860E+00
7.69	1.1778E+00	1.1887E+00	1.1548E+00
12.82	1.1306E+00	1.1415E+00	1.1084E+00
17.94	1.0687E+00	1.0795E+00	1.0555E+00
23.07	9.9233E-01	1.0018E+00	9.8108E-01
28.20	9.0265E-01	9.0925E-01	8.9476E-01
33.32	8.0103E-01	8.0225E-01	8.0803E-01
38.45	6.8875E-01	6.7909E-01	7.0851E-01
43.58	5.6894E-01	5.3719E-01	6.2561E-01
47.17	4.9165E-01	4.2579E-01	0.0000E+00
50.62	4.3302E-01	3.4958E-01	0.0000E+00
55.49	3.5106E-01	2.6114E-01	0.0000E+00
60.35	2.7571E-01	1.9014E-01	0.0000E+00
64.98	2.2052E-01	1.4323E-01	0.0000E+00
69.39	1.8438E-01	1.1459E-01	0.0000E+00
76.46	1.3630E-01	7.8798E-02	0.0000E+00
86.80	8.7272E-02	4.6445E-02	0.0000E+00
98.14	5.0063E-02	2.5060E-02	0.0000E+00
110.00	2.1529E-02	1.1166E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11B-2.5. Fission Power Distribution by Pin in MFF-3 at BOC 11B-2

CORE POSITION 2404

1.048 1.032 1.017 1.003 0.990 0.979 0.968 0.958

1.051 1.035 1.020 1.006 0.993 0.981 0.971 0.961 0.952

1.056 1.039 1.024 1.009 0.996 0.984 0.973 0.964 0.955 0.948

1.061 1.044 1.028 1.013 1.000 0.988 0.977 0.967 0.959 0.951 0.944

1.067 1.050 1.033 1.018 1.004 0.992 0.980 0.971 0.962 0.954 0.948 0.942

1.074 1.056 1.040 1.024 1.010 0.997 0.985 0.975 0.966 0.958 0.951 0.946 0.940

1.082 1.064 1.047 1.031 1.016 1.003 0.991 0.980 0.970 0.962 0.955 0.950 0.944 0.939

1.092 1.074 1.056 1.040 1.024 1.010 0.997 0.986 0.976 0.967 0.960 0.954 0.949 0.944 0.939

1.084 1.066 1.049 1.033 1.019 1.005 0.993 0.983 0.974 0.966 0.959 0.953 0.948 0.943

1.077 1.060 1.044 1.029 1.015 1.002 0.991 0.981 0.972 0.965 0.959 0.953 0.948

1.072 1.055 1.040 1.025 1.012 1.000 0.989 0.980 0.972 0.965 0.959 0.954

1.068 1.052 1.037 1.023 1.010 0.999 0.989 0.980 0.972 0.966 0.960

1.065 1.050 1.035 1.022 1.010 0.999 0.989 0.981 0.973 0.966

1.063 1.048 1.034 1.021 1.010 0.999 0.990 0.981 0.974

1.062 1.047 1.034 1.022 1.010 1.000 0.991 0.982

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Table B11B-2.6. Fission Power Distribution by Pin in MFF-5 at BOC 11B-2

CORE POSITION 1304

0.940 0.944 0.949 0.954 0.960 0.967 0.975 0.983

0.944 0.946 0.950 0.954 0.959 0.965 0.971 0.979 0.987

0.949 0.951 0.953 0.956 0.959 0.964 0.969 0.976 0.983 0.991

0.956 0.957 0.957 0.959 0.961 0.964 0.969 0.974 0.980 0.987 0.995

0.965 0.965 0.964 0.964 0.965 0.967 0.970 0.974 0.979 0.985 0.992 1.000

0.976 0.974 0.972 0.971 0.971 0.971 0.973 0.976 0.980 0.985 0.991 0.998 1.005

0.987 0.985 0.982 0.980 0.979 0.978 0.978 0.980 0.983 0.987 0.992 0.998 1.005 1.012

0.999 0.996 0.993 0.990 0.988 0.986 0.986 0.986 0.988 0.991 0.995 1.000 1.006 1.013 1.021

1.009 1.005 1.001 0.998 0.996 0.994 0.994 0.995 0.997 1.000 1.004 1.010 1.016 1.023

1.018 1.014 1.010 1.007 1.005 1.003 1.003 1.004 1.007 1.010 1.015 1.021 1.027

1.026 1.022 1.019 1.016 1.014 1.013 1.014 1.016 1.019 1.023 1.028 1.033

1.035 1.031 1.028 1.026 1.025 1.025 1.026 1.028 1.032 1.036 1.041

1.044 1.041 1.038 1.037 1.036 1.037 1.039 1.042 1.046 1.051

1.054 1.051 1.049 1.049 1.049 1.051 1.054 1.057 1.062

1.064 1.062 1.062 1.062 1.064 1.066 1.069 1.073

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Table B11B-2.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11B-2

CORE POSITION 2404

0.994 0.988 0.981 0.973 0.964 0.954 0.944 0.932

1.006 1.000 0.994 0.987 0.978 0.969 0.958 0.947 0.935

1.016 1.011 1.005 0.999 0.991 0.982 0.972 0.961 0.949 0.936

1.025 1.021 1.016 1.010 1.003 0.994 0.985 0.975 0.963 0.950 0.937

1.032 1.029 1.024 1.019 1.013 1.005 0.996 0.987 0.976 0.963 0.950 0.936

1.038 1.036 1.032 1.027 1.021 1.015 1.007 0.997 0.987 0.975 0.963 0.949 0.934

1.043 1.041 1.038 1.034 1.029 1.023 1.015 1.007 0.997 0.986 0.974 0.961 0.946 0.931

1.047 1.045 1.042 1.039 1.035 1.029 1.023 1.015 1.006 0.995 0.984 0.971 0.957 0.943 0.927

1.047 1.045 1.042 1.039 1.034 1.028 1.021 1.013 1.003 0.993 0.980 0.967 0.953 0.938

1.047 1.044 1.041 1.038 1.033 1.026 1.019 1.010 1.000 0.988 0.976 0.962 0.948

1.045 1.043 1.040 1.035 1.030 1.023 1.015 1.006 0.995 0.983 0.970 0.956

1.043 1.040 1.036 1.032 1.026 1.019 1.010 1.000 0.989 0.977 0.963

1.039 1.036 1.032 1.027 1.021 1.013 1.004 0.994 0.983 0.970

1.035 1.032 1.027 1.022 1.015 1.007 0.998 0.987 0.975

1.030 1.026 1.021 1.016 1.008 1.000 0.990 0.979

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Table B11B-2.8. Fast Flux Distribution by Pin in MFF-5 at BOC 11B-2

CORE POSITION 1304

0.980 0.978 0.974 0.968 0.961 0.953 0.943 0.932

0.988 0.987 0.984 0.980 0.974 0.967 0.958 0.947 0.936

0.994 0.995 0.993 0.990 0.985 0.979 0.971 0.962 0.951 0.940

0.999 1.001 1.001 0.999 0.995 0.990 0.984 0.975 0.966 0.955 0.943

1.003 1.005 1.007 1.006 1.004 1.000 0.995 0.988 0.979 0.969 0.958 0.946

1.005 1.009 1.011 1.012 1.011 1.008 1.004 0.998 0.991 0.982 0.972 0.960 0.948

1.006 1.010 1.014 1.016 1.016 1.015 1.012 1.008 1.001 0.994 0.984 0.974 0.962 0.950

1.005 1.011 1.015 1.018 1.020 1.020 1.018 1.015 1.010 1.003 0.995 0.986 0.975 0.963 0.951

1.010 1.016 1.020 1.022 1.023 1.023 1.021 1.017 1.012 1.005 0.996 0.987 0.976 0.964

1.015 1.020 1.023 1.026 1.026 1.025 1.023 1.018 1.012 1.005 0.996 0.986 0.975

1.019 1.023 1.026 1.028 1.028 1.027 1.023 1.019 1.012 1.005 0.996 0.986

1.022 1.026 1.029 1.030 1.029 1.027 1.023 1.018 1.011 1.003 0.994

1.025 1.028 1.030 1.030 1.029 1.027 1.022 1.017 1.010 1.002

1.027 1.030 1.031 1.030 1.029 1.025 1.021 1.015 1.007

1.028 1.030 1.031 1.030 1.027 1.023 1.018 1.012

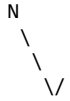

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Table B11B-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 11B-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5234E+15	2.6421E+15
SE	2.4887E+15	2.5823E+15
SW	2.3070E+15	2.4769E+15
W	2.2130E+15	2.4056E+15
NW	2.2785E+15	2.5586E+15
NE	2.4321E+15	2.6799E+15

Table B11B-2.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 11B-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.787E-01	9.113E-01
U-238	7.757E-02	7.559E-02
Pu-239	4.353E-02	1.312E-02
Pu-240	2.072E-04	1.815E-05
Pu-241	1.139E-05	2.976E-07
Pu-242	1.842E-08	1.385E-10
Am-241	4.645E-08	5.378E-10
Total	1.956E+17	2.198E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11B-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 11B-2

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	6.310E+00	0.000E+00	6.310E+00
2304	1.777E-02	4.026E+00	1.337E-02	4.057E+00
2303	1.721E-02	4.004E+00	1.197E-02	4.033E+00
2403	1.663E-02	3.503E+00	1.080E-02	3.530E+00
2505	1.503E-02	3.650E+00	9.902E-03	3.675E+00
2506	8.238E-02	3.366E+00	5.788E-02	3.506E+00
2405	1.095E-02	4.783E+00	9.348E-03	4.804E+00
1304	0.000E+00	7.017E+00	0.000E+00	7.017E+00
1303	1.959E-02	3.864E+00	1.349E-02	3.897E+00
1404	0.000E+00	6.150E+00	0.000E+00	6.150E+00
1405	9.260E-02	3.666E+00	6.143E-02	3.820E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	2.033E-02	3.914E+00	1.377E-02	3.948E+00
1202	1.454E-01	3.818E+00	8.987E-02	4.053E+00

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Table E11B-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 11B-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.599E+15	2.387E+15
MFF-5	1304	3.810E+15	2.555E+15

Table E11B-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 11B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.7484E-02	1.3777E-02	0.0000E+00
-92.78	5.8941E-02	2.6583E-02	0.0000E+00
-87.78	9.4416E-02	4.2503E-02	0.0000E+00
-82.78	1.3665E-01	6.3328E-02	0.0000E+00
-77.78	1.8856E-01	9.1221E-02	0.0000E+00
-72.15	2.4954E-01	1.2790E-01	0.0000E+00
-65.90	3.1456E-01	1.7590E-01	0.0000E+00
-60.35	3.9055E-01	2.4054E-01	0.0000E+00
-55.49	4.7650E-01	3.2497E-01	0.0000E+00
-50.62	5.5990E-01	4.2805E-01	0.0000E+00
-47.17	6.1414E-01	5.1831E-01	0.0000E+00
-43.58	6.7673E-01	6.3423E-01	7.7970E-01
-38.45	7.8305E-01	7.6848E-01	8.2826E-01
-33.32	8.8421E-01	8.8213E-01	9.1225E-01
-28.20	9.7422E-01	9.7723E-01	9.5560E-01
-23.07	1.0514E+00	1.0572E+00	1.0280E+00
-17.94	1.1144E+00	1.1212E+00	1.0880E+00
-12.82	1.1620E+00	1.1687E+00	1.1078E+00
-7.69	1.1945E+00	1.2013E+00	1.1384E+00
-2.56	1.2113E+00	1.2185E+00	1.1542E+00
2.56	1.2122E+00	1.2203E+00	1.1636E+00
7.69	1.1967E+00	1.2056E+00	1.1485E+00
12.82	1.1646E+00	1.1744E+00	1.1175E+00
17.94	1.1159E+00	1.1273E+00	1.1111E+00
23.07	1.0496E+00	1.0605E+00	1.0457E+00
28.20	9.6615E-01	9.7491E-01	9.6450E-01
33.32	8.6655E-01	8.7108E-01	9.1859E-01
38.45	7.5153E-01	7.4448E-01	8.1227E-01
43.58	6.2482E-01	5.9247E-01	7.2625E-01
47.17	5.4216E-01	4.6894E-01	0.0000E+00
50.62	4.7861E-01	3.8390E-01	0.0000E+00
55.49	3.8715E-01	2.8487E-01	0.0000E+00
60.35	3.0142E-01	2.0554E-01	0.0000E+00
64.98	2.3871E-01	1.5395E-01	0.0000E+00
69.39	1.9945E-01	1.2349E-01	0.0000E+00
76.46	1.4786E-01	8.5581E-02	0.0000E+00
86.80	9.4682E-02	5.0709E-02	0.0000E+00
98.14	5.3964E-02	2.7333E-02	0.0000E+00
110.00	2.3043E-02	1.2126E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11B-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 11B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8516E-02	1.4217E-02	0.0000E+00
-92.78	6.1263E-02	2.7520E-02	0.0000E+00
-87.78	9.8290E-02	4.4145E-02	0.0000E+00
-82.78	1.4246E-01	6.6028E-02	0.0000E+00
-77.78	1.9672E-01	9.5558E-02	0.0000E+00
-72.15	2.5982E-01	1.3456E-01	0.0000E+00
-65.90	3.2766E-01	1.8669E-01	0.0000E+00
-60.35	4.0115E-01	2.5446E-01	0.0000E+00
-55.49	4.7841E-01	3.3412E-01	0.0000E+00
-50.62	5.6188E-01	4.3348E-01	0.0000E+00
-47.17	6.1904E-01	5.2419E-01	0.0000E+00
-43.58	6.8270E-01	6.3921E-01	7.7311E-01
-38.45	7.8776E-01	7.7225E-01	8.2271E-01
-33.32	8.8762E-01	8.8518E-01	9.0362E-01
-28.20	9.7676E-01	9.8025E-01	9.6481E-01
-23.07	1.0533E+00	1.0599E+00	1.0365E+00
-17.94	1.1157E+00	1.1238E+00	1.0961E+00
-12.82	1.1630E+00	1.1712E+00	1.1282E+00
-7.69	1.1949E+00	1.2034E+00	1.1588E+00
-2.56	1.2112E+00	1.2201E+00	1.1743E+00
2.56	1.2114E+00	1.2208E+00	1.1784E+00
7.69	1.1952E+00	1.2051E+00	1.1625E+00
12.82	1.1624E+00	1.1729E+00	1.1304E+00
17.94	1.1128E+00	1.1240E+00	1.1023E+00
23.07	1.0459E+00	1.0563E+00	1.0370E+00
28.20	9.6229E-01	9.6993E-01	9.5653E-01
33.32	8.6299E-01	8.6546E-01	8.8740E-01
38.45	7.4925E-01	7.3977E-01	7.8596E-01
43.58	6.2480E-01	5.9045E-01	7.0142E-01
47.17	5.4365E-01	4.7087E-01	0.0000E+00
50.62	4.8149E-01	3.8879E-01	0.0000E+00
55.49	3.9280E-01	2.9239E-01	0.0000E+00
60.35	3.1026E-01	2.1421E-01	0.0000E+00
64.98	2.4927E-01	1.6216E-01	0.0000E+00
69.39	2.0899E-01	1.3014E-01	0.0000E+00
76.46	1.5501E-01	8.9883E-02	0.0000E+00
86.80	9.9286E-02	5.3118E-02	0.0000E+00
98.14	5.6684E-02	2.8634E-02	0.0000E+00
110.00	2.4227E-02	1.2713E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11B-2.5. Fission Power Distribution by Pin in MFF-3 at EOC 11B-2

CORE POSITION 2404

1.052 1.038 1.025 1.013 1.002 0.992 0.983 0.976

1.053 1.039 1.025 1.013 1.002 0.992 0.983 0.975 0.968

1.055 1.040 1.026 1.014 1.002 0.992 0.983 0.975 0.968 0.962

1.058 1.043 1.029 1.015 1.003 0.993 0.983 0.975 0.968 0.962 0.957

1.063 1.047 1.032 1.018 1.006 0.995 0.985 0.976 0.969 0.963 0.958 0.953

1.068 1.052 1.037 1.022 1.009 0.997 0.987 0.978 0.970 0.964 0.959 0.954 0.950

1.075 1.058 1.042 1.028 1.014 1.002 0.991 0.981 0.973 0.966 0.960 0.956 0.952 0.948

1.083 1.066 1.050 1.034 1.020 1.007 0.995 0.985 0.976 0.969 0.963 0.958 0.953 0.950 0.946

1.075 1.058 1.042 1.028 1.014 1.002 0.991 0.981 0.973 0.966 0.961 0.956 0.952 0.948

1.068 1.052 1.037 1.023 1.010 0.998 0.988 0.979 0.971 0.965 0.959 0.955 0.951

1.063 1.047 1.032 1.019 1.006 0.995 0.986 0.977 0.970 0.964 0.959 0.954

1.058 1.043 1.029 1.016 1.004 0.994 0.985 0.977 0.970 0.964 0.959

1.055 1.041 1.027 1.015 1.003 0.993 0.984 0.977 0.970 0.964

1.053 1.039 1.026 1.014 1.003 0.993 0.985 0.977 0.970

1.052 1.038 1.026 1.014 1.003 0.994 0.985 0.977

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Table E11B-2.6. Fission Power Distribution by Pin in MFF-5 at EOC 11B-2

CORE POSITION 1304

0.943 0.947 0.951 0.957 0.964 0.971 0.979 0.988

0.946 0.949 0.952 0.956 0.962 0.968 0.975 0.983 0.992

0.952 0.953 0.955 0.957 0.961 0.966 0.972 0.979 0.987 0.996

0.959 0.959 0.959 0.960 0.963 0.966 0.971 0.977 0.983 0.991 1.000

0.968 0.966 0.965 0.965 0.966 0.968 0.971 0.976 0.981 0.988 0.996 1.005

0.978 0.975 0.973 0.972 0.971 0.972 0.974 0.977 0.981 0.987 0.994 1.001 1.010

0.989 0.986 0.983 0.980 0.979 0.978 0.978 0.980 0.983 0.988 0.993 1.000 1.008 1.017

1.001 0.997 0.993 0.990 0.987 0.986 0.985 0.985 0.987 0.991 0.995 1.001 1.008 1.016 1.025

1.010 1.005 1.001 0.997 0.995 0.993 0.993 0.994 0.996 0.999 1.004 1.010 1.017 1.025

1.017 1.013 1.008 1.005 1.003 1.001 1.001 1.003 1.005 1.009 1.015 1.021 1.028

1.025 1.020 1.016 1.013 1.011 1.011 1.011 1.013 1.017 1.021 1.027 1.033

1.033 1.028 1.025 1.022 1.021 1.021 1.023 1.025 1.029 1.034 1.040

1.041 1.037 1.034 1.033 1.032 1.033 1.035 1.039 1.043 1.048

1.049 1.046 1.045 1.044 1.044 1.046 1.049 1.053 1.058

1.059 1.057 1.056 1.056 1.058 1.060 1.064 1.068

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Table E11B-2.7. Fast Flux Distribution by Pin in MFF-3 at EOC 11B-2

CORE POSITION 2404

0.998 0.993 0.988 0.981 0.974 0.965 0.956 0.946

1.008 1.003 0.998 0.992 0.985 0.977 0.968 0.958 0.947

1.016 1.012 1.008 1.002 0.996 0.989 0.980 0.970 0.960 0.948

1.023 1.020 1.016 1.011 1.006 0.999 0.991 0.981 0.971 0.960 0.948

1.029 1.027 1.023 1.019 1.014 1.007 1.000 0.991 0.982 0.971 0.959 0.946

1.034 1.032 1.029 1.025 1.021 1.015 1.008 1.000 0.991 0.981 0.969 0.956 0.943

1.037 1.036 1.034 1.031 1.027 1.021 1.015 1.008 0.999 0.989 0.978 0.966 0.953 0.939

1.039 1.038 1.037 1.034 1.031 1.026 1.021 1.014 1.006 0.997 0.986 0.975 0.962 0.948 0.934

1.040 1.038 1.037 1.034 1.030 1.025 1.019 1.012 1.003 0.993 0.982 0.970 0.957 0.943

1.039 1.038 1.035 1.032 1.028 1.023 1.016 1.008 0.999 0.988 0.977 0.964 0.950

1.037 1.036 1.033 1.030 1.025 1.019 1.012 1.003 0.994 0.983 0.970 0.957

1.035 1.033 1.030 1.026 1.021 1.014 1.007 0.998 0.987 0.976 0.963

1.031 1.029 1.026 1.021 1.015 1.009 1.000 0.991 0.980 0.968

1.027 1.024 1.020 1.015 1.009 1.002 0.993 0.983 0.972

1.021 1.018 1.014 1.009 1.002 0.994 0.985 0.974

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Table E11B-2.8. Fast Flux Distribution by Pin in MFF-5 at EOC 11B-2

CORE POSITION 1304

0.983 0.981 0.977 0.971 0.964 0.956 0.947 0.937

0.991 0.990 0.987 0.982 0.976 0.969 0.961 0.951 0.940

0.997 0.997 0.995 0.992 0.987 0.981 0.974 0.965 0.955 0.944

1.002 1.003 1.002 1.000 0.997 0.992 0.985 0.977 0.968 0.958 0.947

1.006 1.007 1.008 1.007 1.005 1.001 0.996 0.989 0.981 0.971 0.961 0.949

1.007 1.010 1.012 1.012 1.011 1.009 1.005 0.999 0.992 0.983 0.974 0.963 0.951

1.008 1.012 1.015 1.016 1.016 1.015 1.012 1.007 1.001 0.994 0.985 0.975 0.964 0.953

1.008 1.012 1.016 1.018 1.020 1.019 1.018 1.014 1.009 1.003 0.995 0.986 0.976 0.965 0.954

1.012 1.016 1.020 1.022 1.022 1.022 1.019 1.016 1.011 1.004 0.996 0.987 0.977 0.966

1.015 1.019 1.022 1.024 1.024 1.023 1.021 1.017 1.011 1.004 0.996 0.986 0.976

1.018 1.022 1.025 1.026 1.026 1.024 1.021 1.016 1.010 1.003 0.995 0.985

1.021 1.024 1.026 1.027 1.026 1.024 1.020 1.015 1.009 1.002 0.993

1.023 1.025 1.027 1.027 1.026 1.023 1.019 1.014 1.007 0.999

1.024 1.026 1.027 1.026 1.024 1.021 1.017 1.011 1.004

1.024 1.026 1.026 1.025 1.023 1.019 1.014 1.008

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Table E11B-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 11B-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4704E+15	2.5916E+15
SE	2.4494E+15	2.5447E+15
SW	2.3040E+15	2.4396E+15
W	2.2160E+15	2.3742E+15
NW	2.2504E+15	2.5102E+15
NE	2.3841E+15	2.6155E+15

Table E11B-2.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 11B-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.590E-01	8.901E-01
U-238	7.813E-02	7.618E-02
Pu-239	6.239E-02	3.358E-02
Pu-240	4.164E-04	1.142E-04
Pu-241	3.326E-05	4.835E-06
Pu-242	7.390E-08	5.507E-09
Am-241	1.045E-07	6.078E-09
Total	1.858E+17	2.066E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11B-2.11. Composition of MFF-3 at EOC 11B-2

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.3961E-03
			U-238	6.3240E-03	6.1184E-03
			Pu-239	0.0000E+00	1.4440E-04
			Pu-240	0.0000E+00	3.3557E-06
			Pu-241	0.0000E+00	4.8625E-08
			Pu-242	0.0000E+00	4.5740E-10
			Am-241	0.0000E+00	9.0656E-10
			FP	0.0000E+00	6.0465E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.2545E-03
			U-238	6.3240E-03	6.0656E-03
			Pu-239	0.0000E+00	1.7147E-04
			Pu-240	0.0000E+00	4.3988E-06
			Pu-241	0.0000E+00	7.3445E-08
			Pu-242	0.0000E+00	8.1044E-10
			Am-241	0.0000E+00	1.3799E-09
			FP	0.0000E+00	7.4897E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.1779E-03
			U-238	6.3240E-03	6.0380E-03
			Pu-239	0.0000E+00	1.8661E-04
			Pu-240	0.0000E+00	5.2930E-06
			Pu-241	0.0000E+00	9.7203E-08
			Pu-242	0.0000E+00	1.1898E-09
			Am-241	0.0000E+00	1.8194E-09
			FP	0.0000E+00	8.2228E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.2032E-03
			U-238	6.3240E-03	6.0470E-03
			Pu-239	0.0000E+00	1.8146E-04
			Pu-240	0.0000E+00	4.9616E-06
			Pu-241	0.0000E+00	8.8164E-08
			Pu-242	0.0000E+00	1.0414E-09
			Am-241	0.0000E+00	1.6463E-09
			FP	0.0000E+00	7.9850E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.3276E-03
			U-238	6.3240E-03	6.0910E-03
			Pu-239	0.0000E+00	1.5650E-04
			Pu-240	0.0000E+00	3.5667E-06
			Pu-241	0.0000E+00	5.3533E-08
			Pu-242	0.0000E+00	5.2732E-10
			Am-241	0.0000E+00	1.0016E-09
			FP	0.0000E+00	6.8155E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.5163E-03
			U-238	6.3240E-03	6.1568E-03
			Pu-239	0.0000E+00	1.1954E-04
			Pu-240	0.0000E+00	2.1522E-06
			Pu-241	0.0000E+00	2.4896E-08
			Pu-242	0.0000E+00	1.8499E-10
			Am-241	0.0000E+00	4.6347E-10
			FP	0.0000E+00	4.9898E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E11B-2.12. Composition of MFF-5 at EOC 11B-2

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.5803E-03
			U-238	6.4484E-03	6.3412E-03
			Pu-239	0.0000E+00	8.0802E-05
			Pu-240	0.0000E+00	9.5800E-07
			Pu-241	0.0000E+00	7.3974E-09
			Pu-242	0.0000E+00	3.5626E-11
			Am-241	0.0000E+00	5.5037E-11
			FP	0.0000E+00	3.0754E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.5040E-03
			U-238	6.4484E-03	6.3143E-03
			Pu-239	0.0000E+00	9.6910E-05
			Pu-240	0.0000E+00	1.2553E-06
			Pu-241	0.0000E+00	1.1138E-08
			Pu-242	0.0000E+00	6.2385E-11
			Am-241	0.0000E+00	8.3517E-11
			FP	0.0000E+00	3.8223E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.4606E-03
			U-238	6.4484E-03	6.2998E-03
			Pu-239	0.0000E+00	1.0636E-04
			Pu-240	0.0000E+00	1.5192E-06
			Pu-241	0.0000E+00	1.4849E-08
			Pu-242	0.0000E+00	9.2053E-11
			Am-241	0.0000E+00	1.1104E-10
			FP	0.0000E+00	4.2192E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.4734E-03
			U-238	6.4484E-03	6.3041E-03
			Pu-239	0.0000E+00	1.0352E-04
			Pu-240	0.0000E+00	1.4328E-06
			Pu-241	0.0000E+00	1.3598E-08
			Pu-242	0.0000E+00	8.1758E-11
			Am-241	0.0000E+00	1.0162E-10
			FP	0.0000E+00	4.1044E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			
			U-235	2.9371E-03	2.5405E-03

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			U-238	6.4484E-03	6.3263E-03
			Pu-239	0.0000E+00	8.8740E-05
			Pu-240	0.0000E+00	1.0378E-06
			Pu-241	0.0000E+00	8.3669E-09
			Pu-242	0.0000E+00	4.2463E-11
			Am-241	0.0000E+00	6.2551E-11
			FP	0.0000E+00	3.4970E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.6415E-03
			U-238	6.4484E-03	6.3600E-03
			Pu-239	0.0000E+00	6.7042E-05
			Pu-240	0.0000E+00	6.2741E-07
			Pu-241	0.0000E+00	3.9146E-09
			Pu-242	0.0000E+00	1.5173E-11
			Am-241	0.0000E+00	2.9083E-11
			FP	0.0000E+00	2.5512E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.12. Therefore, the compositions in these five axial levels are not repeated in this table.

5.11.8 Cycle 11C

Table B11C.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 11C

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *	
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	6.345E+00	0.000E+00	6.345E+00
2304	9.180E-03	5.227E+00	7.110E-03	5.244E+00
2303	1.886E-02	4.098E+00	1.115E-02	4.128E+00
2403	1.805E-02	3.440E+00	9.272E-03	3.467E+00
2505	7.331E-03	4.404E+00	5.067E-03	4.417E+00
2506	8.947E-02	3.394E+00	5.209E-02	3.535E+00
2405	1.686E-02	3.627E+00	1.103E-02	3.655E+00
1304	0.000E+00	7.091E+00	0.000E+00	7.091E+00
1303	1.548E-02	4.592E+00	9.134E-03	4.617E+00
1404	0.000E+00	6.089E+00	0.000E+00	6.089E+00
1405	1.001E-01	3.696E+00	5.599E-02	3.852E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	2.209E-02	3.970E+00	1.274E-02	4.004E+00
1202	1.579E-01	3.933E+00	8.377E-02	4.175E+00

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Table B11C.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 11C

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.639E+15	2.2475E+15
MFF-5	1304	3.870E+15	2.618E+15

Table B11C.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 11C

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9555E-02	1.4760E-02	0.0000E+00
-92.78	6.3340E-02	2.8479E-02	0.0000E+00
-87.78	1.0143E-01	4.5538E-02	0.0000E+00
-82.78	1.4673E-01	6.7860E-02	0.0000E+00
-77.78	2.0238E-01	9.7770E-02	0.0000E+00
-72.15	2.6773E-01	1.3713E-01	0.0000E+00
-65.90	3.3758E-01	1.8872E-01	0.0000E+00
-60.35	4.1935E-01	2.5824E-01	0.0000E+00
-55.49	5.1180E-01	3.4900E-01	0.0000E+00
-50.62	6.0155E-01	4.5972E-01	0.0000E+00
-47.17	6.5998E-01	5.5652E-01	0.0000E+00
-43.58	7.2742E-01	6.8075E-01	8.3988E-01
-38.45	8.4023E-01	8.2361E-01	8.9076E-01
-33.32	9.4565E-01	9.4285E-01	9.7761E-01
-28.20	1.0371E+00	1.0402E+00	1.0191E+00
-23.07	1.1124E+00	1.1188E+00	1.0893E+00
-17.94	1.1696E+00	1.1776E+00	1.1436E+00
-12.82	1.2079E+00	1.2159E+00	1.1530E+00
-7.69	1.2273E+00	1.2354E+00	1.1709E+00
-2.56	1.2278E+00	1.2363E+00	1.1707E+00
2.56	1.2106E+00	1.2196E+00	1.1624E+00
7.69	1.1767E+00	1.1862E+00	1.1293E+00
12.82	1.1277E+00	1.1376E+00	1.0819E+00
17.94	1.0645E+00	1.0753E+00	1.0596E+00
23.07	9.8730E-01	9.9734E-01	9.8335E-01
28.20	8.9711E-01	9.0475E-01	8.9538E-01
33.32	7.9527E-01	7.9874E-01	8.4272E-01
38.45	6.8276E-01	6.7572E-01	7.3756E-01
43.58	5.6268E-01	5.3324E-01	6.5297E-01
47.17	4.8563E-01	4.2045E-01	0.0000E+00
50.62	4.2698E-01	3.4308E-01	0.0000E+00
55.49	3.4396E-01	2.5366E-01	0.0000E+00
60.35	2.6691E-01	1.8243E-01	0.0000E+00
64.98	2.1083E-01	1.3627E-01	0.0000E+00
69.39	1.7593E-01	1.0913E-01	0.0000E+00
76.46	1.3032E-01	7.5500E-02	0.0000E+00
86.80	8.3727E-02	4.4751E-02	0.0000E+00
98.14	4.8343E-02	2.4257E-02	0.0000E+00
110.00	2.0904E-02	1.0858E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11C.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 11C

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	3.0469E-02	1.5140E-02	0.0000E+00
-92.78	6.5423E-02	2.9306E-02	0.0000E+00
-87.78	1.0492E-01	4.7013E-02	0.0000E+00
-82.78	1.5201E-01	7.0328E-02	0.0000E+00
-77.78	2.0979E-01	1.0180E-01	0.0000E+00
-72.15	2.7692E-01	1.4338E-01	0.0000E+00
-65.90	3.4921E-01	1.9897E-01	0.0000E+00
-60.35	4.2760E-01	2.7127E-01	0.0000E+00
-55.49	5.1003E-01	3.5625E-01	0.0000E+00
-50.62	5.9902E-01	4.6217E-01	0.0000E+00
-47.17	6.5985E-01	5.5861E-01	0.0000E+00
-43.58	7.2767E-01	6.8064E-01	8.2437E-01
-38.45	8.3798E-01	8.2070E-01	8.7599E-01
-33.32	9.4090E-01	9.3770E-01	9.5884E-01
-28.20	1.0303E+00	1.0337E+00	1.0188E+00
-23.07	1.1042E+00	1.1110E+00	1.0875E+00
-17.94	1.1607E+00	1.1692E+00	1.1412E+00
-12.82	1.1992E+00	1.2079E+00	1.1641E+00
-7.69	1.2197E+00	1.2286E+00	1.1834E+00
-2.56	1.2225E+00	1.2317E+00	1.1857E+00
2.56	1.2082E+00	1.2179E+00	1.1756E+00
7.69	1.1774E+00	1.1875E+00	1.1453E+00
12.82	1.1311E+00	1.1416E+00	1.1001E+00
17.94	1.0701E+00	1.0811E+00	1.0600E+00
23.07	9.9466E-01	1.0047E+00	9.8603E-01
28.20	9.0567E-01	9.1310E-01	9.0002E-01
33.32	8.0459E-01	8.0711E-01	8.2687E-01
38.45	6.9250E-01	6.8415E-01	7.2554E-01
43.58	5.7257E-01	5.4182E-01	6.4076E-01
47.17	4.9507E-01	4.3014E-01	0.0000E+00
50.62	4.3631E-01	3.5371E-01	0.0000E+00
55.49	3.5388E-01	2.6461E-01	0.0000E+00
60.35	2.7802E-01	1.9284E-01	0.0000E+00
64.98	2.2240E-01	1.4532E-01	0.0000E+00
69.39	1.8596E-01	1.1627E-01	0.0000E+00
76.46	1.3745E-01	7.9945E-02	0.0000E+00
86.80	8.7959E-02	4.7100E-02	0.0000E+00
98.14	5.0418E-02	2.5398E-02	0.0000E+00
110.00	2.1671E-02	1.1311E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B11C.5. Fission Power Distribution by Pin in MFF-3 at BOC 11C

CORE POSITION 2404

1.049 1.034 1.019 1.005 0.993 0.982 0.971 0.962

1.053 1.037 1.022 1.008 0.995 0.984 0.974 0.965 0.956

1.057 1.041 1.025 1.011 0.998 0.986 0.976 0.967 0.959 0.952

1.062 1.045 1.029 1.015 1.001 0.989 0.979 0.969 0.961 0.954 0.948

1.068 1.051 1.034 1.019 1.005 0.993 0.982 0.972 0.964 0.957 0.950 0.945

1.075 1.057 1.041 1.025 1.011 0.998 0.986 0.976 0.967 0.960 0.953 0.948 0.943

1.083 1.065 1.048 1.032 1.017 1.003 0.991 0.980 0.971 0.963 0.957 0.951 0.946 0.941

1.092 1.074 1.057 1.040 1.024 1.010 0.997 0.986 0.976 0.968 0.961 0.954 0.949 0.945 0.940

1.084 1.066 1.049 1.033 1.018 1.005 0.993 0.982 0.973 0.965 0.959 0.953 0.948 0.944

1.077 1.060 1.043 1.028 1.014 1.001 0.990 0.980 0.971 0.964 0.958 0.952 0.948

1.071 1.055 1.039 1.024 1.010 0.998 0.988 0.978 0.970 0.963 0.957 0.952

1.067 1.050 1.035 1.021 1.008 0.997 0.986 0.978 0.970 0.963 0.957

1.063 1.047 1.033 1.019 1.007 0.996 0.986 0.977 0.970 0.963

1.060 1.045 1.031 1.018 1.006 0.995 0.986 0.978 0.970

1.058 1.044 1.030 1.017 1.006 0.996 0.986 0.978

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Table B11C.6. Fission Power Distribution by Pin in MFF-5 at BOC 11C

CORE POSITION 1304

0.938 0.943 0.948 0.953 0.960 0.967 0.975 0.983

0.942 0.945 0.949 0.953 0.959 0.965 0.971 0.979 0.987

0.948 0.949 0.952 0.955 0.959 0.964 0.969 0.976 0.983 0.991

0.955 0.956 0.957 0.958 0.961 0.964 0.969 0.974 0.980 0.988 0.995

0.964 0.963 0.963 0.964 0.965 0.967 0.970 0.974 0.979 0.986 0.993 1.000

0.974 0.973 0.972 0.971 0.971 0.971 0.973 0.976 0.980 0.985 0.992 0.999 1.006

0.986 0.984 0.981 0.979 0.978 0.978 0.979 0.980 0.983 0.987 0.993 0.999 1.006 1.013

0.998 0.995 0.992 0.990 0.987 0.986 0.986 0.986 0.988 0.991 0.995 1.001 1.007 1.014 1.021

1.008 1.004 1.001 0.998 0.996 0.994 0.994 0.995 0.997 1.000 1.005 1.010 1.017 1.024

1.017 1.013 1.010 1.007 1.005 1.004 1.004 1.005 1.007 1.011 1.016 1.021 1.028

1.026 1.022 1.019 1.016 1.014 1.014 1.014 1.016 1.019 1.023 1.028 1.034

1.035 1.031 1.028 1.026 1.025 1.025 1.026 1.029 1.032 1.037 1.042

1.044 1.041 1.038 1.037 1.037 1.038 1.039 1.042 1.046 1.051

1.053 1.051 1.050 1.049 1.050 1.051 1.054 1.057 1.062

1.064 1.062 1.062 1.062 1.064 1.066 1.069 1.073

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Table B11C.7. Fast Flux Distribution by Pin in MFF-3 at BOC 11C

CORE POSITION 2404

1.000 0.993 0.986 0.979 0.971 0.961 0.952 0.941

1.011 1.005 0.999 0.991 0.983 0.975 0.965 0.955 0.944

1.021 1.016 1.010 1.003 0.995 0.987 0.978 0.968 0.957 0.945

1.030 1.025 1.020 1.013 1.006 0.998 0.989 0.979 0.969 0.957 0.945

1.039 1.034 1.028 1.022 1.015 1.008 0.999 0.990 0.980 0.969 0.957 0.944

1.045 1.041 1.036 1.030 1.024 1.016 1.008 0.999 0.989 0.979 0.967 0.955 0.942

1.051 1.047 1.042 1.037 1.030 1.024 1.016 1.007 0.998 0.987 0.976 0.964 0.951 0.938

1.056 1.051 1.047 1.042 1.036 1.029 1.022 1.014 1.005 0.995 0.984 0.972 0.960 0.946 0.932

1.055 1.050 1.046 1.040 1.034 1.027 1.019 1.010 1.001 0.990 0.979 0.967 0.954 0.940

1.053 1.048 1.043 1.037 1.030 1.023 1.015 1.005 0.995 0.985 0.973 0.960 0.947

1.049 1.044 1.039 1.032 1.025 1.018 1.009 0.999 0.989 0.978 0.965 0.953

1.044 1.039 1.033 1.027 1.019 1.011 1.002 0.992 0.981 0.969 0.957

1.038 1.033 1.026 1.019 1.012 1.003 0.994 0.983 0.972 0.960

1.031 1.025 1.018 1.011 1.003 0.994 0.984 0.974 0.963

1.022 1.016 1.009 1.002 0.993 0.984 0.974 0.964

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Table B11C.8. Fast Flux Distribution by Pin in MFF-5 at BOC 11C

CORE POSITION 1304

0.976 0.974 0.971 0.965 0.959 0.951 0.942 0.931

0.984 0.983 0.981 0.977 0.971 0.964 0.956 0.946 0.936

0.991 0.991 0.990 0.987 0.983 0.977 0.969 0.961 0.950 0.939

0.997 0.998 0.998 0.996 0.993 0.988 0.982 0.974 0.965 0.954 0.943

1.001 1.003 1.004 1.004 1.002 0.998 0.993 0.986 0.978 0.968 0.958 0.946

1.004 1.007 1.009 1.010 1.009 1.006 1.002 0.997 0.990 0.981 0.971 0.960 0.949

1.006 1.010 1.013 1.015 1.015 1.013 1.010 1.006 1.000 0.993 0.984 0.974 0.963 0.951

1.007 1.012 1.016 1.018 1.019 1.019 1.017 1.014 1.009 1.003 0.995 0.986 0.975 0.964 0.952

1.013 1.017 1.021 1.023 1.023 1.023 1.020 1.016 1.011 1.004 0.996 0.987 0.976 0.965

1.018 1.022 1.025 1.027 1.027 1.025 1.022 1.018 1.012 1.005 0.997 0.987 0.977

1.023 1.026 1.029 1.030 1.029 1.027 1.024 1.019 1.013 1.005 0.996 0.987

1.027 1.030 1.032 1.032 1.031 1.028 1.024 1.019 1.012 1.004 0.995

1.030 1.033 1.034 1.033 1.031 1.028 1.024 1.018 1.011 1.003

1.033 1.035 1.035 1.034 1.031 1.027 1.022 1.016 1.009

1.035 1.036 1.035 1.033 1.030 1.026 1.021 1.014

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Table B11C.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 11C

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5559E+15	2.6731E+15
SE	2.5221E+15	2.5887E+15
SW	2.3383E+15	2.4848E+15
W	2.2541E+15	2.4217E+15
NW	2.2841E+15	2.5779E+15
NE	2.4048E+15	2.7059E+15

Table B11C.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 11C

	Fission Rate*	
Isotope	MFF-3	MFF-5
U235	8.571E-01	8.884E-01
U238	7.984E-02	7.782E-02
PU239	6.256E-02	3.368E-02
PU240	4.236E-04	1.161E-04
PU241	3.291E-05	4.785E-06
PU240	7.517E-08	5.600E-09
AM241	1.555E-07	1.332E-08
Total	1.868E+17	2.088E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11C.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 11C

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *	
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	6.133E+00	0.000E+00	6.133E+00
2304	1.048E-02	4.997E+00	8.464E-03	5.016E+00
2303	1.919E-02	3.967E+00	1.244E-02	3.999E+00
2403	1.824E-02	3.452E+00	1.047E-02	3.480E+00
2505	8.076E-03	4.422E+00	5.963E-03	4.436E+00
2506	9.036E-02	3.303E+00	5.823E-02	3.451E+00
2405	1.687E-02	3.519E+00	1.218E-02	3.548E+00
1304	0.000E+00	6.791E+00	0.000E+00	6.791E+00
1303	1.604E-02	4.432E+00	1.031E-02	4.458E+00
1404	0.000E+00	5.919E+00	0.000E+00	5.919E+00
1405	1.017E-01	3.579E+00	6.260E-02	3.743E+00
1406	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2301	2.201E-02	3.855E+00	1.400E-02	3.891E+00
1202	1.559E-01	3.759E+00	9.108E-02	4.006E+00

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Table E11C.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 11C

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.631E+15	2.406E+15
MFF-5	1304	3.835E+15	2.570E+15

Table E11C.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 11C

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8080E-02	1.4112E-02	0.0000E+00
-92.78	6.0207E-02	2.7230E-02	0.0000E+00
-87.78	9.6439E-02	4.3539E-02	0.0000E+00
-82.78	1.3957E-01	6.4878E-02	0.0000E+00
-77.78	1.9258E-01	9.3467E-02	0.0000E+00
-72.15	2.5488E-01	1.3109E-01	0.0000E+00
-65.90	3.2140E-01	1.8035E-01	0.0000E+00
-60.35	3.9920E-01	2.4665E-01	0.0000E+00
-55.49	4.8718E-01	3.3308E-01	0.0000E+00
-50.62	5.7251E-01	4.3835E-01	0.0000E+00
-47.17	6.2795E-01	5.3024E-01	0.0000E+00
-43.58	6.9181E-01	6.4816E-01	8.0173E-01
-38.45	8.0012E-01	7.8513E-01	8.5147E-01
-33.32	9.0290E-01	9.0088E-01	9.3705E-01
-28.20	9.9387E-01	9.9716E-01	9.7378E-01
-23.07	1.0713E+00	1.0775E+00	1.0461E+00
-17.94	1.1335E+00	1.1409E+00	1.1052E+00
-12.82	1.1794E+00	1.1866E+00	1.1184E+00
-7.69	1.2091E+00	1.2164E+00	1.1463E+00
-2.56	1.2222E+00	1.2298E+00	1.1585E+00
2.56	1.2185E+00	1.2267E+00	1.1649E+00
7.69	1.1974E+00	1.2061E+00	1.1446E+00
12.82	1.1590E+00	1.1684E+00	1.1077E+00
17.94	1.1035E+00	1.1142E+00	1.1010E+00
23.07	1.0302E+00	1.0403E+00	1.0283E+00
28.20	9.4023E-01	9.4818E-01	9.4020E-01
33.32	8.3571E-01	8.3970E-01	8.9509E-01
38.45	7.1853E-01	7.1160E-01	7.8430E-01
43.58	5.9290E-01	5.6226E-01	6.9539E-01
47.17	5.1251E-01	4.4385E-01	0.0000E+00
50.62	4.5109E-01	3.6263E-01	0.0000E+00
55.49	3.6377E-01	2.6846E-01	0.0000E+00
60.35	2.8246E-01	1.9329E-01	0.0000E+00
64.98	2.2322E-01	1.4451E-01	0.0000E+00
69.39	1.8626E-01	1.1578E-01	0.0000E+00
76.46	1.3785E-01	8.0110E-02	0.0000E+00
86.80	8.8143E-02	4.7399E-02	0.0000E+00
98.14	5.0187E-02	2.5524E-02	0.0000E+00
110.00	2.1421E-02	1.1317E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11C.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 11C

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9157E-02	1.4583E-02	0.0000E+00
-92.78	6.2633E-02	2.8229E-02	0.0000E+00
-87.78	1.0048E-01	4.5284E-02	0.0000E+00
-82.78	1.4562E-01	6.7738E-02	0.0000E+00
-77.78	2.0104E-01	9.8039E-02	0.0000E+00
-72.15	2.6547E-01	1.3807E-01	0.0000E+00
-65.90	3.3474E-01	1.9154E-01	0.0000E+00
-60.35	4.0980E-01	2.6099E-01	0.0000E+00
-55.49	4.8867E-01	3.4243E-01	0.0000E+00
-50.62	5.7378E-01	4.4365E-01	0.0000E+00
-47.17	6.3189E-01	5.3570E-01	0.0000E+00
-43.58	6.9652E-01	6.5223E-01	7.9286E-01
-38.45	8.0306E-01	7.8722E-01	8.4362E-01
-33.32	9.0391E-01	9.0145E-01	9.2578E-01
-28.20	9.9335E-01	9.9677E-01	9.7987E-01
-23.07	1.0695E+00	1.0760E+00	1.0510E+00
-17.94	1.1307E+00	1.1386E+00	1.1094E+00
-12.82	1.1760E+00	1.1838E+00	1.1344E+00
-7.69	1.2052E+00	1.2132E+00	1.1623E+00
-2.56	1.2181E+00	1.2264E+00	1.1744E+00
2.56	1.2144E+00	1.2232E+00	1.1760E+00
7.69	1.1936E+00	1.2030E+00	1.1557E+00
12.82	1.1559E+00	1.1659E+00	1.1190E+00
17.94	1.1014E+00	1.1124E+00	1.0930E+00
23.07	1.0298E+00	1.0401E+00	1.0227E+00
28.20	9.4209E-01	9.5001E-01	9.3773E-01
33.32	8.4003E-01	8.4328E-01	8.7310E-01
38.45	7.2514E-01	7.1702E-01	7.6836E-01
43.58	6.0127E-01	5.6945E-01	6.8077E-01
47.17	5.2126E-01	4.5315E-01	0.0000E+00
50.62	4.6026E-01	3.7344E-01	0.0000E+00
55.49	3.7410E-01	2.8006E-01	0.0000E+00
60.35	2.9443E-01	2.0455E-01	0.0000E+00
64.98	2.3583E-01	1.5440E-01	0.0000E+00
69.39	1.9731E-01	1.2365E-01	0.0000E+00
76.46	1.4590E-01	8.5124E-02	0.0000E+00
86.80	9.3173E-02	5.0148E-02	0.0000E+00
98.14	5.3074E-02	2.6967E-02	0.0000E+00
110.00	2.2659E-02	1.1956E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E11C.5. Fission Power Distribution by Pin in MFF-3 at EOC 11C

CORE POSITION 2404

1.052 1.038 1.025 1.013 1.002 0.992 0.983 0.976

1.054 1.039 1.026 1.013 1.002 0.992 0.983 0.976 0.969

1.056 1.041 1.027 1.014 1.003 0.992 0.983 0.975 0.969 0.963

1.060 1.044 1.030 1.016 1.004 0.993 0.984 0.976 0.969 0.963 0.958

1.064 1.048 1.033 1.019 1.006 0.995 0.985 0.977 0.969 0.963 0.958 0.954

1.070 1.054 1.038 1.023 1.010 0.998 0.987 0.978 0.971 0.964 0.959 0.955 0.951

1.077 1.060 1.044 1.029 1.015 1.002 0.991 0.981 0.973 0.966 0.960 0.956 0.952 0.948

1.085 1.068 1.051 1.036 1.021 1.008 0.996 0.985 0.976 0.969 0.963 0.957 0.953 0.949 0.946

1.077 1.060 1.044 1.029 1.015 1.002 0.991 0.981 0.973 0.966 0.960 0.955 0.951 0.948

1.070 1.053 1.038 1.023 1.010 0.998 0.987 0.978 0.970 0.964 0.959 0.954 0.950

1.064 1.048 1.033 1.019 1.006 0.995 0.985 0.976 0.969 0.963 0.958 0.953

1.059 1.044 1.029 1.016 1.004 0.993 0.983 0.975 0.968 0.962 0.957

1.055 1.040 1.027 1.014 1.002 0.992 0.983 0.975 0.968 0.962

1.053 1.038 1.025 1.012 1.001 0.991 0.982 0.974 0.968

1.051 1.037 1.024 1.012 1.001 0.991 0.982 0.974

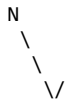

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Table E11C.6. Fission Power Distribution by Pin in MFF-5 at EOC 11C

CORE POSITION 1304

0.940 0.945 0.950 0.955 0.962 0.970 0.978 0.987

0.944 0.947 0.950 0.955 0.960 0.967 0.974 0.982 0.991

0.949 0.951 0.953 0.956 0.960 0.965 0.971 0.979 0.987 0.995

0.956 0.957 0.957 0.959 0.962 0.965 0.970 0.976 0.983 0.991 1.000

0.965 0.964 0.964 0.964 0.965 0.968 0.971 0.976 0.981 0.988 0.996 1.005

0.976 0.974 0.972 0.971 0.971 0.972 0.974 0.977 0.981 0.987 0.994 1.002 1.010

0.987 0.984 0.982 0.979 0.978 0.978 0.978 0.980 0.984 0.988 0.994 1.001 1.009 1.017

0.999 0.996 0.992 0.989 0.987 0.985 0.985 0.986 0.988 0.991 0.996 1.002 1.009 1.017 1.025

1.008 1.004 1.000 0.997 0.995 0.993 0.993 0.994 0.997 1.000 1.005 1.011 1.018 1.026

1.016 1.012 1.008 1.005 1.003 1.002 1.002 1.004 1.006 1.011 1.016 1.022 1.029

1.024 1.020 1.017 1.014 1.012 1.012 1.012 1.014 1.018 1.022 1.028 1.034

1.033 1.029 1.026 1.023 1.022 1.022 1.024 1.027 1.030 1.035 1.041

1.041 1.038 1.035 1.034 1.034 1.034 1.037 1.040 1.044 1.050

1.050 1.047 1.046 1.045 1.046 1.048 1.051 1.055 1.059

1.060 1.058 1.057 1.058 1.059 1.062 1.066 1.070

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Table E11C.7. Fast Flux Distribution by Pin in MFF-3 at EOC 11C

CORE POSITION 2404

1.002 0.997 0.991 0.985 0.978 0.970 0.961 0.952

1.012 1.007 1.002 0.996 0.989 0.981 0.973 0.964 0.954

1.021 1.016 1.011 1.006 0.999 0.992 0.984 0.975 0.965 0.954

1.029 1.024 1.020 1.014 1.008 1.001 0.993 0.985 0.975 0.965 0.954

1.035 1.031 1.027 1.022 1.016 1.009 1.002 0.994 0.984 0.974 0.963 0.952

1.041 1.037 1.033 1.028 1.023 1.017 1.009 1.001 0.992 0.983 0.972 0.961 0.948

1.046 1.042 1.038 1.034 1.028 1.022 1.016 1.008 0.999 0.990 0.979 0.968 0.956 0.944

1.049 1.046 1.042 1.038 1.033 1.027 1.021 1.013 1.005 0.996 0.986 0.975 0.963 0.951 0.938

1.048 1.045 1.041 1.036 1.031 1.024 1.017 1.009 1.001 0.991 0.980 0.969 0.957 0.944

1.046 1.042 1.038 1.033 1.027 1.020 1.013 1.004 0.995 0.985 0.974 0.962 0.950

1.042 1.038 1.033 1.028 1.022 1.015 1.007 0.998 0.988 0.977 0.966 0.954

1.038 1.033 1.028 1.022 1.015 1.008 0.999 0.990 0.980 0.969 0.957

1.032 1.027 1.021 1.015 1.008 1.000 0.991 0.981 0.971 0.960

1.024 1.019 1.013 1.006 0.999 0.991 0.981 0.972 0.961

1.016 1.010 1.004 0.997 0.989 0.981 0.971 0.961

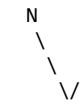

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Table E11C.8. Fast Flux Distribution by Pin in MFF-5 at EOC 11C

CORE POSITION 1304

0.978 0.976 0.973 0.968 0.961 0.954 0.945 0.935

0.986 0.985 0.983 0.979 0.973 0.966 0.958 0.949 0.939

0.993 0.993 0.991 0.989 0.984 0.978 0.971 0.963 0.953 0.943

0.998 0.999 0.999 0.997 0.994 0.989 0.983 0.975 0.967 0.957 0.946

1.002 1.004 1.005 1.004 1.002 0.999 0.994 0.987 0.979 0.970 0.960 0.949

1.005 1.008 1.010 1.010 1.009 1.007 1.003 0.997 0.990 0.982 0.973 0.963 0.952

1.007 1.011 1.013 1.015 1.015 1.013 1.010 1.006 1.000 0.993 0.985 0.975 0.965 0.954

1.008 1.012 1.016 1.018 1.019 1.018 1.017 1.013 1.009 1.002 0.995 0.986 0.977 0.966 0.955

1.013 1.017 1.020 1.022 1.022 1.022 1.019 1.015 1.010 1.004 0.996 0.987 0.978 0.967

1.018 1.021 1.024 1.025 1.025 1.024 1.021 1.017 1.011 1.005 0.997 0.988 0.978

1.022 1.025 1.027 1.028 1.027 1.025 1.022 1.017 1.011 1.004 0.996 0.987

1.025 1.028 1.029 1.029 1.028 1.026 1.022 1.017 1.011 1.003 0.995

1.028 1.030 1.031 1.030 1.029 1.025 1.021 1.016 1.009 1.001

1.030 1.031 1.032 1.030 1.028 1.024 1.020 1.014 1.007

1.031 1.032 1.031 1.030 1.027 1.023 1.017 1.011

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Table E11C.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 11C

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5072E+15	2.6207E+15
SE	2.4848E+15	2.5475E+15
SW	2.3315E+15	2.4451E+15
W	2.2521E+15	2.3879E+15
NW	2.2589E+15	2.5305E+15
NE	2.3652E+15	2.6443E+15

Table E11C.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 11C

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.450E-01	8.753E-01
U-238	7.990E-02	7.789E-02
Pu-239	7.443E-02	4.656E-02
Pu-240	5.901E-04	2.179E-04
Pu-241	5.523E-05	1.254E-05
Pu-242	1.457E-07	1.962E-08
Am-241	2.268E-07	2.735E-08
Total	1.806E+17	1.999E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E11C.11. Composition of MFF-3 at EOC 11C

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.2865E-03
			U-238	6.3240E-03	6.0815E-03
			Pu-239	0.0000E+00	1.6682E-04
			Pu-240	0.0000E+00	4.6269E-06
			Pu-241	0.0000E+00	7.8503E-08
			Pu-242	0.0000E+00	8.8058E-10
			Am-241	0.0000E+00	1.9239E-09
			FP	0.0000E+00	7.0441E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.1279E-03
			U-238	6.3240E-03	6.0195E-03
			Pu-239	0.0000E+00	1.9687E-04
			Pu-240	0.0000E+00	6.0149E-06
			Pu-241	0.0000E+00	1.1716E-07
			Pu-242	0.0000E+00	1.5407E-09
			Am-241	0.0000E+00	2.8900E-09
			FP	0.0000E+00	8.6916E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	2.0421E-03
			U-238	6.3240E-03	5.9869E-03
			Pu-239	0.0000E+00	2.1364E-04
			Pu-240	0.0000E+00	7.2231E-06
			Pu-241	0.0000E+00	1.5467E-07
			Pu-242	0.0000E+00	2.2578E-09
			Am-241	0.0000E+00	3.8011E-09
			FP	0.0000E+00	9.5281E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	2.0698E-03
			U-238	6.3240E-03	5.9974E-03
			Pu-239	0.0000E+00	2.0806E-04
			Pu-240	0.0000E+00	6.7845E-06
			Pu-241	0.0000E+00	1.4068E-07
			Pu-242	0.0000E+00	1.9827E-09
			Am-241	0.0000E+00	3.4498E-09
			FP	0.0000E+00	9.2626E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.2089E-03
			U-238	6.3240E-03	6.0490E-03
			Pu-239	0.0000E+00	1.8040E-04
			Pu-240	0.0000E+00	4.9020E-06
			Pu-241	0.0000E+00	8.6008E-08
			Pu-242	0.0000E+00	1.0104E-09
			Am-241	0.0000E+00	2.1125E-09
			FP	0.0000E+00	7.9320E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.4222E-03
			U-238	6.3240E-03	6.1263E-03
			Pu-239	0.0000E+00	1.3892E-04
			Pu-240	0.0000E+00	2.9868E-06
			Pu-241	0.0000E+00	4.0552E-08
			Pu-242	0.0000E+00	3.5953E-10
			Am-241	0.0000E+00	9.9147E-10
			FP	0.0000E+00	5.8378E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E11C.12. Composition of MFF-5 at EOC 11C

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.4569E-03
			U-238	6.4484E-03	6.3013E-03
			Pu-239	0.0000E+00	1.0825E-04
			Pu-240	0.0000E+00	1.7744E-06
			Pu-241	0.0000E+00	1.8598E-08
			Pu-242	0.0000E+00	1.2376E-10
			Am-241	0.0000E+00	2.4246E-10
			FP	0.0000E+00	4.1676E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.3576E-03
			U-238	6.4484E-03	6.2646E-03
			Pu-239	0.0000E+00	1.2898E-04
			Pu-240	0.0000E+00	2.3079E-06
			Pu-241	0.0000E+00	2.7677E-08
			Pu-242	0.0000E+00	2.1391E-10
			Am-241	0.0000E+00	3.6223E-10
			FP	0.0000E+00	5.1595E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.3012E-03
			U-238	6.4484E-03	6.2447E-03
			Pu-239	0.0000E+00	1.4114E-04
			Pu-240	0.0000E+00	2.7883E-06
			Pu-241	0.0000E+00	3.6819E-08
			Pu-242	0.0000E+00	3.1524E-10
			Am-241	0.0000E+00	4.8055E-10
			FP	0.0000E+00	5.6855E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.3174E-03
			U-238	6.4484E-03	6.2504E-03
			Pu-239	0.0000E+00	1.3758E-04
			Pu-240	0.0000E+00	2.6348E-06
			Pu-241	0.0000E+00	3.3809E-08
			Pu-242	0.0000E+00	2.8084E-10
			Am-241	0.0000E+00	4.4084E-10
			FP	0.0000E+00	5.5378E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			
			U-235	2.9371E-03	2.4042E-03

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			U-238	6.4484E-03	6.2806E-03
			Pu-239	0.0000E+00	1.1862E-04
			Pu-240	0.0000E+00	1.9185E-06
			Pu-241	0.0000E+00	2.0957E-08
			Pu-242	0.0000E+00	1.4690E-10
			Am-241	0.0000E+00	2.7329E-10
			FP	0.0000E+00	4.7377E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.5367E-03
			U-238	6.4484E-03	6.3267E-03
			Pu-239	0.0000E+00	9.0435E-05
			Pu-240	0.0000E+00	1.1715E-06
			Pu-241	0.0000E+00	9.9539E-09
			Pu-242	0.0000E+00	5.3367E-11
			Am-241	0.0000E+00	1.2931E-10
			FP	0.0000E+00	3.4772E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

5.11.9 Cycle 12A-1

Table B12A-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 12A-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *	
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.889E+00	0.000E+00	5.889E+00
2304	1.031E-02	4.771E+00	7.801E-03	4.789E+00
2303	1.935E-02	3.881E+00	1.169E-02	3.912E+00
2403	1.855E-02	3.368E+00	9.722E-03	3.396E+00
2505	8.078E-03	4.216E+00	5.414E-03	4.230E+00
2506	8.921E-02	3.132E+00	5.311E-02	3.274E+00
2405	1.648E-02	3.324E+00	1.110E-02	3.352E+00
1304	0.000E+00	7.128E+00	0.000E+00	7.128E+00
1303	1.662E-02	4.488E+00	1.009E-02	4.514E+00
1404	0.000E+00	6.236E+00	0.000E+00	6.236E+00
1405	1.110E-01	3.927E+00	6.502E-02	4.103E+00
1406	1.058E-02	4.748E+00	7.886E-03	4.766E+00
2301	2.326E-02	4.013E+00	1.407E-02	4.051E+00
1202	1.605E-01	3.790E+00	8.845E-02	4.039E+00

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Table B12A-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 12A-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.488E+15	2.310E+15
MFF-5	1304	4.085E+15	2.776E+15

Table B12A-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 12A-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9322E-02	1.4747E-02	0.0000E+00
-92.78	6.2856E-02	2.8447E-02	0.0000E+00
-87.78	1.0064E-01	4.5465E-02	0.0000E+00
-82.78	1.4559E-01	6.7710E-02	0.0000E+00
-77.78	2.0078E-01	9.7485E-02	0.0000E+00
-72.15	2.6559E-01	1.3663E-01	0.0000E+00
-65.90	3.3463E-01	1.8778E-01	0.0000E+00
-60.35	4.1507E-01	2.5642E-01	0.0000E+00
-55.49	5.0577E-01	3.4569E-01	0.0000E+00
-50.62	5.9338E-01	4.5414E-01	0.0000E+00
-47.17	6.5000E-01	5.4864E-01	0.0000E+00
-43.58	7.1512E-01	6.6983E-01	8.2975E-01
-38.45	8.2539E-01	8.0979E-01	8.7914E-01
-33.32	9.2931E-01	9.2717E-01	9.6523E-01
-28.20	1.0204E+00	1.0237E+00	1.0005E+00
-23.07	1.0967E+00	1.1030E+00	1.0716E+00
-17.94	1.1564E+00	1.1640E+00	1.1284E+00
-12.82	1.1987E+00	1.2060E+00	1.1375E+00
-7.69	1.2235E+00	1.2308E+00	1.1606E+00
-2.56	1.2303E+00	1.2378E+00	1.1668E+00
2.56	1.2191E+00	1.2272E+00	1.1661E+00
7.69	1.1897E+00	1.1982E+00	1.1375E+00
12.82	1.1427E+00	1.1519E+00	1.0920E+00
17.94	1.0793E+00	1.0900E+00	1.0765E+00
23.07	1.0006E+00	1.0108E+00	9.9821E-01
28.20	9.0841E-01	9.1648E-01	9.0785E-01
33.32	8.0465E-01	8.0889E-01	8.6154E-01
38.45	6.9048E-01	6.8424E-01	7.5355E-01
43.58	5.6922E-01	5.4017E-01	6.6741E-01
47.17	4.9189E-01	4.2644E-01	0.0000E+00
50.62	4.3289E-01	3.4841E-01	0.0000E+00
55.49	3.4908E-01	2.5800E-01	0.0000E+00
60.35	2.7110E-01	1.8585E-01	0.0000E+00
64.98	2.1429E-01	1.3902E-01	0.0000E+00
69.39	1.7887E-01	1.1145E-01	0.0000E+00
76.46	1.3247E-01	7.7203E-02	0.0000E+00
86.80	8.4802E-02	4.5760E-02	0.0000E+00
98.14	4.8370E-02	2.4695E-02	0.0000E+00
110.00	2.0730E-02	1.0989E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12A-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 12A-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8854E-02	1.4303E-02	0.0000E+00
-92.78	6.1793E-02	2.7603E-02	0.0000E+00
-87.78	9.8911E-02	4.4183E-02	0.0000E+00
-82.78	1.4302E-01	6.5961E-02	0.0000E+00
-77.78	1.9705E-01	9.5320E-02	0.0000E+00
-72.15	2.6020E-01	1.3431E-01	0.0000E+00
-65.90	3.2903E-01	1.8702E-01	0.0000E+00
-60.35	4.0535E-01	2.5675E-01	0.0000E+00
-55.49	4.8654E-01	3.3981E-01	0.0000E+00
-50.62	5.7476E-01	4.4428E-01	0.0000E+00
-47.17	6.3595E-01	5.3992E-01	0.0000E+00
-43.58	7.0495E-01	6.6075E-01	7.9796E-01
-38.45	8.1692E-01	8.0134E-01	8.5553E-01
-33.32	9.2173E-01	9.1946E-01	9.4313E-01
-28.20	1.0134E+00	1.0169E+00	1.0001E+00
-23.07	1.0902E+00	1.0967E+00	1.0724E+00
-17.94	1.1504E+00	1.1581E+00	1.1302E+00
-12.82	1.1933E+00	1.2009E+00	1.1529E+00
-7.69	1.2188E+00	1.2264E+00	1.1772E+00
-2.56	1.2269E+00	1.2347E+00	1.1847E+00
2.56	1.2174E+00	1.2258E+00	1.1808E+00
7.69	1.1904E+00	1.1994E+00	1.1544E+00
12.82	1.1466E+00	1.1561E+00	1.1116E+00
17.94	1.0865E+00	1.0971E+00	1.0795E+00
23.07	1.0104E+00	1.0204E+00	1.0044E+00
28.20	9.1968E-01	9.2751E-01	9.1601E-01
33.32	8.1593E-01	8.1931E-01	8.4783E-01
38.45	7.0028E-01	6.9289E-01	7.4088E-01
43.58	5.7617E-01	5.4618E-01	6.5042E-01
47.17	4.9602E-01	4.3179E-01	0.0000E+00
50.62	4.3563E-01	3.5348E-01	0.0000E+00
55.49	3.5120E-01	2.6253E-01	0.0000E+00
60.35	2.7338E-01	1.8954E-01	0.0000E+00
64.98	2.1679E-01	1.4173E-01	0.0000E+00
69.39	1.8086E-01	1.1330E-01	0.0000E+00
76.46	1.3356E-01	7.8041E-02	0.0000E+00
86.80	8.5281E-02	4.6051E-02	0.0000E+00
98.14	4.8625E-02	2.4816E-02	0.0000E+00
110.00	2.0873E-02	1.1060E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12A-1.5. Fission Power Distribution by Pin in MFF-3 at BOC 12A-1

CORE POSITION 2404

1.063 1.048 1.033 1.020 1.008 0.997 0.987 0.979

1.064 1.048 1.034 1.020 1.008 0.997 0.987 0.978 0.970

1.065 1.049 1.034 1.021 1.008 0.997 0.987 0.978 0.970 0.963

1.068 1.052 1.036 1.022 1.009 0.997 0.987 0.978 0.970 0.963 0.957

1.072 1.055 1.039 1.024 1.011 0.998 0.988 0.978 0.970 0.963 0.958 0.952

1.076 1.059 1.043 1.027 1.013 1.001 0.989 0.980 0.971 0.964 0.958 0.953 0.948

1.082 1.065 1.048 1.032 1.017 1.004 0.992 0.982 0.973 0.965 0.959 0.954 0.949 0.945

1.089 1.071 1.054 1.038 1.023 1.009 0.996 0.985 0.976 0.968 0.961 0.955 0.950 0.946 0.942

1.079 1.062 1.045 1.030 1.015 1.002 0.990 0.980 0.971 0.964 0.957 0.952 0.947 0.943

1.071 1.054 1.038 1.023 1.009 0.996 0.985 0.976 0.968 0.961 0.955 0.950 0.945

1.063 1.047 1.031 1.017 1.004 0.992 0.982 0.973 0.965 0.958 0.953 0.948

1.057 1.041 1.026 1.013 1.000 0.989 0.979 0.970 0.963 0.957 0.951

1.052 1.037 1.023 1.009 0.997 0.987 0.977 0.969 0.962 0.955

1.048 1.033 1.020 1.007 0.995 0.985 0.976 0.968 0.961

1.045 1.031 1.017 1.005 0.994 0.984 0.975 0.967

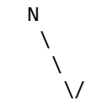

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Table B12A-1.6. Fission Power Distribution by Pin in MFF-5 at BOC 12A-1

CORE POSITION 1304

0.958 0.962 0.967 0.972 0.977 0.982 0.986 0.991

0.958 0.962 0.966 0.970 0.975 0.979 0.984 0.989 0.994

0.960 0.963 0.966 0.970 0.974 0.978 0.982 0.987 0.992 0.997

0.963 0.965 0.968 0.971 0.974 0.977 0.981 0.985 0.990 0.995 1.000

0.968 0.969 0.971 0.973 0.975 0.978 0.981 0.985 0.989 0.994 0.999 1.004

0.974 0.974 0.975 0.976 0.977 0.979 0.982 0.985 0.989 0.993 0.998 1.003 1.009

0.981 0.981 0.981 0.981 0.981 0.983 0.984 0.987 0.990 0.994 0.999 1.004 1.009 1.015

0.989 0.988 0.988 0.987 0.987 0.987 0.988 0.990 0.993 0.996 1.000 1.005 1.010 1.016 1.022

0.997 0.995 0.994 0.993 0.993 0.993 0.995 0.996 0.999 1.003 1.007 1.012 1.018 1.024

1.004 1.002 1.001 1.000 1.000 1.000 1.002 1.004 1.007 1.011 1.016 1.021 1.027

1.012 1.010 1.008 1.007 1.007 1.008 1.009 1.012 1.016 1.020 1.025 1.030

1.019 1.017 1.015 1.015 1.015 1.016 1.018 1.021 1.025 1.030 1.035

1.026 1.024 1.023 1.023 1.024 1.025 1.028 1.032 1.036 1.041

1.034 1.032 1.032 1.032 1.033 1.036 1.039 1.043 1.047

1.042 1.041 1.041 1.042 1.044 1.046 1.050 1.054

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Table B12A-1.7. Fast Flux Distribution by Pin in MFF-3 at BOC 12A-1

CORE POSITION 2404

1.012 1.006 1.000 0.992 0.984 0.975 0.965 0.955

1.021 1.016 1.009 1.002 0.995 0.986 0.977 0.967 0.956

1.029 1.024 1.018 1.012 1.004 0.996 0.987 0.977 0.967 0.955

1.036 1.031 1.026 1.020 1.013 1.005 0.996 0.987 0.976 0.965 0.954

1.042 1.038 1.032 1.027 1.020 1.013 1.004 0.995 0.985 0.974 0.963 0.950

1.047 1.043 1.038 1.032 1.026 1.019 1.011 1.002 0.993 0.982 0.971 0.959 0.946

1.050 1.046 1.042 1.037 1.031 1.024 1.017 1.008 0.999 0.989 0.978 0.966 0.954 0.940

1.053 1.049 1.045 1.040 1.035 1.028 1.021 1.013 1.004 0.995 0.984 0.973 0.960 0.947 0.934

1.050 1.046 1.042 1.037 1.031 1.024 1.017 1.008 0.999 0.989 0.978 0.966 0.953 0.940

1.047 1.043 1.038 1.032 1.026 1.019 1.011 1.002 0.992 0.982 0.970 0.958 0.945

1.042 1.037 1.032 1.026 1.020 1.012 1.004 0.994 0.984 0.973 0.961 0.949

1.036 1.031 1.025 1.019 1.012 1.004 0.995 0.986 0.975 0.964 0.952

1.028 1.023 1.017 1.011 1.003 0.995 0.986 0.976 0.965 0.953

1.020 1.014 1.008 1.001 0.993 0.985 0.975 0.965 0.954

1.010 1.005 0.998 0.991 0.983 0.974 0.964 0.954

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Table B12A-1.8. Fast Flux Distribution by Pin in MFF-5 at BOC 12A-1

CORE POSITION 1304

0.984 0.986 0.987 0.987 0.986 0.985 0.982 0.979

0.989 0.991 0.992 0.993 0.993 0.991 0.990 0.987 0.983

0.991 0.994 0.997 0.998 0.998 0.998 0.996 0.994 0.990 0.986

0.993 0.997 1.000 1.002 1.003 1.003 1.002 1.000 0.997 0.993 0.988

0.994 0.998 1.002 1.004 1.006 1.006 1.006 1.005 1.002 0.999 0.994 0.989

0.993 0.998 1.002 1.006 1.008 1.009 1.009 1.009 1.007 1.004 1.000 0.995 0.989

0.991 0.997 1.002 1.006 1.009 1.011 1.012 1.011 1.010 1.007 1.004 0.999 0.994 0.987

0.988 0.994 1.000 1.005 1.008 1.011 1.012 1.013 1.012 1.010 1.007 1.003 0.997 0.991 0.984

0.991 0.997 1.003 1.007 1.010 1.012 1.013 1.013 1.012 1.009 1.005 1.000 0.994 0.988

0.993 0.999 1.004 1.008 1.011 1.012 1.013 1.012 1.010 1.007 1.002 0.997 0.990

0.995 1.001 1.005 1.008 1.011 1.012 1.011 1.010 1.007 1.003 0.998 0.992

0.996 1.001 1.005 1.008 1.009 1.010 1.009 1.006 1.003 0.998 0.993

0.996 1.001 1.004 1.006 1.007 1.006 1.005 1.002 0.998 0.993

0.996 0.999 1.002 1.003 1.004 1.002 1.000 0.997 0.992

0.994 0.997 0.999 1.000 0.999 0.997 0.995 0.991

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Table B12A-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 12A-1

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4032E+15	2.7391E+15
SE	2.4069E+15	2.7329E+15
SW	2.2577E+15	2.7072E+15
W	2.1595E+15	2.7189E+15
NW	2.1544E+15	2.7293E+15
NE	2.2534E+15	2.7623E+15

Table B12A-1.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 12A-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.452E-01	8.707E-01
U-238	7.975E-02	8.219E-02
Pu-239	7.443E-02	4.685E-02
Pu-240	5.895E-04	2.266E-04
Pu-241	5.467E-05	1.236E-05
Pu-242	1.455E-07	2.040E-08
Am-241	3.222E-07	5.139E-08
Total	1.734E+17	2.099E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12A-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 12A-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.802E+00	0.000E+00	5.802E+00
2304	1.109E-02	4.681E+00	8.773E-03	4.701E+00
2303	1.963E-02	3.828E+00	1.271E-02	3.860E+00
2403	1.871E-02	3.376E+00	1.070E-02	3.406E+00
2505	8.540E-03	4.232E+00	6.113E-03	4.247E+00
2506	9.016E-02	3.105E+00	5.797E-02	3.253E+00
2405	1.659E-02	3.292E+00	1.200E-02	3.321E+00
1304	0.000E+00	6.933E+00	0.000E+00	6.933E+00
1303	1.703E-02	4.403E+00	1.103E-02	4.431E+00
1404	0.000E+00	6.109E+00	0.000E+00	6.109E+00
1405	1.120E-01	3.834E+00	7.040E-02	4.016E+00
1406	1.118E-02	4.649E+00	8.761E-03	4.669E+00
2301	2.325E-02	3.944E+00	1.510E-02	3.982E+00
1202	1.600E-01	3.706E+00	9.452E-02	3.961E+00

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Table E12A-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 12A-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.507E+15	2.312E+15
MFF-5	1304	4.068E+15	2.750E+15

Table E12A-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 12A-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8383E-02	1.4322E-02	0.0000E+00
-92.78	6.0856E-02	2.7627E-02	0.0000E+00
-87.78	9.7457E-02	4.4157E-02	0.0000E+00
-82.78	1.4100E-01	6.5763E-02	0.0000E+00
-77.78	1.9451E-01	9.4685E-02	0.0000E+00
-72.15	2.5735E-01	1.3271E-01	0.0000E+00
-65.90	3.2431E-01	1.8239E-01	0.0000E+00
-60.35	4.0230E-01	2.4904E-01	0.0000E+00
-55.49	4.9031E-01	3.3568E-01	0.0000E+00
-50.62	5.7534E-01	4.4088E-01	0.0000E+00
-47.17	6.3028E-01	5.3246E-01	0.0000E+00
-43.58	6.9345E-01	6.4998E-01	8.0611E-01
-38.45	8.0102E-01	7.8630E-01	8.5494E-01
-33.32	9.0309E-01	9.0130E-01	9.4005E-01
-28.20	9.9344E-01	9.9677E-01	9.7214E-01
-23.07	1.0703E+00	1.0764E+00	1.0439E+00
-17.94	1.1321E+00	1.1393E+00	1.1026E+00
-12.82	1.1778E+00	1.1845E+00	1.1129E+00
-7.69	1.2075E+00	1.2142E+00	1.1406E+00
-2.56	1.2207E+00	1.2277E+00	1.1529E+00
2.56	1.2172E+00	1.2250E+00	1.1603E+00
7.69	1.1966E+00	1.2049E+00	1.1404E+00
12.82	1.1587E+00	1.1678E+00	1.1040E+00
17.94	1.1037E+00	1.1144E+00	1.1021E+00
23.07	1.0309E+00	1.0413E+00	1.0298E+00
28.20	9.4135E-01	9.4972E-01	9.4193E-01
33.32	8.3722E-01	8.4181E-01	9.0232E-01
38.45	7.2027E-01	7.1395E-01	7.9112E-01
43.58	5.9484E-01	5.6464E-01	7.0200E-01
47.17	5.1466E-01	4.4618E-01	0.0000E+00
50.62	4.5332E-01	3.6486E-01	0.0000E+00
55.49	3.6587E-01	2.7044E-01	0.0000E+00
60.35	2.8439E-01	1.9497E-01	0.0000E+00
64.98	2.2494E-01	1.4595E-01	0.0000E+00
69.39	1.8783E-01	1.1705E-01	0.0000E+00
76.46	1.3916E-01	8.1122E-02	0.0000E+00
86.80	8.9086E-02	4.8093E-02	0.0000E+00
98.14	5.0772E-02	2.5945E-02	0.0000E+00
110.00	2.1690E-02	1.1521E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12A-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 12A-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8131E-02	1.3996E-02	0.0000E+00
-92.78	6.0253E-02	2.7011E-02	0.0000E+00
-87.78	9.6458E-02	4.3232E-02	0.0000E+00
-82.78	1.3949E-01	6.4540E-02	0.0000E+00
-77.78	1.9221E-01	9.3261E-02	0.0000E+00
-72.15	2.5384E-01	1.3139E-01	0.0000E+00
-65.90	3.2096E-01	1.8293E-01	0.0000E+00
-60.35	3.9532E-01	2.5104E-01	0.0000E+00
-55.49	4.7441E-01	3.3204E-01	0.0000E+00
-50.62	5.6033E-01	4.3375E-01	0.0000E+00
-47.17	6.1992E-01	5.2681E-01	0.0000E+00
-43.58	6.8704E-01	6.4443E-01	7.8027E-01
-38.45	7.9654E-01	7.8179E-01	8.3712E-01
-33.32	8.9967E-01	8.9780E-01	9.2386E-01
-28.20	9.9071E-01	9.9423E-01	9.7613E-01
-23.07	1.0680E+00	1.0743E+00	1.0491E+00
-17.94	1.1301E+00	1.1374E+00	1.1086E+00
-12.82	1.1760E+00	1.1831E+00	1.1313E+00
-7.69	1.2060E+00	1.2130E+00	1.1598E+00
-2.56	1.2196E+00	1.2268E+00	1.1727E+00
2.56	1.2166E+00	1.2244E+00	1.1758E+00
7.69	1.1965E+00	1.2051E+00	1.1562E+00
12.82	1.1595E+00	1.1690E+00	1.1203E+00
17.94	1.1056E+00	1.1163E+00	1.0993E+00
23.07	1.0342E+00	1.0445E+00	1.0288E+00
28.20	9.4603E-01	9.5431E-01	9.4296E-01
33.32	8.4287E-01	8.4681E-01	8.8236E-01
38.45	7.2594E-01	7.1870E-01	7.7377E-01
43.58	5.9911E-01	5.6820E-01	6.8159E-01
47.17	5.1686E-01	4.5007E-01	0.0000E+00
50.62	4.5474E-01	3.6908E-01	0.0000E+00
55.49	3.6729E-01	2.7470E-01	0.0000E+00
60.35	2.8645E-01	1.9872E-01	0.0000E+00
64.98	2.2754E-01	1.4885E-01	0.0000E+00
69.39	1.9004E-01	1.1911E-01	0.0000E+00
76.46	1.4054E-01	8.2177E-02	0.0000E+00
86.80	8.9843E-02	4.8560E-02	0.0000E+00
98.14	5.1242E-02	2.6187E-02	0.0000E+00
110.00	2.1978E-02	1.1669E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12A-1.5. Fission Power Distribution by Pin in MFF-3 at EOC 12A-1

CORE POSITION 2404

1.063 1.049 1.035 1.023 1.012 1.001 0.992 0.984

1.063 1.048 1.035 1.022 1.010 1.000 0.991 0.983 0.976

1.064 1.049 1.035 1.022 1.010 0.999 0.990 0.982 0.974 0.968

1.066 1.050 1.036 1.022 1.010 0.999 0.989 0.981 0.973 0.967 0.962

1.069 1.053 1.038 1.024 1.011 0.999 0.989 0.980 0.973 0.966 0.961 0.957

1.074 1.057 1.041 1.026 1.013 1.001 0.990 0.981 0.973 0.966 0.961 0.956 0.952

1.079 1.062 1.046 1.030 1.016 1.004 0.992 0.982 0.974 0.967 0.961 0.956 0.952 0.948

1.085 1.068 1.052 1.036 1.021 1.008 0.996 0.985 0.976 0.968 0.962 0.957 0.952 0.948 0.945

1.076 1.059 1.043 1.027 1.013 1.001 0.990 0.980 0.971 0.964 0.958 0.953 0.949 0.945

1.067 1.051 1.035 1.021 1.007 0.995 0.985 0.975 0.968 0.961 0.955 0.951 0.947

1.060 1.044 1.029 1.015 1.002 0.991 0.981 0.972 0.965 0.959 0.953 0.949

1.054 1.038 1.024 1.011 0.998 0.988 0.978 0.970 0.963 0.957 0.951

1.049 1.034 1.020 1.007 0.996 0.985 0.976 0.968 0.961 0.955

1.045 1.031 1.017 1.005 0.994 0.984 0.975 0.967 0.960

1.042 1.028 1.015 1.003 0.992 0.982 0.974 0.966

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Table E12A-1.6. Fission Power Distribution by Pin in MFF-5 at EOC 12A-1

CORE POSITION 1304

0.958 0.962 0.967 0.972 0.976 0.981 0.986 0.991

0.959 0.962 0.966 0.970 0.975 0.979 0.984 0.989 0.994

0.961 0.963 0.966 0.970 0.973 0.978 0.982 0.987 0.992 0.997

0.964 0.966 0.968 0.971 0.973 0.977 0.981 0.985 0.990 0.995 1.000

0.969 0.970 0.971 0.973 0.975 0.977 0.981 0.984 0.989 0.994 0.999 1.004

0.975 0.975 0.975 0.976 0.977 0.979 0.982 0.985 0.989 0.993 0.998 1.004 1.009

0.982 0.981 0.981 0.981 0.981 0.983 0.984 0.987 0.990 0.994 0.999 1.004 1.009 1.015

0.990 0.989 0.988 0.987 0.987 0.987 0.988 0.990 0.993 0.996 1.000 1.005 1.010 1.016 1.022

0.998 0.996 0.995 0.993 0.993 0.993 0.994 0.996 0.999 1.003 1.007 1.012 1.018 1.024

1.005 1.003 1.001 1.000 1.000 1.000 1.001 1.004 1.007 1.011 1.016 1.021 1.027

1.012 1.010 1.008 1.007 1.007 1.008 1.009 1.012 1.015 1.020 1.025 1.031

1.019 1.017 1.015 1.015 1.015 1.016 1.018 1.021 1.025 1.030 1.035

1.026 1.024 1.023 1.023 1.023 1.025 1.028 1.031 1.036 1.041

1.034 1.032 1.032 1.032 1.033 1.035 1.038 1.042 1.047

1.042 1.041 1.041 1.041 1.043 1.046 1.049 1.054

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Table E12A-1.7. Fast Flux Distribution by Pin in MFF-3 at EOC 12A-1

CORE POSITION 2404

1.013 1.007 1.001 0.994 0.987 0.979 0.970 0.960

1.021 1.016 1.010 1.004 0.997 0.989 0.980 0.970 0.960

1.028 1.024 1.018 1.012 1.006 0.998 0.989 0.980 0.970 0.959

1.035 1.030 1.025 1.020 1.013 1.006 0.998 0.989 0.979 0.969 0.957

1.040 1.036 1.031 1.026 1.020 1.013 1.005 0.997 0.987 0.977 0.966 0.954

1.044 1.041 1.036 1.031 1.026 1.019 1.012 1.003 0.994 0.984 0.973 0.962 0.949

1.047 1.044 1.040 1.035 1.030 1.024 1.017 1.009 1.000 0.990 0.980 0.968 0.956 0.944

1.049 1.046 1.042 1.038 1.033 1.027 1.020 1.013 1.005 0.995 0.985 0.974 0.962 0.950 0.936

1.047 1.044 1.039 1.035 1.029 1.023 1.016 1.008 0.999 0.989 0.979 0.967 0.955 0.942

1.044 1.040 1.035 1.030 1.024 1.018 1.010 1.002 0.992 0.982 0.971 0.959 0.946

1.039 1.035 1.030 1.024 1.018 1.011 1.003 0.994 0.984 0.973 0.962 0.950

1.033 1.028 1.023 1.017 1.010 1.003 0.994 0.985 0.975 0.964 0.952

1.026 1.021 1.015 1.009 1.002 0.994 0.985 0.975 0.965 0.954

1.017 1.012 1.006 0.999 0.992 0.984 0.975 0.965 0.954

1.008 1.002 0.996 0.989 0.981 0.973 0.963 0.953

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Table E12A-1.8. Fast Flux Distribution by Pin in MFF-5 at EOC 12A-1

CORE POSITION 1304

0.985 0.986 0.987 0.987 0.986 0.984 0.982 0.979

0.989 0.991 0.992 0.993 0.992 0.991 0.989 0.987 0.983

0.992 0.995 0.997 0.998 0.998 0.997 0.996 0.993 0.990 0.986

0.994 0.997 1.000 1.002 1.002 1.002 1.001 0.999 0.997 0.993 0.988

0.994 0.998 1.002 1.004 1.006 1.006 1.006 1.004 1.002 0.999 0.994 0.989

0.994 0.999 1.003 1.006 1.008 1.009 1.009 1.008 1.006 1.003 1.000 0.995 0.989

0.992 0.997 1.002 1.006 1.009 1.011 1.011 1.011 1.010 1.007 1.004 0.999 0.994 0.987

0.989 0.995 1.001 1.005 1.008 1.011 1.012 1.013 1.012 1.010 1.007 1.003 0.998 0.991 0.985

0.992 0.998 1.003 1.007 1.010 1.012 1.013 1.013 1.011 1.009 1.005 1.000 0.995 0.988

0.994 1.000 1.005 1.008 1.011 1.012 1.013 1.012 1.010 1.006 1.002 0.997 0.991

0.996 1.001 1.005 1.008 1.010 1.011 1.011 1.009 1.007 1.003 0.998 0.992

0.997 1.001 1.005 1.008 1.009 1.009 1.008 1.006 1.003 0.998 0.993

0.997 1.001 1.004 1.006 1.007 1.006 1.005 1.002 0.998 0.993

0.996 1.000 1.002 1.003 1.003 1.002 1.000 0.997 0.992

0.994 0.997 0.999 1.000 0.999 0.997 0.994 0.991

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Table E12A-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 12A-1

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.3969E+15	2.7159E+15
SE	2.4036E+15	2.7102E+15
SW	2.2669E+15	2.6812E+15
W	2.1721E+15	2.6945E+15
NW	2.1581E+15	2.7051E+15
NE	2.2515E+15	2.7358E+15

Table E12A-1.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 12A-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.371E-01	8.614E-01
U-238	8.009E-02	8.257E-02
Pu-239	8.202E-02	5.569E-02
Pu-240	7.103E-04	3.147E-04
Pu-241	7.296E-05	2.055E-05
Pu-242	2.101E-07	3.943E-08
Am-241	3.880E-07	6.952E-08
Total	1.708E+17	2.041E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12A-1.11. Composition of MFF-3 at EOC 12A-1

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.2198E-03
			U-238	6.3240E-03	6.0583E-03
			Pu-239	0.0000E+00	1.8043E-04
			Pu-240	0.0000E+00	5.5233E-06
			Pu-241	0.0000E+00	1.0181E-07
			Pu-242	0.0000E+00	1.2631E-09
			Am-241	0.0000E+00	3.2792E-09
			FP	0.0000E+00	7.6566E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	2.0518E-03
			U-238	6.3240E-03	5.9907E-03
			Pu-239	0.0000E+00	2.1211E-04
			Pu-240	0.0000E+00	7.1456E-06
			Pu-241	0.0000E+00	1.5086E-07
			Pu-242	0.0000E+00	2.1930E-09
			Am-241	0.0000E+00	4.8861E-09
			FP	0.0000E+00	9.4230E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	1.9610E-03
			U-238	6.3240E-03	5.9550E-03
			Pu-239	0.0000E+00	2.2975E-04
			Pu-240	0.0000E+00	8.5686E-06
			Pu-241	0.0000E+00	1.9878E-07
			Pu-242	0.0000E+00	3.2088E-09
			Am-241	0.0000E+00	6.4175E-09
			FP	0.0000E+00	1.0319E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	1.9900E-03
			U-238	6.3240E-03	5.9664E-03
			Pu-239	0.0000E+00	2.2395E-04
			Pu-240	0.0000E+00	8.0574E-06
			Pu-241	0.0000E+00	1.8110E-07
			Pu-242	0.0000E+00	2.8229E-09
			Am-241	0.0000E+00	5.8356E-09
			FP	0.0000E+00	1.0038E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.1372E-03
			U-238	6.3240E-03	6.0227E-03
			Pu-239	0.0000E+00	1.9482E-04
			Pu-240	0.0000E+00	5.8401E-06
			Pu-241	0.0000E+00	1.1120E-07
			Pu-242	0.0000E+00	1.4446E-09
			Am-241	0.0000E+00	3.5879E-09
			FP	0.0000E+00	8.6139E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.3646E-03
			U-238	6.3240E-03	6.1071E-03
			Pu-239	0.0000E+00	1.5078E-04
			Pu-240	0.0000E+00	3.5783E-06
			Pu-241	0.0000E+00	5.2853E-08
			Pu-242	0.0000E+00	5.1838E-10
			Am-241	0.0000E+00	1.6990E-09
			FP	0.0000E+00	6.3610E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E12A-1.12. Composition of MFF-5 at EOC 12A-1

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.3773E-03
			U-238	6.4484E-03	6.2745E-03
			Pu-239	0.0000E+00	1.2576E-04
			Pu-240	0.0000E+00	2.4251E-06
			Pu-241	0.0000E+00	2.9722E-08
			Pu-242	0.0000E+00	2.3477E-10
			Am-241	0.0000E+00	5.8467E-10
			FP	0.0000E+00	4.8861E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.2630E-03
			U-238	6.4484E-03	6.2308E-03
			Pu-239	0.0000E+00	1.4939E-04
			Pu-240	0.0000E+00	3.1531E-06
			Pu-241	0.0000E+00	4.4215E-08
			Pu-242	0.0000E+00	4.0627E-10
			Am-241	0.0000E+00	8.6698E-10
			FP	0.0000E+00	6.0433E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.1985E-03
			U-238	6.4484E-03	6.2072E-03
			Pu-239	0.0000E+00	1.6319E-04
			Pu-240	0.0000E+00	3.8087E-06
			Pu-241	0.0000E+00	5.8810E-08
			Pu-242	0.0000E+00	5.9931E-10
			Am-241	0.0000E+00	1.1485E-09
			FP	0.0000E+00	6.6538E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.2165E-03
			U-238	6.4484E-03	6.2138E-03
			Pu-239	0.0000E+00	1.5926E-04
			Pu-240	0.0000E+00	3.6051E-06
			Pu-241	0.0000E+00	5.4135E-08
			Pu-242	0.0000E+00	5.3549E-10
			Am-241	0.0000E+00	1.0554E-09
			FP	0.0000E+00	6.4875E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			

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			U-235	2.9371E-03	2.3151E-03
			U-238	6.4484E-03	6.2494E-03
			Pu-239	0.0000E+00	1.3786E-04
			Pu-240	0.0000E+00	2.6345E-06
			Pu-241	0.0000E+00	3.3729E-08
			Pu-242	0.0000E+00	2.8148E-10
			Am-241	0.0000E+00	6.5760E-10
			FP	0.0000E+00	5.5659E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.4677E-03
			U-238	6.4484E-03	6.3040E-03
			Pu-239	0.0000E+00	1.0566E-04
			Pu-240	0.0000E+00	1.6158E-06
			Pu-241	0.0000E+00	1.6117E-08
			Pu-242	0.0000E+00	1.0281E-10
			Am-241	0.0000E+00	3.1419E-10
			FP	0.0000E+00	4.0972E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.12. Therefore, the compositions in these five axial levels are not repeated in this table.

5.11.10Cycle 12A-2

Table B12A-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 12A-2

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.759E+00	0.000E+00	5.759E+00
2304	1.155E-02	4.734E+00	8.542E-03	4.754E+00
2303	2.030E-02	3.849E+00	1.229E-02	3.882E+00
2403	1.914E-02	3.312E+00	1.002E-02	3.341E+00
2505	8.683E-03	4.104E+00	5.672E-03	4.119E+00
2506	9.209E-02	3.058E+00	5.483E-02	3.205E+00
2405	1.705E-02	3.284E+00	1.150E-02	3.312E+00
1304	0.000E+00	6.978E+00	0.000E+00	6.978E+00
1303	1.766E-02	4.435E+00	1.069E-02	4.464E+00
1404	0.000E+00	6.120E+00	0.000E+00	6.120E+00
1405	1.160E-01	3.866E+00	6.797E-02	4.050E+00
1406	1.154E-02	4.649E+00	8.424E-03	4.669E+00
2301	2.288E-02	4.087E+00	1.343E-02	4.123E+00
1202	1.662E-01	3.774E+00	9.206E-02	4.032E+00

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Table B12A-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 12A-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.487E+15	2.303E+15
MFF-5	1304	4.103E+15	2.780E+15

Table B12A-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 12A-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9421E-02	1.4844E-02	0.0000E+00
-92.78	6.3063E-02	2.8631E-02	0.0000E+00
-87.78	1.0097E-01	4.5756E-02	0.0000E+00
-82.78	1.4604E-01	6.8127E-02	0.0000E+00
-77.78	2.0137E-01	9.8071E-02	0.0000E+00
-72.15	2.6633E-01	1.3741E-01	0.0000E+00
-65.90	3.3549E-01	1.8879E-01	0.0000E+00
-60.35	4.1601E-01	2.5765E-01	0.0000E+00
-55.49	5.0673E-01	3.4706E-01	0.0000E+00
-50.62	5.9425E-01	4.5546E-01	0.0000E+00
-47.17	6.5066E-01	5.4970E-01	0.0000E+00
-43.58	7.1549E-01	6.7046E-01	8.3237E-01
-38.45	8.2547E-01	8.1010E-01	8.8178E-01
-33.32	9.2914E-01	9.2721E-01	9.6793E-01
-28.20	1.0199E+00	1.0233E+00	9.9884E-01
-23.07	1.0961E+00	1.1023E+00	1.0697E+00
-17.94	1.1557E+00	1.1632E+00	1.1263E+00
-12.82	1.1979E+00	1.2049E+00	1.1326E+00
-7.69	1.2226E+00	1.2296E+00	1.1556E+00
-2.56	1.2295E+00	1.2366E+00	1.1619E+00
2.56	1.2184E+00	1.2262E+00	1.1620E+00
7.69	1.1892E+00	1.1975E+00	1.1338E+00
12.82	1.1425E+00	1.1515E+00	1.0887E+00
17.94	1.0796E+00	1.0901E+00	1.0777E+00
23.07	1.0012E+00	1.0114E+00	9.9970E-01
28.20	9.0928E-01	9.1752E-01	9.0954E-01
33.32	8.0578E-01	8.1036E-01	8.6837E-01
38.45	6.9177E-01	6.8586E-01	7.5985E-01
43.58	5.7059E-01	5.4185E-01	6.7326E-01
47.17	4.9339E-01	4.2813E-01	0.0000E+00
50.62	4.3443E-01	3.5011E-01	0.0000E+00
55.49	3.5048E-01	2.5949E-01	0.0000E+00
60.35	2.7230E-01	1.8706E-01	0.0000E+00
64.98	2.1531E-01	1.4001E-01	0.0000E+00
69.39	1.7975E-01	1.1227E-01	0.0000E+00
76.46	1.3314E-01	7.7793E-02	0.0000E+00
86.80	8.5236E-02	4.6116E-02	0.0000E+00
98.14	4.8616E-02	2.4889E-02	0.0000E+00
110.00	2.0834E-02	1.1076E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12A-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 12A-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8919E-02	1.4381E-02	0.0000E+00
-92.78	6.1924E-02	2.7753E-02	0.0000E+00
-87.78	9.9119E-02	4.4422E-02	0.0000E+00
-82.78	1.4332E-01	6.6314E-02	0.0000E+00
-77.78	1.9745E-01	9.5829E-02	0.0000E+00
-72.15	2.6070E-01	1.3501E-01	0.0000E+00
-65.90	3.2964E-01	1.8797E-01	0.0000E+00
-60.35	4.0605E-01	2.5797E-01	0.0000E+00
-55.49	4.8727E-01	3.4118E-01	0.0000E+00
-50.62	5.7548E-01	4.4557E-01	0.0000E+00
-47.17	6.3655E-01	5.4098E-01	0.0000E+00
-43.58	7.0535E-01	6.6140E-01	8.0124E-01
-38.45	8.1713E-01	8.0180E-01	8.5910E-01
-33.32	9.2179E-01	9.1974E-01	9.4696E-01
-28.20	1.0133E+00	1.0169E+00	9.9879E-01
-23.07	1.0899E+00	1.0963E+00	1.0710E+00
-17.94	1.1501E+00	1.1576E+00	1.1286E+00
-12.82	1.1928E+00	1.2001E+00	1.1477E+00
-7.69	1.2183E+00	1.2255E+00	1.1720E+00
-2.56	1.2263E+00	1.2338E+00	1.1795E+00
2.56	1.2169E+00	1.2249E+00	1.1764E+00
7.69	1.1901E+00	1.1987E+00	1.1502E+00
12.82	1.1463E+00	1.1557E+00	1.1077E+00
17.94	1.0865E+00	1.0971E+00	1.0804E+00
23.07	1.0107E+00	1.0208E+00	1.0055E+00
28.20	9.2008E-01	9.2812E-01	9.1717E-01
33.32	8.1648E-01	8.2031E-01	8.5477E-01
38.45	7.0097E-01	6.9399E-01	7.4709E-01
43.58	5.7693E-01	5.4730E-01	6.5596E-01
47.17	4.9686E-01	4.3299E-01	0.0000E+00
50.62	4.3654E-01	3.5474E-01	0.0000E+00
55.49	3.5201E-01	2.6366E-01	0.0000E+00
60.35	2.7406E-01	1.9045E-01	0.0000E+00
64.98	2.1737E-01	1.4245E-01	0.0000E+00
69.39	1.8135E-01	1.1388E-01	0.0000E+00
76.46	1.3391E-01	7.8446E-02	0.0000E+00
86.80	8.5492E-02	4.6287E-02	0.0000E+00
98.14	4.8735E-02	2.4937E-02	0.0000E+00
110.00	2.0917E-02	1.1113E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12A-2.5. Fission Power Distribution by Pin in MFF-3 at BOC 12A-2

CORE POSITION 2404

1.064 1.048 1.033 1.019 1.007 0.995 0.985 0.975

1.065 1.049 1.034 1.020 1.007 0.995 0.985 0.975 0.967

1.067 1.051 1.035 1.021 1.008 0.996 0.985 0.976 0.967 0.960

1.071 1.054 1.037 1.022 1.009 0.997 0.986 0.976 0.968 0.960 0.954

1.075 1.057 1.041 1.025 1.011 0.998 0.987 0.977 0.968 0.961 0.954 0.949

1.080 1.062 1.045 1.029 1.014 1.001 0.989 0.979 0.970 0.962 0.955 0.949 0.944

1.087 1.068 1.051 1.034 1.019 1.005 0.993 0.982 0.972 0.964 0.957 0.951 0.945 0.941

1.094 1.076 1.058 1.041 1.025 1.010 0.997 0.986 0.975 0.967 0.959 0.953 0.947 0.942 0.937

1.084 1.066 1.048 1.032 1.017 1.003 0.991 0.980 0.970 0.962 0.955 0.949 0.944 0.939

1.075 1.058 1.041 1.025 1.011 0.997 0.986 0.975 0.967 0.959 0.952 0.947 0.942

1.068 1.050 1.034 1.019 1.005 0.993 0.982 0.972 0.964 0.956 0.950 0.945

1.061 1.045 1.029 1.015 1.001 0.989 0.979 0.970 0.962 0.954 0.948

1.056 1.040 1.025 1.011 0.998 0.987 0.977 0.968 0.960 0.953

1.052 1.036 1.022 1.008 0.996 0.985 0.975 0.966 0.958

1.048 1.033 1.019 1.006 0.994 0.983 0.974 0.965

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Table B12A-2.6. Fission Power Distribution by Pin in MFF-5 at BOC 12A-2

CORE POSITION 1304

0.957 0.962 0.966 0.971 0.975 0.980 0.985 0.989

0.958 0.962 0.965 0.969 0.974 0.978 0.983 0.987 0.992

0.960 0.963 0.966 0.969 0.973 0.977 0.981 0.985 0.990 0.995

0.963 0.965 0.967 0.970 0.973 0.976 0.980 0.984 0.989 0.993 0.998

0.968 0.969 0.971 0.972 0.974 0.977 0.980 0.984 0.988 0.992 0.997 1.002

0.974 0.974 0.975 0.976 0.977 0.979 0.982 0.985 0.988 0.992 0.997 1.002 1.007

0.981 0.981 0.981 0.981 0.982 0.983 0.984 0.987 0.990 0.994 0.998 1.003 1.008 1.013

0.990 0.989 0.988 0.987 0.987 0.987 0.988 0.990 0.993 0.996 1.000 1.004 1.009 1.015 1.020

0.998 0.996 0.995 0.994 0.994 0.994 0.995 0.997 0.999 1.003 1.007 1.012 1.017 1.022

1.005 1.003 1.002 1.001 1.000 1.001 1.002 1.004 1.007 1.011 1.015 1.020 1.026

1.013 1.011 1.009 1.008 1.008 1.009 1.010 1.013 1.016 1.020 1.025 1.030

1.020 1.018 1.017 1.016 1.016 1.017 1.019 1.022 1.026 1.030 1.035

1.028 1.026 1.025 1.025 1.025 1.027 1.029 1.033 1.037 1.041

1.036 1.034 1.034 1.034 1.035 1.037 1.040 1.044 1.048

1.044 1.043 1.043 1.044 1.046 1.048 1.051 1.055

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Table B12A-2.7. Fast Flux Distribution by Pin in MFF-3 at BOC 12A-2

CORE POSITION 2404

1.014 1.007 0.999 0.991 0.982 0.973 0.962 0.951

1.023 1.017 1.010 1.002 0.993 0.984 0.974 0.963 0.952

1.032 1.026 1.019 1.012 1.003 0.994 0.985 0.974 0.963 0.951

1.040 1.034 1.027 1.020 1.012 1.004 0.994 0.984 0.973 0.961 0.949

1.046 1.041 1.035 1.028 1.020 1.012 1.003 0.993 0.982 0.971 0.959 0.946

1.052 1.047 1.041 1.034 1.027 1.019 1.011 1.001 0.991 0.979 0.967 0.955 0.941

1.056 1.051 1.046 1.039 1.033 1.025 1.017 1.008 0.998 0.987 0.975 0.962 0.949 0.935

1.059 1.055 1.049 1.043 1.037 1.030 1.022 1.013 1.003 0.993 0.981 0.969 0.956 0.943 0.929

1.057 1.052 1.046 1.040 1.033 1.025 1.017 1.008 0.998 0.987 0.975 0.962 0.949 0.935

1.053 1.048 1.042 1.035 1.028 1.020 1.011 1.001 0.991 0.979 0.967 0.954 0.940

1.048 1.042 1.036 1.029 1.021 1.013 1.003 0.993 0.982 0.971 0.958 0.945

1.041 1.035 1.029 1.021 1.013 1.004 0.995 0.984 0.973 0.961 0.948

1.034 1.027 1.020 1.013 1.004 0.995 0.985 0.974 0.963 0.951

1.025 1.018 1.011 1.003 0.994 0.985 0.975 0.964 0.952

1.015 1.008 1.001 0.992 0.983 0.974 0.963 0.952

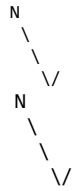

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Table B12A-2.8. Fast Flux Distribution by Pin in MFF-5 at BOC 12A-2

CORE POSITION 1304

0.983 0.985 0.985 0.985 0.984 0.983 0.980 0.977

0.987 0.989 0.991 0.991 0.991 0.990 0.988 0.985 0.981

0.990 0.993 0.995 0.996 0.997 0.996 0.994 0.992 0.988 0.984

0.992 0.996 0.999 1.000 1.001 1.001 1.000 0.998 0.995 0.991 0.986

0.993 0.997 1.001 1.003 1.005 1.005 1.005 1.003 1.001 0.997 0.993 0.987

0.992 0.997 1.002 1.005 1.007 1.008 1.008 1.007 1.005 1.002 0.998 0.993 0.987

0.991 0.997 1.001 1.005 1.008 1.010 1.011 1.010 1.009 1.006 1.003 0.998 0.992 0.986

0.988 0.994 1.000 1.005 1.008 1.011 1.012 1.012 1.012 1.009 1.006 1.002 0.997 0.990 0.983

0.991 0.998 1.003 1.007 1.010 1.012 1.013 1.013 1.011 1.009 1.005 1.000 0.994 0.987

0.994 1.000 1.005 1.009 1.011 1.013 1.013 1.012 1.010 1.007 1.003 0.997 0.990

0.996 1.002 1.006 1.009 1.012 1.012 1.012 1.011 1.008 1.004 0.999 0.993

0.998 1.003 1.007 1.009 1.011 1.011 1.010 1.008 1.004 1.000 0.994

0.998 1.003 1.006 1.008 1.009 1.009 1.007 1.004 1.000 0.995

0.998 1.002 1.005 1.006 1.006 1.005 1.003 0.999 0.995

0.998 1.001 1.003 1.003 1.003 1.001 0.998 0.994

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Table B12A-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 12A-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4124E+15	2.7482E+15
SE	2.4106E+15	2.7348E+15
SW	2.2469E+15	2.7077E+15
W	2.1406E+15	2.7166E+15
NW	2.1382E+15	2.7378E+15
NE	2.2495E+15	2.7798E+15

Table B12A-2.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 12A-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.368E-01	8.610E-01
U-238	8.029E-02	8.296E-02
Pu-239	8.208E-02	5.575E-02
Pu-240	7.124E-04	3.161E-04
Pu-241	7.283E-05	2.051E-05
Pu-242	2.107E-07	3.960E-08
Am-241	4.085E-07	7.558E-08
Total	1.696E+17	2.054E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12A-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 12A-2

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.679E+00	0.000E+00	5.679E+00
2304	1.218E-02	4.646E+00	9.462E-03	4.668E+00
2303	2.046E-02	3.797E+00	1.325E-02	3.830E+00
2403	1.922E-02	3.321E+00	1.096E-02	3.351E+00
2505	9.058E-03	4.124E+00	6.345E-03	4.139E+00
2506	9.263E-02	3.036E+00	5.946E-02	3.188E+00
2405	1.709E-02	3.254E+00	1.236E-02	3.283E+00
1304	0.000E+00	6.793E+00	0.000E+00	6.793E+00
1303	1.795E-02	4.354E+00	1.157E-02	4.384E+00
1404	0.000E+00	5.998E+00	0.000E+00	5.998E+00
1405	1.165E-01	3.776E+00	7.296E-02	3.965E+00
1406	1.201E-02	4.556E+00	9.237E-03	4.577E+00
2301	2.287E-02	4.015E+00	1.438E-02	4.052E+00
1202	1.650E-01	3.690E+00	9.771E-02	3.953E+00

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Table E12A-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 12A-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.502E+15	2.303E+15
MFF-5	1304	4.081E+15	2.751E+15

Table E12A-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 12A-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8516E-02	1.4430E-02	0.0000E+00
-92.78	6.1131E-02	2.7833E-02	0.0000E+00
-87.78	9.7890E-02	4.4482E-02	0.0000E+00
-82.78	1.4161E-01	6.6238E-02	0.0000E+00
-77.78	1.9532E-01	9.5352E-02	0.0000E+00
-72.15	2.5839E-01	1.3361E-01	0.0000E+00
-65.90	3.2553E-01	1.8356E-01	0.0000E+00
-60.35	4.0370E-01	2.5050E-01	0.0000E+00
-55.49	4.9184E-01	3.3738E-01	0.0000E+00
-50.62	5.7686E-01	4.4263E-01	0.0000E+00
-47.17	6.3168E-01	5.3410E-01	0.0000E+00
-43.58	6.9462E-01	6.5135E-01	8.0938E-01
-38.45	8.0202E-01	7.8753E-01	8.5826E-01
-33.32	9.0395E-01	9.0234E-01	9.4343E-01
-28.20	9.9408E-01	9.9745E-01	9.7166E-01
-23.07	1.0708E+00	1.0768E+00	1.0432E+00
-17.94	1.1323E+00	1.1394E+00	1.1016E+00
-12.82	1.1777E+00	1.1843E+00	1.1092E+00
-7.69	1.2071E+00	1.2136E+00	1.1366E+00
-2.56	1.2201E+00	1.2269E+00	1.1486E+00
2.56	1.2165E+00	1.2240E+00	1.1566E+00
7.69	1.1957E+00	1.2039E+00	1.1366E+00
12.82	1.1578E+00	1.1668E+00	1.1003E+00
17.94	1.1029E+00	1.1137E+00	1.1022E+00
23.07	1.0303E+00	1.0407E+00	1.0300E+00
28.20	9.4101E-01	9.4949E-01	9.4230E-01
33.32	8.3717E-01	8.4201E-01	9.0759E-01
38.45	7.2049E-01	7.1446E-01	7.9601E-01
43.58	5.9531E-01	5.6533E-01	7.0664E-01
47.17	5.1536E-01	4.4714E-01	0.0000E+00
50.62	4.5417E-01	3.6593E-01	0.0000E+00
55.49	3.6675E-01	2.7147E-01	0.0000E+00
60.35	2.8516E-01	1.9585E-01	0.0000E+00
64.98	2.2564E-01	1.4668E-01	0.0000E+00
69.39	1.8844E-01	1.1767E-01	0.0000E+00
76.46	1.3963E-01	8.1571E-02	0.0000E+00
86.80	8.9393E-02	4.8365E-02	0.0000E+00
98.14	5.0944E-02	2.6094E-02	0.0000E+00
110.00	2.1762E-02	1.1587E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12A-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 12A-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8239E-02	1.4094E-02	0.0000E+00
-92.78	6.0483E-02	2.7198E-02	0.0000E+00
-87.78	9.6821E-02	4.3533E-02	0.0000E+00
-82.78	1.4001E-01	6.4983E-02	0.0000E+00
-77.78	1.9291E-01	9.3895E-02	0.0000E+00
-72.15	2.5472E-01	1.3228E-01	0.0000E+00
-65.90	3.2205E-01	1.8412E-01	0.0000E+00
-60.35	3.9662E-01	2.5258E-01	0.0000E+00
-55.49	4.7588E-01	3.3386E-01	0.0000E+00
-50.62	5.6193E-01	4.3569E-01	0.0000E+00
-47.17	6.2146E-01	5.2865E-01	0.0000E+00
-43.58	6.8848E-01	6.4606E-01	7.8440E-01
-38.45	7.9793E-01	7.8344E-01	8.4152E-01
-33.32	9.0100E-01	8.9938E-01	9.2858E-01
-28.20	9.9189E-01	9.9554E-01	9.7622E-01
-23.07	1.0690E+00	1.0753E+00	1.0489E+00
-17.94	1.1309E+00	1.1381E+00	1.1082E+00
-12.82	1.1765E+00	1.1833E+00	1.1275E+00
-7.69	1.2061E+00	1.2128E+00	1.1556E+00
-2.56	1.2194E+00	1.2263E+00	1.1681E+00
2.56	1.2161E+00	1.2237E+00	1.1717E+00
7.69	1.1958E+00	1.2040E+00	1.1520E+00
12.82	1.1586E+00	1.1678E+00	1.1159E+00
17.94	1.1046E+00	1.1152E+00	1.0991E+00
23.07	1.0330E+00	1.0434E+00	1.0285E+00
28.20	9.4494E-01	9.5328E-01	9.4259E-01
33.32	8.4195E-01	8.4613E-01	8.8738E-01
38.45	7.2521E-01	7.1823E-01	7.7823E-01
43.58	5.9863E-01	5.6800E-01	6.8556E-01
47.17	5.1665E-01	4.5023E-01	0.0000E+00
50.62	4.5470E-01	3.6948E-01	0.0000E+00
55.49	3.6740E-01	2.7519E-01	0.0000E+00
60.35	2.8658E-01	1.9917E-01	0.0000E+00
64.98	2.2767E-01	1.4923E-01	0.0000E+00
69.39	1.9016E-01	1.1943E-01	0.0000E+00
76.46	1.4064E-01	8.2398E-02	0.0000E+00
86.80	8.9892E-02	4.8689E-02	0.0000E+00
98.14	5.1261E-02	2.6251E-02	0.0000E+00
110.00	2.1982E-02	1.1696E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12A-2.5. Fission Power Distribution by Pin in MFF-3 at EOC 12A-2

CORE POSITION 2404

1.064 1.049 1.035 1.022 1.010 0.999 0.990 0.981

1.065 1.049 1.035 1.021 1.009 0.998 0.989 0.980 0.972

1.066 1.050 1.035 1.022 1.009 0.998 0.988 0.979 0.972 0.965

1.069 1.052 1.037 1.023 1.010 0.998 0.988 0.979 0.971 0.964 0.958

1.072 1.055 1.039 1.025 1.011 0.999 0.988 0.979 0.971 0.964 0.958 0.953

1.077 1.060 1.043 1.028 1.014 1.001 0.990 0.980 0.971 0.964 0.958 0.953 0.948

1.083 1.065 1.048 1.032 1.018 1.004 0.992 0.982 0.973 0.965 0.959 0.953 0.948 0.944

1.090 1.072 1.055 1.038 1.023 1.009 0.997 0.985 0.976 0.967 0.960 0.954 0.949 0.945 0.941

1.080 1.063 1.046 1.030 1.015 1.002 0.990 0.980 0.971 0.963 0.956 0.951 0.946 0.942

1.072 1.054 1.038 1.023 1.009 0.996 0.985 0.975 0.967 0.959 0.953 0.948 0.943

1.064 1.047 1.032 1.017 1.004 0.992 0.981 0.972 0.964 0.957 0.951 0.946

1.058 1.042 1.027 1.012 1.000 0.988 0.978 0.969 0.961 0.955 0.949

1.053 1.037 1.022 1.009 0.997 0.986 0.976 0.967 0.960 0.953

1.048 1.033 1.019 1.006 0.994 0.984 0.974 0.966 0.958

1.045 1.030 1.017 1.004 0.993 0.982 0.973 0.964

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Table E12A-2.6. Fission Power Distribution by Pin in MFF-5 at EOC 12A-2

CORE POSITION 1304

0.957 0.962 0.966 0.970 0.975 0.980 0.984 0.989

0.958 0.962 0.965 0.969 0.973 0.978 0.982 0.987 0.992

0.960 0.963 0.966 0.969 0.973 0.976 0.981 0.985 0.990 0.995

0.964 0.966 0.968 0.970 0.973 0.976 0.980 0.984 0.988 0.993 0.998

0.969 0.970 0.971 0.972 0.974 0.977 0.980 0.984 0.988 0.992 0.997 1.002

0.975 0.975 0.975 0.976 0.977 0.979 0.981 0.984 0.988 0.992 0.997 1.002 1.007

0.982 0.982 0.981 0.981 0.982 0.983 0.984 0.987 0.990 0.993 0.998 1.003 1.008 1.013

0.991 0.990 0.989 0.988 0.987 0.987 0.988 0.990 0.992 0.996 1.000 1.004 1.009 1.015 1.020

0.999 0.997 0.995 0.994 0.994 0.994 0.995 0.997 0.999 1.003 1.007 1.012 1.017 1.023

1.006 1.004 1.002 1.001 1.000 1.001 1.002 1.004 1.007 1.011 1.015 1.020 1.026

1.013 1.011 1.009 1.008 1.008 1.008 1.010 1.012 1.016 1.020 1.025 1.030

1.021 1.018 1.017 1.016 1.016 1.017 1.019 1.022 1.026 1.030 1.035

1.028 1.026 1.025 1.024 1.025 1.026 1.029 1.032 1.036 1.041

1.036 1.034 1.033 1.034 1.035 1.037 1.039 1.043 1.048

1.044 1.043 1.043 1.043 1.045 1.048 1.051 1.055

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Table E12A-2.7. Fast Flux Distribution by Pin in MFF-3 at EOC 12A-2

CORE POSITION 2404

1.014 1.008 1.001 0.993 0.985 0.976 0.966 0.956

1.023 1.017 1.010 1.003 0.995 0.987 0.977 0.967 0.956

1.031 1.025 1.019 1.012 1.005 0.996 0.987 0.977 0.967 0.955

1.038 1.033 1.027 1.020 1.013 1.005 0.996 0.987 0.976 0.965 0.953

1.044 1.039 1.034 1.027 1.020 1.013 1.004 0.995 0.985 0.974 0.962 0.950

1.049 1.044 1.039 1.033 1.027 1.019 1.011 1.002 0.992 0.981 0.970 0.958 0.945

1.053 1.048 1.043 1.038 1.031 1.024 1.017 1.008 0.998 0.988 0.977 0.965 0.952 0.939

1.056 1.051 1.047 1.041 1.035 1.029 1.021 1.013 1.003 0.993 0.983 0.971 0.958 0.945 0.932

1.053 1.049 1.044 1.038 1.031 1.024 1.016 1.007 0.998 0.987 0.976 0.964 0.951 0.937

1.050 1.045 1.039 1.033 1.026 1.019 1.010 1.001 0.991 0.980 0.968 0.955 0.942

1.044 1.039 1.033 1.027 1.020 1.012 1.003 0.993 0.982 0.971 0.959 0.946

1.038 1.033 1.026 1.019 1.012 1.003 0.994 0.984 0.973 0.961 0.949

1.031 1.025 1.018 1.011 1.003 0.994 0.984 0.974 0.963 0.951

1.022 1.016 1.009 1.001 0.993 0.984 0.974 0.963 0.952

1.012 1.006 0.999 0.991 0.982 0.973 0.962 0.952

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Table E12A-2.8. Fast Flux Distribution by Pin in MFF-5 at EOC 12A-2

CORE POSITION 1304

0.983 0.985 0.985 0.985 0.984 0.982 0.980 0.977

0.988 0.990 0.991 0.991 0.991 0.990 0.987 0.985 0.981

0.991 0.994 0.995 0.996 0.996 0.996 0.994 0.992 0.988 0.984

0.993 0.996 0.999 1.000 1.001 1.001 1.000 0.998 0.995 0.991 0.986

0.994 0.998 1.001 1.003 1.005 1.005 1.005 1.003 1.000 0.997 0.993 0.987

0.993 0.998 1.002 1.005 1.007 1.008 1.008 1.007 1.005 1.002 0.998 0.993 0.987

0.992 0.997 1.002 1.006 1.008 1.010 1.011 1.010 1.009 1.006 1.003 0.998 0.992 0.986

0.989 0.995 1.001 1.005 1.008 1.011 1.012 1.012 1.011 1.009 1.006 1.002 0.997 0.991 0.984

0.992 0.998 1.003 1.007 1.010 1.012 1.013 1.013 1.011 1.009 1.005 1.000 0.994 0.988

0.995 1.001 1.005 1.009 1.011 1.013 1.013 1.012 1.010 1.007 1.002 0.997 0.991

0.997 1.002 1.006 1.009 1.011 1.012 1.012 1.010 1.008 1.004 0.999 0.993

0.998 1.003 1.007 1.009 1.010 1.011 1.010 1.008 1.004 1.000 0.994

0.999 1.003 1.006 1.008 1.009 1.008 1.007 1.004 1.000 0.995

0.999 1.002 1.005 1.006 1.006 1.005 1.003 0.999 0.995

0.998 1.001 1.002 1.003 1.002 1.001 0.998 0.994

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Table E12A-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 12A-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4038E+15	2.7222E+15
SE	2.4050E+15	2.7096E+15
SW	2.2541E+15	2.6792E+15
W	2.1519E+15	2.6895E+15
NW	2.1408E+15	2.7107E+15
NE	2.2458E+15	2.7501E+15

Table E12A-2.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 12A-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.294E-01	8.523E-01
U-238	8.058E-02	8.326E-02
Pu-239	8.912E-02	6.399E-02
Pu-240	8.336E-04	4.110E-04
Pu-241	9.293E-05	3.072E-05
Pu-242	2.876E-07	6.701E-08
Am-241	4.865E-07	1.015E-07
Total	1.672E+17	2.000E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12A-2.11. Composition of MFF-3 at EOC 12A-2

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.1601E-03
			U-238	6.3240E-03	6.0370E-03
			Pu-239	0.0000E+00	1.9259E-04
			Pu-240	0.0000E+00	6.4082E-06
			Pu-241	0.0000E+00	1.2749E-07
			Pu-242	0.0000E+00	1.7133E-09
			Am-241	0.0000E+00	4.0796E-09
			FP	0.0000E+00	8.2093E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	1.9841E-03
			U-238	6.3240E-03	5.9643E-03
			Pu-239	0.0000E+00	2.2562E-04
			Pu-240	0.0000E+00	8.2565E-06
			Pu-241	0.0000E+00	1.8777E-07
			Pu-242	0.0000E+00	2.9552E-09
			Am-241	0.0000E+00	6.0422E-09
			FP	0.0000E+00	1.0080E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	1.8891E-03
			U-238	6.3240E-03	5.9258E-03
			Pu-239	0.0000E+00	2.4397E-04
			Pu-240	0.0000E+00	9.8877E-06
			Pu-241	0.0000E+00	2.4697E-07
			Pu-242	0.0000E+00	4.3180E-09
			Am-241	0.0000E+00	7.9194E-09
			FP	0.0000E+00	1.1028E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	1.9191E-03
			U-238	6.3240E-03	5.9380E-03
			Pu-239	0.0000E+00	2.3799E-04
			Pu-240	0.0000E+00	9.3074E-06
			Pu-241	0.0000E+00	2.2534E-07
			Pu-242	0.0000E+00	3.8051E-09
			Am-241	0.0000E+00	7.2106E-09
			FP	0.0000E+00	1.0734E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.0731E-03
			U-238	6.3240E-03	5.9986E-03
			Pu-239	0.0000E+00	2.0767E-04
			Pu-240	0.0000E+00	6.7660E-06
			Pu-241	0.0000E+00	1.3892E-07
			Pu-242	0.0000E+00	1.9549E-09
			Am-241	0.0000E+00	4.4515E-09
			FP	0.0000E+00	9.2289E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.3126E-03
			U-238	6.3240E-03	6.0895E-03
			Pu-239	0.0000E+00	1.6147E-04
			Pu-240	0.0000E+00	4.1663E-06
			Pu-241	0.0000E+00	6.6507E-08
			Pu-242	0.0000E+00	7.0677E-10
			Am-241	0.0000E+00	2.1230E-09
			FP	0.0000E+00	6.8360E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E12A-2.12. Composition of MFF-5 at EOC 12A-2

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.3059E-03
			U-238	6.4484E-03	6.2498E-03
			Pu-239	0.0000E+00	1.4142E-04
			Pu-240	0.0000E+00	3.1107E-06
			Pu-241	0.0000E+00	4.3329E-08
			Pu-242	0.0000E+00	3.9126E-10
			Am-241	0.0000E+00	8.4222E-10
			FP	0.0000E+00	5.5364E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.1788E-03
			U-238	6.4484E-03	6.1997E-03
			Pu-239	0.0000E+00	1.6748E-04
			Pu-240	0.0000E+00	4.0401E-06
			Pu-241	0.0000E+00	6.4373E-08
			Pu-242	0.0000E+00	6.7699E-10
			Am-241	0.0000E+00	1.2440E-09
			FP	0.0000E+00	6.8393E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.1074E-03
			U-238	6.4484E-03	6.1727E-03
			Pu-239	0.0000E+00	1.8263E-04
			Pu-240	0.0000E+00	4.8773E-06
			Pu-241	0.0000E+00	8.5566E-08
			Pu-242	0.0000E+00	9.9893E-10
			Am-241	0.0000E+00	1.6453E-09
			FP	0.0000E+00	7.5235E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.1269E-03
			U-238	6.4484E-03	6.1801E-03
			Pu-239	0.0000E+00	1.7840E-04
			Pu-240	0.0000E+00	4.6228E-06
			Pu-241	0.0000E+00	7.8918E-08
			Pu-242	0.0000E+00	8.9459E-10
			Am-241	0.0000E+00	1.5142E-09
			FP	0.0000E+00	7.3413E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			
			U-235	2.9371E-03	2.2355E-03

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			U-238	6.4484E-03	6.2206E-03
			Pu-239	0.0000E+00	1.5498E-04
			Pu-240	0.0000E+00	3.3892E-06
			Pu-241	0.0000E+00	4.9395E-08
			Pu-242	0.0000E+00	4.7232E-10
			Am-241	0.0000E+00	9.4791E-10
			FP	0.0000E+00	6.3139E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.4054E-03
			U-238	6.4484E-03	6.2830E-03
			Pu-239	0.0000E+00	1.1938E-04
			Pu-240	0.0000E+00	2.0874E-06
			Pu-241	0.0000E+00	2.3737E-08
			Pu-242	0.0000E+00	1.7342E-10
			Am-241	0.0000E+00	4.5608E-10
			FP	0.0000E+00	4.6612E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.12. Therefore, the compositions in these five axial levels are not repeated in this table.

5.11.11Cycle 12B-1

Table B12B-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 12B-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *	
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.914E+00	0.000E+00	5.914E+00
2304	1.281E-02	4.806E+00	9.418E-03	4.828E+00
2303	2.285E-02	4.150E+00	1.325E-02	4.186E+00
2403	2.172E-02	3.530E+00	1.116E-02	3.563E+00
2505	9.875E-03	4.279E+00	6.353E-03	4.295E+00
2506	1.242E-02	3.801E+00	8.931E-03	3.822E+00
2405	1.117E-01	3.571E+00	6.679E-02	3.749E+00
1304	0.000E+00	6.867E+00	0.000E+00	6.867E+00
1303	2.133E-02	4.324E+00	1.161E-02	4.357E+00
1404	0.000E+00	5.983E+00	0.000E+00	5.983E+00
1405	1.575E-02	4.065E+00	1.097E-02	4.092E+00
1406	1.253E-02	4.608E+00	8.963E-03	4.629E+00
2301	1.408E-01	4.089E+00	6.727E-02	4.297E+00
1202	1.639E-01	3.759E+00	9.221E-02	4.015E+00

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Table B12B-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 12B-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.665E+15	2.430E+15
MFF-5	1304	4.138E+15	2.797E+15

Table B12B-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 12B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9184E-02	1.4734E-02	0.0000E+00
-92.78	6.2535E-02	2.8417E-02	0.0000E+00
-87.78	1.0011E-01	4.5426E-02	0.0000E+00
-82.78	1.4478E-01	6.7661E-02	0.0000E+00
-77.78	1.9957E-01	9.7434E-02	0.0000E+00
-72.15	2.6375E-01	1.3657E-01	0.0000E+00
-65.90	3.3236E-01	1.8772E-01	0.0000E+00
-60.35	4.1280E-01	2.5638E-01	0.0000E+00
-55.49	5.0353E-01	3.4568E-01	0.0000E+00
-50.62	5.9136E-01	4.5405E-01	0.0000E+00
-47.17	6.4819E-01	5.4825E-01	0.0000E+00
-43.58	7.1364E-01	6.6884E-01	8.2983E-01
-38.45	8.2403E-01	8.0874E-01	8.8183E-01
-33.32	9.2787E-01	9.2591E-01	9.6908E-01
-28.20	1.0187E+00	1.0220E+00	9.9675E-01
-23.07	1.0948E+00	1.1010E+00	1.0677E+00
-17.94	1.1544E+00	1.1618E+00	1.1243E+00
-12.82	1.1966E+00	1.2035E+00	1.1283E+00
-7.69	1.2215E+00	1.2284E+00	1.1515E+00
-2.56	1.2288E+00	1.2358E+00	1.1580E+00
2.56	1.2182E+00	1.2258E+00	1.1594E+00
7.69	1.1896E+00	1.1977E+00	1.1317E+00
12.82	1.1435E+00	1.1525E+00	1.0874E+00
17.94	1.0812E+00	1.0918E+00	1.0806E+00
23.07	1.0032E+00	1.0135E+00	1.0030E+00
28.20	9.1148E-01	9.1978E-01	9.1278E-01
33.32	8.0785E-01	8.1260E-01	8.7576E-01
38.45	6.9334E-01	6.8759E-01	7.6564E-01
43.58	5.7130E-01	5.4273E-01	6.7635E-01
47.17	4.9318E-01	4.2852E-01	0.0000E+00
50.62	4.3369E-01	3.5003E-01	0.0000E+00
55.49	3.4923E-01	2.5896E-01	0.0000E+00
60.35	2.7073E-01	1.8626E-01	0.0000E+00
64.98	2.1355E-01	1.3910E-01	0.0000E+00
69.39	1.7800E-01	1.1136E-01	0.0000E+00
76.46	1.3156E-01	7.6959E-02	0.0000E+00
86.80	8.4042E-02	4.5495E-02	0.0000E+00
98.14	4.7852E-02	2.4498E-02	0.0000E+00
110.00	2.0488E-02	1.0888E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12B-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 12B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9104E-02	1.4533E-02	0.0000E+00
-92.78	6.2309E-02	2.8038E-02	0.0000E+00
-87.78	9.9707E-02	4.4867E-02	0.0000E+00
-82.78	1.4411E-01	6.6961E-02	0.0000E+00
-77.78	1.9840E-01	9.6730E-02	0.0000E+00
-72.15	2.6172E-01	1.3623E-01	0.0000E+00
-65.90	3.3077E-01	1.8945E-01	0.0000E+00
-60.35	4.0755E-01	2.5957E-01	0.0000E+00
-55.49	4.8889E-01	3.4284E-01	0.0000E+00
-50.62	5.7697E-01	4.4711E-01	0.0000E+00
-47.17	6.3778E-01	5.4226E-01	0.0000E+00
-43.58	7.0649E-01	6.6241E-01	8.0462E-01
-38.45	8.1806E-01	8.0265E-01	8.6307E-01
-33.32	9.2230E-01	9.2019E-01	9.5106E-01
-28.20	1.0133E+00	1.0167E+00	9.9789E-01
-23.07	1.0894E+00	1.0956E+00	1.0696E+00
-17.94	1.1492E+00	1.1564E+00	1.1267E+00
-12.82	1.1916E+00	1.1985E+00	1.1425E+00
-7.69	1.2170E+00	1.2238E+00	1.1665E+00
-2.56	1.2251E+00	1.2321E+00	1.1740E+00
2.56	1.2159E+00	1.2236E+00	1.1719E+00
7.69	1.1894E+00	1.1978E+00	1.1461E+00
12.82	1.1461E+00	1.1554E+00	1.1041E+00
17.94	1.0867E+00	1.0974E+00	1.0815E+00
23.07	1.0113E+00	1.0217E+00	1.0069E+00
28.20	9.2103E-01	9.2951E-01	9.1879E-01
33.32	8.1768E-01	8.2208E-01	8.6168E-01
38.45	7.0205E-01	6.9568E-01	7.5296E-01
43.58	5.7754E-01	5.4844E-01	6.6012E-01
47.17	4.9696E-01	4.3380E-01	0.0000E+00
50.62	4.3639E-01	3.5533E-01	0.0000E+00
55.49	3.5161E-01	2.6398E-01	0.0000E+00
60.35	2.7351E-01	1.9055E-01	0.0000E+00
64.98	2.1678E-01	1.4245E-01	0.0000E+00
69.39	1.8079E-01	1.1383E-01	0.0000E+00
76.46	1.3344E-01	7.8369E-02	0.0000E+00
86.80	8.5155E-02	4.6219E-02	0.0000E+00
98.14	4.8519E-02	2.4892E-02	0.0000E+00
110.00	2.0817E-02	1.1089E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12B-1.5. Fission Power Distribution by Pin in MFF-3 at BOC 12B-1

CORE POSITION 2404

1.061 1.047 1.033 1.020 1.008 0.997 0.987 0.979

1.063 1.047 1.033 1.020 1.008 0.997 0.987 0.979 0.971

1.064 1.049 1.034 1.021 1.008 0.997 0.987 0.979 0.971 0.964

1.067 1.051 1.036 1.022 1.009 0.998 0.988 0.979 0.971 0.964 0.959

1.071 1.054 1.039 1.024 1.011 0.999 0.989 0.979 0.971 0.965 0.959 0.954

1.075 1.058 1.042 1.027 1.014 1.001 0.990 0.981 0.972 0.965 0.960 0.954 0.950

1.081 1.064 1.047 1.032 1.018 1.005 0.993 0.983 0.974 0.967 0.961 0.955 0.951 0.947

1.088 1.070 1.053 1.037 1.023 1.009 0.997 0.986 0.977 0.969 0.962 0.957 0.952 0.948 0.944

1.078 1.061 1.044 1.029 1.015 1.002 0.991 0.981 0.972 0.965 0.959 0.954 0.949 0.945

1.069 1.052 1.037 1.022 1.008 0.996 0.986 0.977 0.969 0.962 0.956 0.951 0.947

1.061 1.045 1.030 1.016 1.003 0.992 0.982 0.973 0.966 0.960 0.954 0.950

1.055 1.039 1.025 1.011 0.999 0.989 0.979 0.971 0.964 0.958 0.953

1.049 1.034 1.020 1.008 0.996 0.986 0.977 0.969 0.962 0.957

1.044 1.030 1.017 1.005 0.994 0.984 0.975 0.968 0.961

1.041 1.027 1.014 1.003 0.992 0.983 0.974 0.967

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Table B12B-1.6. Fission Power Distribution by Pin in MFF-5 at BOC 12B-1

CORE POSITION 1304

0.955 0.960 0.965 0.970 0.975 0.980 0.985 0.990

0.956 0.960 0.964 0.969 0.974 0.978 0.983 0.988 0.993

0.957 0.961 0.965 0.969 0.973 0.977 0.982 0.986 0.991 0.996

0.960 0.963 0.966 0.969 0.973 0.977 0.981 0.985 0.990 0.995 1.000

0.964 0.966 0.969 0.971 0.974 0.977 0.981 0.985 0.989 0.994 0.999 1.004

0.970 0.971 0.973 0.974 0.977 0.979 0.982 0.986 0.990 0.994 0.999 1.004 1.009

0.977 0.977 0.978 0.979 0.980 0.982 0.985 0.988 0.991 0.995 1.000 1.005 1.010 1.015

0.985 0.985 0.985 0.985 0.986 0.987 0.988 0.991 0.994 0.997 1.002 1.006 1.011 1.017 1.022

0.993 0.993 0.992 0.992 0.993 0.994 0.995 0.998 1.001 1.005 1.009 1.014 1.019 1.025

1.001 1.000 1.000 1.000 1.000 1.001 1.003 1.005 1.009 1.013 1.017 1.022 1.028

1.009 1.008 1.007 1.007 1.008 1.009 1.011 1.014 1.018 1.022 1.027 1.032

1.017 1.016 1.016 1.016 1.016 1.018 1.020 1.024 1.027 1.032 1.037

1.026 1.025 1.024 1.025 1.026 1.028 1.030 1.034 1.038 1.043

1.034 1.034 1.034 1.034 1.036 1.038 1.041 1.045 1.049

1.043 1.043 1.043 1.044 1.046 1.049 1.053 1.057

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Table B12B-1.7. Fast Flux Distribution by Pin in MFF-3 at BOC 12B-1

CORE POSITION 2404

1.013 1.007 0.999 0.992 0.983 0.974 0.964 0.953

1.022 1.016 1.009 1.002 0.994 0.985 0.975 0.965 0.954

1.030 1.024 1.018 1.011 1.003 0.995 0.986 0.976 0.965 0.954

1.037 1.032 1.026 1.019 1.012 1.004 0.995 0.985 0.975 0.964 0.952

1.043 1.038 1.032 1.026 1.019 1.012 1.003 0.994 0.984 0.973 0.962 0.950

1.047 1.043 1.038 1.032 1.025 1.018 1.010 1.001 0.992 0.981 0.970 0.958 0.946

1.051 1.047 1.042 1.036 1.030 1.023 1.016 1.007 0.998 0.988 0.978 0.966 0.954 0.941

1.053 1.049 1.044 1.039 1.034 1.027 1.020 1.012 1.004 0.994 0.984 0.973 0.961 0.948 0.935

1.050 1.046 1.041 1.036 1.030 1.023 1.016 1.008 0.999 0.989 0.978 0.967 0.955 0.942

1.046 1.042 1.037 1.031 1.025 1.018 1.010 1.002 0.992 0.982 0.971 0.960 0.947

1.041 1.037 1.031 1.025 1.019 1.012 1.004 0.995 0.985 0.975 0.964 0.952

1.035 1.030 1.025 1.019 1.012 1.004 0.996 0.987 0.977 0.966 0.955

1.028 1.023 1.017 1.011 1.004 0.996 0.987 0.978 0.968 0.957

1.020 1.014 1.008 1.002 0.994 0.986 0.978 0.968 0.958

1.010 1.005 0.999 0.992 0.985 0.976 0.967 0.958

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Table B12B-1.8. Fast Flux Distribution by Pin in MFF-5 at BOC 12B-1

CORE POSITION 1304

0.977 0.979 0.980 0.981 0.980 0.979 0.977 0.974

0.981 0.984 0.986 0.987 0.987 0.986 0.985 0.982 0.979

0.984 0.988 0.990 0.992 0.993 0.993 0.992 0.990 0.987 0.983

0.987 0.991 0.994 0.996 0.998 0.998 0.998 0.997 0.994 0.991 0.987

0.987 0.992 0.996 0.999 1.002 1.003 1.003 1.002 1.000 0.997 0.994 0.989

0.987 0.993 0.997 1.001 1.004 1.006 1.007 1.007 1.005 1.003 1.000 0.995 0.990

0.985 0.992 0.997 1.002 1.005 1.008 1.010 1.010 1.009 1.007 1.005 1.001 0.996 0.990

0.983 0.990 0.996 1.001 1.006 1.009 1.011 1.012 1.012 1.011 1.008 1.005 1.001 0.995 0.989

0.987 0.994 1.000 1.005 1.009 1.011 1.013 1.014 1.013 1.011 1.008 1.005 1.000 0.994

0.990 0.997 1.003 1.007 1.011 1.013 1.014 1.014 1.013 1.011 1.007 1.003 0.998

0.993 1.000 1.005 1.009 1.012 1.014 1.014 1.014 1.012 1.009 1.005 1.000

0.996 1.001 1.006 1.010 1.012 1.013 1.014 1.012 1.010 1.007 1.002

0.997 1.003 1.007 1.010 1.012 1.012 1.012 1.010 1.007 1.004

0.998 1.003 1.007 1.009 1.010 1.010 1.009 1.007 1.004

0.999 1.003 1.006 1.007 1.008 1.008 1.006 1.004

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Table B12B-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 12B-1

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5264E+15	2.7566E+15
SE	2.5356E+15	2.7339E+15
SW	2.3736E+15	2.7094E+15
W	2.2682E+15	2.7361E+15
NW	2.2762E+15	2.7833E+15
NE	2.3748E+15	2.8132E+15

Table B12B-1.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 12B-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.274E-01	8.517E-01
U-238	8.238E-02	8.377E-02
Pu-239	8.931E-02	6.407E-02
Pu-240	8.477E-04	4.133E-04
Pu-241	9.196E-05	3.046E-05
Pu-242	2.925E-07	6.738E-08
Am-241	6.230E-07	1.456E-07
Total	1.741E+17	2.022E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12B-1.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 12B-1

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.811E+00	0.000E+00	5.811E+00
2304	1.341E-02	4.706E+00	1.039E-02	4.729E+00
2303	2.291E-02	4.079E+00	1.427E-02	4.117E+00
2403	2.170E-02	3.526E+00	1.219E-02	3.560E+00
2505	1.028E-02	4.280E+00	7.108E-03	4.297E+00
2506	1.257E-02	3.756E+00	9.693E-03	3.778E+00
2405	1.127E-01	3.514E+00	7.237E-02	3.699E+00
1304	0.000E+00	6.684E+00	0.000E+00	6.684E+00
1303	2.140E-02	4.247E+00	1.254E-02	4.281E+00
1404	0.000E+00	5.868E+00	0.000E+00	5.868E+00
1405	1.590E-02	3.982E+00	1.182E-02	4.009E+00
1406	1.300E-02	4.518E+00	9.848E-03	4.541E+00
2301	1.411E-01	4.005E+00	7.234E-02	4.218E+00
1202	1.625E-01	3.674E+00	9.789E-02	3.935E+00

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Table E12B-1.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 12B-1

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.673E+15	2.424E+15
MFF-5	1304	4.119E+15	2.771E+15

Table E12B-1.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 12B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8323E-02	1.4346E-02	0.0000E+00
-92.78	6.0695E-02	2.7670E-02	0.0000E+00
-87.78	9.7179E-02	4.4229E-02	0.0000E+00
-82.78	1.4056E-01	6.5877E-02	0.0000E+00
-77.78	1.9378E-01	9.4866E-02	0.0000E+00
-72.15	2.5614E-01	1.3296E-01	0.0000E+00
-65.90	3.2277E-01	1.8272E-01	0.0000E+00
-60.35	4.0089E-01	2.4950E-01	0.0000E+00
-55.49	4.8904E-01	3.3628E-01	0.0000E+00
-50.62	5.7434E-01	4.4152E-01	0.0000E+00
-47.17	6.2951E-01	5.3290E-01	0.0000E+00
-43.58	6.9305E-01	6.4992E-01	8.0732E-01
-38.45	8.0076E-01	7.8627E-01	8.5867E-01
-33.32	9.0277E-01	9.0117E-01	9.4487E-01
-28.20	9.9285E-01	9.9614E-01	9.6962E-01
-23.07	1.0695E+00	1.0754E+00	1.0411E+00
-17.94	1.1310E+00	1.1379E+00	1.0995E+00
-12.82	1.1764E+00	1.1827E+00	1.1047E+00
-7.69	1.2060E+00	1.2122E+00	1.1322E+00
-2.56	1.2193E+00	1.2258E+00	1.1444E+00
2.56	1.2161E+00	1.2234E+00	1.1534E+00
7.69	1.1959E+00	1.2039E+00	1.1340E+00
12.82	1.1586E+00	1.1675E+00	1.0984E+00
17.94	1.1043E+00	1.1151E+00	1.1046E+00
23.07	1.0322E+00	1.0428E+00	1.0328E+00
28.20	9.4320E-01	9.5192E-01	9.4537E-01
33.32	8.3944E-01	8.4460E-01	9.1566E-01
38.45	7.2243E-01	7.1661E-01	8.0264E-01
43.58	5.9648E-01	5.6669E-01	7.1067E-01
47.17	5.1565E-01	4.4792E-01	0.0000E+00
50.62	4.5394E-01	3.6625E-01	0.0000E+00
55.49	3.6595E-01	2.7127E-01	0.0000E+00
60.35	2.8404E-01	1.9533E-01	0.0000E+00
64.98	2.2426E-01	1.4602E-01	0.0000E+00
69.39	1.8704E-01	1.1696E-01	0.0000E+00
76.46	1.3834E-01	8.0893E-02	0.0000E+00
86.80	8.8402E-02	4.7849E-02	0.0000E+00
98.14	5.0303E-02	2.5764E-02	0.0000E+00
110.00	2.1471E-02	1.1428E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12B-1.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 12B-1

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8400E-02	1.4234E-02	0.0000E+00
-92.78	6.0813E-02	2.7462E-02	0.0000E+00
-87.78	9.7322E-02	4.3944E-02	0.0000E+00
-82.78	1.4068E-01	6.5577E-02	0.0000E+00
-77.78	1.9369E-01	9.4720E-02	0.0000E+00
-72.15	2.5554E-01	1.3338E-01	0.0000E+00
-65.90	3.2290E-01	1.8544E-01	0.0000E+00
-60.35	3.9775E-01	2.5396E-01	0.0000E+00
-55.49	4.7707E-01	3.3521E-01	0.0000E+00
-50.62	5.6288E-01	4.3680E-01	0.0000E+00
-47.17	6.2214E-01	5.2940E-01	0.0000E+00
-43.58	6.8900E-01	6.4643E-01	7.8704E-01
-38.45	7.9810E-01	7.8350E-01	8.4471E-01
-33.32	9.0072E-01	8.9896E-01	9.3183E-01
-28.20	9.9107E-01	9.9445E-01	9.7451E-01
-23.07	1.0678E+00	1.0737E+00	1.0467E+00
-17.94	1.1293E+00	1.1361E+00	1.1056E+00
-12.82	1.1747E+00	1.1810E+00	1.1217E+00
-7.69	1.2043E+00	1.2106E+00	1.1497E+00
-2.56	1.2178E+00	1.2244E+00	1.1623E+00
2.56	1.2150E+00	1.2222E+00	1.1670E+00
7.69	1.1952E+00	1.2033E+00	1.1478E+00
12.82	1.1587E+00	1.1678E+00	1.1125E+00
17.94	1.1053E+00	1.1162E+00	1.1007E+00
23.07	1.0345E+00	1.0452E+00	1.0306E+00
28.20	9.4686E-01	9.5579E-01	9.4509E-01
33.32	8.4417E-01	8.4911E-01	8.9569E-01
38.45	7.2733E-01	7.2110E-01	7.8546E-01
43.58	6.0019E-01	5.7016E-01	6.9099E-01
47.17	5.1757E-01	4.5185E-01	0.0000E+00
50.62	4.5529E-01	3.7076E-01	0.0000E+00
55.49	3.6758E-01	2.7603E-01	0.0000E+00
60.35	2.8650E-01	1.9966E-01	0.0000E+00
64.98	2.2748E-01	1.4953E-01	0.0000E+00
69.39	1.8993E-01	1.1963E-01	0.0000E+00
76.46	1.4041E-01	8.2497E-02	0.0000E+00
86.80	8.9720E-02	4.8729E-02	0.0000E+00
98.14	5.1141E-02	2.6263E-02	0.0000E+00
110.00	2.1923E-02	1.1698E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12B-1.5. Fission Power Distribution by Pin in MFF-3 at EOC 12B-1

CORE POSITION 2404

1.062 1.048 1.034 1.022 1.011 1.001 0.992 0.984

1.062 1.048 1.034 1.022 1.010 1.000 0.991 0.983 0.976

1.064 1.049 1.034 1.022 1.010 0.999 0.990 0.982 0.975 0.969

1.066 1.050 1.036 1.022 1.010 0.999 0.990 0.981 0.974 0.968 0.963

1.069 1.053 1.038 1.024 1.011 1.000 0.990 0.981 0.974 0.968 0.962 0.958

1.073 1.056 1.041 1.026 1.013 1.001 0.991 0.982 0.974 0.968 0.962 0.957 0.953

1.078 1.061 1.045 1.030 1.017 1.004 0.993 0.983 0.975 0.968 0.962 0.958 0.953 0.950

1.084 1.067 1.051 1.035 1.021 1.008 0.996 0.986 0.977 0.970 0.963 0.958 0.954 0.950 0.946

1.074 1.058 1.042 1.027 1.013 1.001 0.990 0.981 0.972 0.966 0.960 0.955 0.951 0.947

1.065 1.049 1.034 1.020 1.007 0.995 0.985 0.976 0.969 0.962 0.957 0.953 0.949

1.058 1.042 1.028 1.014 1.002 0.991 0.981 0.973 0.966 0.960 0.955 0.950

1.051 1.036 1.022 1.009 0.998 0.987 0.978 0.970 0.964 0.958 0.953

1.046 1.032 1.018 1.006 0.995 0.985 0.976 0.968 0.962 0.956

1.042 1.028 1.015 1.003 0.992 0.983 0.974 0.967 0.961

1.038 1.024 1.012 1.001 0.990 0.981 0.973 0.966

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Table E12B-1.6. Fission Power Distribution by Pin in MFF-5 at EOC 12B-1

CORE POSITION 1304

0.956 0.961 0.966 0.970 0.975 0.980 0.985 0.990

0.956 0.961 0.965 0.969 0.974 0.978 0.983 0.988 0.993

0.958 0.961 0.965 0.969 0.973 0.977 0.982 0.986 0.991 0.996

0.961 0.964 0.966 0.969 0.973 0.977 0.981 0.985 0.990 0.995 1.000

0.965 0.967 0.969 0.971 0.974 0.977 0.981 0.985 0.989 0.994 0.999 1.004

0.971 0.972 0.973 0.975 0.977 0.979 0.982 0.986 0.990 0.994 0.999 1.004 1.010

0.978 0.978 0.979 0.979 0.981 0.982 0.985 0.987 0.991 0.995 1.000 1.005 1.010 1.016

0.986 0.986 0.985 0.985 0.986 0.987 0.988 0.991 0.994 0.997 1.001 1.006 1.011 1.017 1.023

0.994 0.993 0.993 0.992 0.993 0.994 0.995 0.997 1.001 1.004 1.009 1.014 1.019 1.025

1.002 1.001 1.000 1.000 1.000 1.001 1.003 1.005 1.008 1.012 1.017 1.022 1.028

1.010 1.008 1.008 1.007 1.008 1.009 1.011 1.014 1.017 1.021 1.026 1.032

1.018 1.016 1.016 1.015 1.016 1.018 1.020 1.023 1.027 1.031 1.036

1.026 1.025 1.024 1.024 1.025 1.027 1.030 1.033 1.037 1.042

1.034 1.033 1.033 1.034 1.035 1.037 1.040 1.044 1.049

1.043 1.042 1.043 1.044 1.046 1.048 1.052 1.056

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Table E12B-1.7. Fast Flux Distribution by Pin in MFF-3 at EOC 12B-1

CORE POSITION 2404

1.014 1.008 1.001 0.994 0.986 0.977 0.968 0.958

1.022 1.016 1.010 1.003 0.996 0.988 0.979 0.969 0.959

1.029 1.024 1.018 1.012 1.005 0.997 0.988 0.979 0.969 0.958

1.036 1.031 1.025 1.019 1.012 1.005 0.997 0.988 0.978 0.967 0.956

1.041 1.036 1.031 1.026 1.019 1.012 1.004 0.996 0.986 0.976 0.965 0.953

1.045 1.041 1.036 1.031 1.025 1.018 1.011 1.002 0.993 0.983 0.973 0.961 0.949

1.048 1.044 1.040 1.035 1.029 1.023 1.016 1.008 0.999 0.990 0.979 0.968 0.956 0.944

1.050 1.046 1.042 1.037 1.032 1.026 1.020 1.012 1.004 0.995 0.985 0.974 0.963 0.951 0.938

1.047 1.043 1.039 1.034 1.028 1.022 1.015 1.007 0.999 0.989 0.979 0.968 0.956 0.944

1.043 1.039 1.035 1.029 1.024 1.017 1.010 1.001 0.992 0.983 0.972 0.961 0.949

1.038 1.034 1.029 1.024 1.017 1.011 1.003 0.994 0.985 0.975 0.964 0.953

1.032 1.028 1.023 1.017 1.010 1.003 0.995 0.986 0.977 0.966 0.955

1.025 1.020 1.015 1.009 1.002 0.995 0.986 0.977 0.968 0.957

1.017 1.012 1.006 1.000 0.993 0.985 0.977 0.968 0.958

1.008 1.003 0.997 0.990 0.983 0.975 0.967 0.957

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Table E12B-1.8. Fast Flux Distribution by Pin in MFF-5 at EOC 12B-1

CORE POSITION 1304

0.977 0.979 0.980 0.981 0.980 0.979 0.977 0.975

0.982 0.984 0.986 0.987 0.987 0.986 0.985 0.983 0.980

0.985 0.988 0.991 0.992 0.993 0.993 0.992 0.990 0.987 0.984

0.987 0.991 0.994 0.997 0.998 0.998 0.998 0.996 0.994 0.991 0.987

0.988 0.993 0.997 1.000 1.002 1.003 1.003 1.002 1.000 0.997 0.994 0.989

0.988 0.993 0.998 1.002 1.004 1.006 1.007 1.006 1.005 1.003 0.999 0.995 0.990

0.987 0.993 0.998 1.002 1.006 1.008 1.009 1.010 1.009 1.007 1.004 1.001 0.996 0.990

0.984 0.991 0.997 1.002 1.006 1.009 1.011 1.012 1.012 1.010 1.008 1.005 1.001 0.995 0.989

0.988 0.994 1.000 1.005 1.009 1.011 1.013 1.013 1.013 1.011 1.008 1.004 1.000 0.994

0.991 0.998 1.003 1.007 1.010 1.013 1.014 1.014 1.013 1.010 1.007 1.003 0.998

0.994 1.000 1.005 1.009 1.012 1.013 1.014 1.013 1.012 1.009 1.005 1.000

0.996 1.002 1.006 1.009 1.012 1.013 1.013 1.012 1.010 1.006 1.002

0.997 1.002 1.006 1.009 1.011 1.012 1.011 1.010 1.007 1.003

0.998 1.003 1.006 1.008 1.010 1.010 1.009 1.007 1.003

0.998 1.002 1.005 1.007 1.007 1.007 1.005 1.003

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Table E12B-1.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 12B-1

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.5121E+15	2.7326E+15
SE	2.5242E+15	2.7117E+15
SW	2.3755E+15	2.6842E+15
W	2.2739E+15	2.7116E+15
NW	2.2724E+15	2.7566E+15
NE	2.3649E+15	2.7843E+15

Table E12B-1.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 12B-1

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.192E-01	8.426E-01
U-238	8.270E-02	8.413E-02
Pu-239	9.697E-02	7.275E-02
Pu-240	9.906E-04	5.260E-04
Pu-241	1.174E-04	4.421E-05
Pu-242	3.981E-07	1.089E-07
Am-241	7.237E-07	1.838E-07
Total	1.711E+17	1.968E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12B-1.11. Composition of MFF-3 at EOC 12B-1

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.0974E-03
			U-238	6.3240E-03	6.0141E-03
			Pu-239	0.0000E+00	2.0527E-04
			Pu-240	0.0000E+00	7.4134E-06
			Pu-241	0.0000E+00	1.5823E-07
			Pu-242	0.0000E+00	2.3131E-09
			Am-241	0.0000E+00	5.9218E-09
			FP	0.0000E+00	8.7962E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	1.9133E-03
			U-238	6.3240E-03	5.9358E-03
			Pu-239	0.0000E+00	2.3958E-04
			Pu-240	0.0000E+00	9.5168E-06
			Pu-241	0.0000E+00	2.3180E-07
			Pu-242	0.0000E+00	3.9672E-09
			Am-241	0.0000E+00	8.7093E-09
			FP	0.0000E+00	1.0777E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	1.8142E-03
			U-238	6.3240E-03	5.8943E-03
			Pu-239	0.0000E+00	2.5860E-04
			Pu-240	0.0000E+00	1.1381E-05
			Pu-241	0.0000E+00	3.0432E-07
			Pu-242	0.0000E+00	5.7884E-09
			Am-241	0.0000E+00	1.1394E-08
			FP	0.0000E+00	1.1778E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	1.8451E-03
			U-238	6.3240E-03	5.9073E-03
			Pu-239	0.0000E+00	2.5248E-04
			Pu-240	0.0000E+00	1.0726E-05
			Pu-241	0.0000E+00	2.7814E-07
			Pu-242	0.0000E+00	5.1108E-09
			Am-241	0.0000E+00	1.0391E-08
			FP	0.0000E+00	1.1472E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	2.0056E-03
			U-238	6.3240E-03	5.9725E-03
			Pu-239	0.0000E+00	2.2105E-04
			Pu-240	0.0000E+00	7.8233E-06
			Pu-241	0.0000E+00	1.7227E-07
			Pu-242	0.0000E+00	2.6377E-09
			Am-241	0.0000E+00	6.4422E-09
			FP	0.0000E+00	9.8843E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.2575E-03
			U-238	6.3240E-03	6.0704E-03
			Pu-239	0.0000E+00	1.7272E-04
			Pu-240	0.0000E+00	4.8406E-06
			Pu-241	0.0000E+00	8.3049E-08
			Pu-242	0.0000E+00	9.6043E-10
			Am-241	0.0000E+00	3.0973E-09
			FP	0.0000E+00	7.3443E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E12B-1.12. Composition of MFF-5 at EOC 12B-1

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.2335E-03
			U-238	6.4484E-03	6.2240E-03
			Pu-239	0.0000E+00	1.5725E-04
			Pu-240	0.0000E+00	3.9066E-06
			Pu-241	0.0000E+00	6.0828E-08
			Pu-242	0.0000E+00	6.2354E-10
			Am-241	0.0000E+00	1.4996E-09
			FP	0.0000E+00	6.2016E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.0942E-03
			U-238	6.4484E-03	6.1674E-03
			Pu-239	0.0000E+00	1.8558E-04
			Pu-240	0.0000E+00	5.0649E-06
			Pu-241	0.0000E+00	9.0174E-08
			Pu-242	0.0000E+00	1.0777E-09
			Am-241	0.0000E+00	2.2089E-09
			FP	0.0000E+00	7.6488E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	2.0163E-03
			U-238	6.4484E-03	6.1370E-03
			Pu-239	0.0000E+00	2.0197E-04
			Pu-240	0.0000E+00	6.1079E-06
			Pu-241	0.0000E+00	1.1971E-07
			Pu-242	0.0000E+00	1.5893E-09
			Am-241	0.0000E+00	2.9188E-09
			FP	0.0000E+00	8.4050E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	2.0372E-03
			U-238	6.4484E-03	6.1452E-03
			Pu-239	0.0000E+00	1.9747E-04
			Pu-240	0.0000E+00	5.7961E-06
			Pu-241	0.0000E+00	1.1060E-07
			Pu-242	0.0000E+00	1.4262E-09
			Am-241	0.0000E+00	2.6915E-09
			FP	0.0000E+00	8.2077E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			

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			U-235	2.9371E-03	2.1552E-03
			U-238	6.4484E-03	6.1907E-03
			Pu-239	0.0000E+00	1.7218E-04
			Pu-240	0.0000E+00	4.2639E-06
			Pu-241	0.0000E+00	6.9554E-08
			Pu-242	0.0000E+00	7.5650E-10
			Am-241	0.0000E+00	1.6930E-09
			FP	0.0000E+00	7.0767E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.3419E-03
			U-238	6.4484E-03	6.2611E-03
			Pu-239	0.0000E+00	1.3331E-04
			Pu-240	0.0000E+00	2.6370E-06
			Pu-241	0.0000E+00	3.3612E-08
			Pu-242	0.0000E+00	2.7913E-10
			Am-241	0.0000E+00	8.2003E-10
			FP	0.0000E+00	5.2399E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.12. Therefore, the compositions in these five axial levels are not repeated in this table.

5.11.12Cycle 12B-2

Table B12B-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at BOC 12B-2

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.714E+00	0.000E+00	5.714E+00
2304	1.366E-02	4.649E+00	9.895E-03	4.673E+00
2303	2.348E-02	4.057E+00	1.365E-02	4.095E+00
2403	1.691E-02	3.832E+00	9.627E-03	3.859E+00
2505	1.046E-02	4.154E+00	6.594E-03	4.171E+00
2506	1.271E-02	3.667E+00	9.089E-03	3.689E+00
2405	1.142E-01	3.442E+00	6.817E-02	3.625E+00
1304	0.000E+00	6.697E+00	0.000E+00	6.697E+00
1303	2.219E-02	4.276E+00	1.213E-02	4.311E+00
1404	0.000E+00	5.847E+00	0.000E+00	5.847E+00
1405	1.634E-02	3.969E+00	1.132E-02	3.997E+00
1406	1.344E-02	4.522E+00	9.457E-03	4.545E+00
2301	1.456E-01	4.021E+00	6.958E-02	4.236E+00
1202	1.680E-01	3.700E+00	9.466E-02	3.963E+00

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Table B12B-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at BOC 12B-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.618E+15	2.393E+15
MFF-5	1304	4.134E+15	2.786E+15

Table B12B-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at BOC 12B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9452E-02	1.4906E-02	0.0000E+00
-92.78	6.3096E-02	2.8743E-02	0.0000E+00
-87.78	1.0099E-01	4.5929E-02	0.0000E+00
-82.78	1.4600E-01	6.8381E-02	0.0000E+00
-77.78	2.0117E-01	9.8427E-02	0.0000E+00
-72.15	2.6574E-01	1.3789E-01	0.0000E+00
-65.90	3.3464E-01	1.8936E-01	0.0000E+00
-60.35	4.1525E-01	2.5834E-01	0.0000E+00
-55.49	5.0608E-01	3.4788E-01	0.0000E+00
-50.62	5.9380E-01	4.5636E-01	0.0000E+00
-47.17	6.5041E-01	5.5045E-01	0.0000E+00
-43.58	7.1557E-01	6.7093E-01	8.3422E-01
-38.45	8.2562E-01	8.1061E-01	8.8593E-01
-33.32	9.2901E-01	9.2742E-01	9.7299E-01
-28.20	1.0193E+00	1.0228E+00	9.9614E-01
-23.07	1.0949E+00	1.1012E+00	1.0665E+00
-17.94	1.1540E+00	1.1613E+00	1.1226E+00
-12.82	1.1958E+00	1.2024E+00	1.1237E+00
-7.69	1.2204E+00	1.2269E+00	1.1465E+00
-2.56	1.2275E+00	1.2341E+00	1.1529E+00
2.56	1.2168E+00	1.2242E+00	1.1549E+00
7.69	1.1883E+00	1.1962E+00	1.1274E+00
12.82	1.1425E+00	1.1513E+00	1.0835E+00
17.94	1.0806E+00	1.0911E+00	1.0808E+00
23.07	1.0030E+00	1.0133E+00	1.0035E+00
28.20	9.1167E-01	9.2011E-01	9.1363E-01
33.32	8.0844E-01	8.1346E-01	8.8181E-01
38.45	6.9418E-01	6.8877E-01	7.7128E-01
43.58	5.7230E-01	5.4397E-01	6.8166E-01
47.17	4.9434E-01	4.2977E-01	0.0000E+00
50.62	4.3494E-01	3.5127E-01	0.0000E+00
55.49	3.5042E-01	2.6007E-01	0.0000E+00
60.35	2.7187E-01	1.8721E-01	0.0000E+00
64.98	2.1459E-01	1.3991E-01	0.0000E+00
69.39	1.7896E-01	1.1206E-01	0.0000E+00
76.46	1.3236E-01	7.7506E-02	0.0000E+00
86.80	8.4618E-02	4.5859E-02	0.0000E+00
98.14	4.8210E-02	2.4715E-02	0.0000E+00
110.00	2.0647E-02	1.0991E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12B-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at BOC 12B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.9302E-02	1.4687E-02	0.0000E+00
-92.78	6.2725E-02	2.8333E-02	0.0000E+00
-87.78	1.0036E-01	4.5333E-02	0.0000E+00
-82.78	1.4503E-01	6.7639E-02	0.0000E+00
-77.78	1.9962E-01	9.7684E-02	0.0000E+00
-72.15	2.6324E-01	1.3752E-01	0.0000E+00
-65.90	3.3258E-01	1.9114E-01	0.0000E+00
-60.35	4.0956E-01	2.6165E-01	0.0000E+00
-55.49	4.9104E-01	3.4520E-01	0.0000E+00
-50.62	5.7909E-01	4.4953E-01	0.0000E+00
-47.17	6.3975E-01	5.4447E-01	0.0000E+00
-43.58	7.0818E-01	6.6433E-01	8.0921E-01
-38.45	8.1944E-01	8.0434E-01	8.6764E-01
-33.32	9.2340E-01	9.2158E-01	9.5566E-01
-28.20	1.0141E+00	1.0176E+00	9.9747E-01
-23.07	1.0899E+00	1.0961E+00	1.0688E+00
-17.94	1.1493E+00	1.1565E+00	1.1256E+00
-12.82	1.1914E+00	1.1981E+00	1.1379E+00
-7.69	1.2165E+00	1.2231E+00	1.1616E+00
-2.56	1.2244E+00	1.2311E+00	1.1689E+00
2.56	1.2151E+00	1.2225E+00	1.1674E+00
7.69	1.1885E+00	1.1966E+00	1.1416E+00
12.82	1.1452E+00	1.1543E+00	1.0998E+00
17.94	1.0860E+00	1.0966E+00	1.0816E+00
23.07	1.0107E+00	1.0211E+00	1.0071E+00
28.20	9.2061E-01	9.2914E-01	9.1904E-01
33.32	8.1750E-01	8.2211E-01	8.6751E-01
38.45	7.0211E-01	6.9597E-01	7.5826E-01
43.58	5.7787E-01	5.4897E-01	6.6497E-01
47.17	4.9752E-01	4.3457E-01	0.0000E+00
50.62	4.3707E-01	3.5626E-01	0.0000E+00
55.49	3.5232E-01	2.6490E-01	0.0000E+00
60.35	2.7419E-01	1.9135E-01	0.0000E+00
64.98	2.1739E-01	1.4312E-01	0.0000E+00
69.39	1.8133E-01	1.1441E-01	0.0000E+00
76.46	1.3387E-01	7.8792E-02	0.0000E+00
86.80	8.5443E-02	4.6482E-02	0.0000E+00
98.14	4.8686E-02	2.5037E-02	0.0000E+00
110.00	2.0888E-02	1.1155E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table B12B-2.5. Fission Power Distribution by Pin in MFF-3 at BOC 12B-2

CORE POSITION 2404

1.065 1.050 1.036 1.023 1.011 1.000 0.990 0.981

1.066 1.051 1.036 1.023 1.011 1.000 0.990 0.981 0.973

1.068 1.052 1.037 1.023 1.011 0.999 0.989 0.980 0.972 0.965

1.070 1.054 1.038 1.024 1.011 1.000 0.989 0.980 0.972 0.965 0.959

1.073 1.057 1.041 1.026 1.013 1.001 0.990 0.980 0.972 0.965 0.959 0.954

1.077 1.060 1.044 1.029 1.015 1.003 0.991 0.981 0.973 0.966 0.959 0.954 0.949

1.083 1.065 1.049 1.033 1.019 1.005 0.994 0.983 0.974 0.967 0.960 0.955 0.950 0.945

1.089 1.071 1.054 1.038 1.023 1.010 0.997 0.986 0.977 0.969 0.962 0.956 0.951 0.946 0.942

1.078 1.061 1.045 1.029 1.015 1.002 0.990 0.980 0.972 0.964 0.958 0.952 0.948 0.943

1.069 1.052 1.036 1.022 1.008 0.996 0.985 0.975 0.967 0.960 0.954 0.949 0.945

1.061 1.045 1.029 1.015 1.002 0.991 0.981 0.972 0.964 0.958 0.952 0.947

1.054 1.038 1.024 1.010 0.998 0.987 0.977 0.969 0.962 0.955 0.950

1.048 1.033 1.019 1.006 0.994 0.984 0.975 0.966 0.959 0.953

1.043 1.028 1.015 1.003 0.991 0.981 0.972 0.965 0.958

1.038 1.025 1.012 1.000 0.989 0.979 0.971 0.963

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Table B12B-2.6. Fission Power Distribution by Pin in MFF-5 at BOC 12B-2

CORE POSITION 1304

0.954 0.959 0.963 0.968 0.973 0.978 0.983 0.988

0.954 0.959 0.963 0.967 0.972 0.977 0.981 0.986 0.991

0.956 0.960 0.963 0.967 0.971 0.976 0.980 0.985 0.990 0.995

0.960 0.962 0.965 0.968 0.972 0.975 0.980 0.984 0.989 0.994 0.999

0.964 0.966 0.968 0.971 0.973 0.976 0.980 0.984 0.988 0.993 0.998 1.003

0.970 0.971 0.973 0.974 0.976 0.979 0.982 0.985 0.989 0.993 0.998 1.003 1.009

0.978 0.978 0.979 0.979 0.980 0.982 0.984 0.987 0.991 0.995 0.999 1.004 1.010 1.015

0.986 0.986 0.986 0.986 0.986 0.987 0.989 0.991 0.994 0.997 1.001 1.006 1.011 1.017 1.022

0.995 0.994 0.993 0.993 0.993 0.994 0.996 0.998 1.001 1.005 1.009 1.014 1.019 1.025

1.003 1.002 1.001 1.000 1.001 1.002 1.003 1.006 1.009 1.013 1.017 1.023 1.028

1.011 1.010 1.009 1.008 1.009 1.010 1.012 1.014 1.018 1.022 1.027 1.032

1.019 1.018 1.017 1.017 1.017 1.019 1.021 1.024 1.028 1.032 1.037

1.028 1.026 1.026 1.026 1.027 1.029 1.031 1.034 1.038 1.043

1.036 1.035 1.035 1.036 1.037 1.039 1.042 1.046 1.050

1.045 1.045 1.045 1.046 1.048 1.050 1.053 1.057

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Table B12B-2.7. Fast Flux Distribution by Pin in MFF-3 at BOC 12B-2

CORE POSITION 2404

1.020 1.014 1.006 0.998 0.990 0.980 0.970 0.959

1.028 1.022 1.015 1.008 0.999 0.990 0.980 0.969 0.958

1.035 1.029 1.023 1.016 1.008 0.999 0.990 0.979 0.968 0.956

1.041 1.036 1.029 1.023 1.015 1.007 0.998 0.988 0.977 0.966 0.954

1.046 1.041 1.035 1.029 1.022 1.014 1.005 0.996 0.986 0.975 0.963 0.950

1.050 1.045 1.040 1.034 1.027 1.020 1.011 1.002 0.993 0.982 0.970 0.958 0.945

1.052 1.048 1.043 1.037 1.031 1.024 1.016 1.008 0.998 0.988 0.977 0.965 0.953 0.940

1.054 1.050 1.045 1.040 1.034 1.027 1.020 1.012 1.003 0.993 0.983 0.971 0.959 0.946 0.933

1.050 1.046 1.041 1.035 1.029 1.022 1.015 1.006 0.997 0.987 0.976 0.965 0.952 0.939

1.046 1.041 1.036 1.030 1.024 1.016 1.008 1.000 0.990 0.980 0.969 0.957 0.944

1.040 1.035 1.030 1.024 1.017 1.009 1.001 0.992 0.982 0.972 0.960 0.948

1.033 1.028 1.022 1.016 1.009 1.001 0.993 0.983 0.973 0.963 0.951

1.025 1.020 1.014 1.007 1.000 0.992 0.983 0.974 0.964 0.953

1.016 1.011 1.005 0.998 0.990 0.982 0.973 0.964 0.953

1.007 1.001 0.995 0.988 0.980 0.972 0.963 0.953

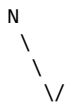

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Table B12B-2.8. Fast Flux Distribution by Pin in MFF-5 at BOC 12B-2

CORE POSITION 1304

0.974 0.976 0.977 0.978 0.978 0.977 0.975 0.973

0.979 0.982 0.983 0.985 0.985 0.984 0.983 0.981 0.978

0.983 0.986 0.988 0.990 0.991 0.991 0.990 0.989 0.986 0.983

0.985 0.989 0.992 0.995 0.996 0.997 0.997 0.995 0.993 0.990 0.986

0.986 0.991 0.995 0.998 1.000 1.001 1.002 1.001 0.999 0.997 0.993 0.989

0.986 0.992 0.997 1.000 1.003 1.005 1.006 1.006 1.005 1.003 1.000 0.996 0.991

0.986 0.992 0.997 1.001 1.005 1.007 1.009 1.009 1.009 1.007 1.005 1.001 0.997 0.991

0.984 0.990 0.996 1.001 1.005 1.009 1.011 1.012 1.012 1.011 1.009 1.006 1.002 0.997 0.991

0.988 0.994 1.000 1.005 1.009 1.011 1.013 1.014 1.013 1.012 1.009 1.005 1.001 0.996

0.992 0.998 1.003 1.008 1.011 1.013 1.014 1.015 1.014 1.011 1.008 1.004 0.999

0.995 1.001 1.006 1.010 1.012 1.014 1.015 1.014 1.013 1.010 1.007 1.002

0.997 1.003 1.007 1.011 1.013 1.014 1.014 1.013 1.011 1.008 1.004

0.999 1.004 1.008 1.011 1.013 1.013 1.013 1.011 1.009 1.005

1.000 1.005 1.008 1.010 1.012 1.012 1.011 1.009 1.006

1.001 1.005 1.007 1.009 1.010 1.009 1.008 1.005

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Table B12B-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at BOC 12B-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4836E+15	2.7521E+15
SE	2.5068E+15	2.7190E+15
SW	2.3573E+15	2.6899E+15
W	2.2356E+15	2.7262E+15
NW	2.2314E+15	2.7782E+15
NE	2.3269E+15	2.8073E+15

Table B12B-2.10. Relative Fission Rates in MFF-3 and MFF-5 at BOC 12B-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.187E-01	8.422E-01
U-238	8.316E-02	8.442E-02
Pu-239	9.703E-02	7.280E-02
Pu-240	9.949E-04	5.278E-04
Pu-241	1.171E-04	4.413E-05
Pu-242	3.998E-07	1.093E-07
Am-241	7.549E-07	1.952E-07
Total	1.682E+17	1.972E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12B-2.1. Fission Power Generated in MFF-3, MFF-5 and Neighboring Assemblies at EOC 12B-2

CORE	* * * * * *	POWER IN MEGAWATTS	* * * * * *
POS.	BELOW CORE	IN CORE	ABOVE CORE	TOTAL PWR
2404	0.000E+00	5.618E+00	0.000E+00	5.618E+00
2304	1.421E-02	4.556E+00	1.090E-02	4.582E+00
2303	2.351E-02	3.991E+00	1.471E-02	4.029E+00
2403	1.720E-02	3.821E+00	1.061E-02	3.849E+00
2505	1.084E-02	4.159E+00	7.380E-03	4.177E+00
2506	1.285E-02	3.629E+00	9.871E-03	3.651E+00
2405	1.150E-01	3.392E+00	7.390E-02	3.581E+00
1304	0.000E+00	6.524E+00	0.000E+00	6.524E+00
1303	2.224E-02	4.203E+00	1.311E-02	4.239E+00
1404	0.000E+00	5.742E+00	0.000E+00	5.742E+00
1405	1.649E-02	3.894E+00	1.221E-02	3.923E+00
1406	1.388E-02	4.439E+00	1.039E-02	4.463E+00
2301	1.457E-01	3.941E+00	7.491E-02	4.162E+00
1202	1.665E-01	3.619E+00	1.006E-01	3.886E+00

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Table E12B-2.2. Assembly Averaged Total and Fast Flux in MFF-3 and MFF-5 at EOC 12B-2

Assembly	Core Pos.	Flux (n/cm^2-sec) Total	> 0.1 MeV
MFF-3	2404	3.629E+15	2.389E+15
MFF-5	1304	4.120E+15	2.763E+15

Table E12B-2.3. Axial Distribution of Total Flux, Fast Flux and Power in MFF-3 at EOC 12B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8541E-02	1.4491E-02	0.0000E+00
-92.78	6.1160E-02	2.7944E-02	0.0000E+00
-87.78	9.7901E-02	4.4653E-02	0.0000E+00
-82.78	1.4157E-01	6.6488E-02	0.0000E+00
-77.78	1.9510E-01	9.5700E-02	0.0000E+00
-72.15	2.5780E-01	1.3407E-01	0.0000E+00
-65.90	3.2467E-01	1.8412E-01	0.0000E+00
-60.35	4.0291E-01	2.5114E-01	0.0000E+00
-55.49	4.9107E-01	3.3810E-01	0.0000E+00
-50.62	5.7623E-01	4.4335E-01	0.0000E+00
-47.17	6.3120E-01	5.3462E-01	0.0000E+00
-43.58	6.9445E-01	6.5144E-01	8.1100E-01
-38.45	8.0180E-01	7.8757E-01	8.6207E-01
-33.32	9.0340E-01	9.0204E-01	9.4813E-01
-28.20	9.9298E-01	9.9637E-01	9.6855E-01
-23.07	1.0692E+00	1.0751E+00	1.0395E+00
-17.94	1.1302E+00	1.1370E+00	1.0975E+00
-12.82	1.1753E+00	1.1813E+00	1.0999E+00
-7.69	1.2047E+00	1.2105E+00	1.1271E+00
-2.56	1.2179E+00	1.2241E+00	1.1393E+00
2.56	1.2148E+00	1.2217E+00	1.1490E+00
7.69	1.1948E+00	1.2025E+00	1.1298E+00
12.82	1.1578E+00	1.1666E+00	1.0946E+00
17.94	1.1040E+00	1.1148E+00	1.1050E+00
23.07	1.0323E+00	1.0431E+00	1.0337E+00
28.20	9.4386E-01	9.5282E-01	9.4664E-01
33.32	8.4057E-01	8.4609E-01	9.2244E-01
38.45	7.2385E-01	7.1843E-01	8.0907E-01
43.58	5.9804E-01	5.6848E-01	7.1680E-01
47.17	5.1732E-01	4.4959E-01	0.0000E+00
50.62	4.5565E-01	3.6789E-01	0.0000E+00
55.49	3.6757E-01	2.7270E-01	0.0000E+00
60.35	2.8549E-01	1.9652E-01	0.0000E+00
64.98	2.2559E-01	1.4701E-01	0.0000E+00
69.39	1.8824E-01	1.1782E-01	0.0000E+00
76.46	1.3934E-01	8.1553E-02	0.0000E+00
86.80	8.9107E-02	4.8284E-02	0.0000E+00
98.14	5.0735E-02	2.6019E-02	0.0000E+00
110.00	2.1662E-02	1.1548E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12B-2.4. Axial Distribution of Total Flux, Fast Flux and Power in MFF-5 at EOC 12B-2

z (cm)	Total Flux	Flux > 0.1 MeV	Power
-97.78	2.8556E-02	1.4364E-02	0.0000E+00
-92.78	6.1139E-02	2.7710E-02	0.0000E+00
-87.78	9.7834E-02	4.4334E-02	0.0000E+00
-82.78	1.4139E-01	6.6150E-02	0.0000E+00
-77.78	1.9465E-01	9.5533E-02	0.0000E+00
-72.15	2.5672E-01	1.3448E-01	0.0000E+00
-65.90	3.2434E-01	1.8688E-01	0.0000E+00
-60.35	3.9934E-01	2.5574E-01	0.0000E+00
-55.49	4.7874E-01	3.3720E-01	0.0000E+00
-50.62	5.6451E-01	4.3880E-01	0.0000E+00
-47.17	6.2360E-01	5.3116E-01	0.0000E+00
-43.58	6.9016E-01	6.4784E-01	7.9095E-01
-38.45	7.9898E-01	7.8462E-01	8.4866E-01
-33.32	9.0132E-01	8.9980E-01	9.3584E-01
-28.20	9.9134E-01	9.9481E-01	9.7359E-01
-23.07	1.0678E+00	1.0737E+00	1.0455E+00
-17.94	1.1290E+00	1.1357E+00	1.1041E+00
-12.82	1.1742E+00	1.1803E+00	1.1168E+00
-7.69	1.2037E+00	1.2096E+00	1.1446E+00
-2.56	1.2171E+00	1.2233E+00	1.1571E+00
2.56	1.2142E+00	1.2211E+00	1.1625E+00
7.69	1.1945E+00	1.2023E+00	1.1434E+00
12.82	1.1581E+00	1.1670E+00	1.1083E+00
17.94	1.1049E+00	1.1158E+00	1.1010E+00
23.07	1.0343E+00	1.0451E+00	1.0311E+00
28.20	9.4693E-01	9.5597E-01	9.4579E-01
33.32	8.4454E-01	8.4977E-01	9.0232E-01
38.45	7.2793E-01	7.2200E-01	7.9159E-01
43.58	6.0103E-01	5.7125E-01	6.9668E-01
47.17	5.1859E-01	4.5306E-01	0.0000E+00
50.62	4.5641E-01	3.7211E-01	0.0000E+00
55.49	3.6868E-01	2.7726E-01	0.0000E+00
60.35	2.8748E-01	2.0070E-01	0.0000E+00
64.98	2.2834E-01	1.5038E-01	0.0000E+00
69.39	1.9069E-01	1.2035E-01	0.0000E+00
76.46	1.4101E-01	8.3025E-02	0.0000E+00
86.80	9.0115E-02	4.9054E-02	0.0000E+00
98.14	5.1370E-02	2.6442E-02	0.0000E+00
110.00	2.2020E-02	1.1779E-02	0.0000E+00

Note: Each axial distribution is normalized to an average of 1.0 over the fuel region (-46.14 cm to 46.14 cm)

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Table E12B-2.5. Fission Power Distribution by Pin in MFF-3 at EOC 12B-2

CORE POSITION 2404

1.066 1.051 1.038 1.025 1.014 1.004 0.995 0.986

1.066 1.051 1.037 1.025 1.013 1.002 0.993 0.985 0.978

1.067 1.051 1.037 1.024 1.012 1.001 0.992 0.984 0.976 0.970

1.068 1.053 1.038 1.024 1.012 1.001 0.991 0.983 0.975 0.969 0.963

1.071 1.055 1.040 1.026 1.013 1.001 0.991 0.982 0.975 0.968 0.962 0.958

1.075 1.058 1.043 1.028 1.015 1.003 0.992 0.983 0.975 0.968 0.962 0.957 0.953

1.079 1.063 1.047 1.032 1.018 1.005 0.994 0.984 0.975 0.968 0.962 0.957 0.952 0.948

1.085 1.068 1.052 1.036 1.022 1.009 0.997 0.986 0.977 0.969 0.963 0.957 0.953 0.949 0.945

1.075 1.058 1.042 1.027 1.013 1.001 0.990 0.980 0.972 0.965 0.959 0.954 0.949 0.945

1.066 1.049 1.034 1.020 1.007 0.995 0.984 0.975 0.967 0.961 0.955 0.950 0.946

1.058 1.042 1.027 1.013 1.001 0.990 0.980 0.971 0.964 0.958 0.952 0.948

1.051 1.036 1.021 1.008 0.996 0.986 0.976 0.968 0.961 0.955 0.950

1.045 1.030 1.017 1.004 0.993 0.982 0.974 0.966 0.959 0.953

1.040 1.026 1.013 1.001 0.990 0.980 0.971 0.964 0.957

1.036 1.022 1.009 0.998 0.987 0.978 0.969 0.962

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Table E12B-2.6. Fission Power Distribution by Pin in MFF-5 at EOC 12B-2

CORE POSITION 1304

0.955 0.959 0.964 0.969 0.973 0.978 0.983 0.988

0.955 0.959 0.963 0.968 0.972 0.977 0.982 0.986 0.991

0.957 0.961 0.964 0.968 0.972 0.976 0.980 0.985 0.990 0.995

0.961 0.963 0.966 0.969 0.972 0.976 0.980 0.984 0.989 0.994 0.999

0.965 0.967 0.969 0.971 0.974 0.977 0.980 0.984 0.988 0.993 0.998 1.004

0.972 0.972 0.973 0.975 0.977 0.979 0.982 0.985 0.989 0.993 0.998 1.004 1.009

0.979 0.979 0.979 0.980 0.981 0.982 0.984 0.987 0.991 0.995 0.999 1.004 1.010 1.015

0.987 0.987 0.986 0.986 0.986 0.987 0.989 0.991 0.994 0.997 1.001 1.006 1.011 1.017 1.023

0.996 0.994 0.994 0.993 0.993 0.994 0.995 0.998 1.001 1.004 1.009 1.014 1.019 1.025

1.004 1.002 1.001 1.000 1.001 1.001 1.003 1.005 1.009 1.012 1.017 1.022 1.028

1.011 1.010 1.009 1.008 1.008 1.009 1.011 1.014 1.017 1.022 1.026 1.032

1.019 1.018 1.017 1.016 1.017 1.018 1.020 1.023 1.027 1.032 1.037

1.028 1.026 1.025 1.025 1.026 1.028 1.030 1.034 1.038 1.042

1.036 1.035 1.034 1.035 1.036 1.038 1.041 1.045 1.049

1.045 1.044 1.044 1.045 1.046 1.049 1.052 1.056

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Table E12B-2.7. Fast Flux Distribution by Pin in MFF-3 at EOC 12B-2

CORE POSITION 2404

1.021 1.015 1.008 1.000 0.992 0.983 0.974 0.963

1.028 1.022 1.016 1.009 1.001 0.993 0.983 0.973 0.962

1.034 1.029 1.023 1.016 1.009 1.001 0.992 0.982 0.972 0.961

1.039 1.035 1.029 1.023 1.016 1.008 1.000 0.990 0.980 0.969 0.958

1.044 1.039 1.034 1.028 1.022 1.014 1.006 0.997 0.988 0.977 0.966 0.954

1.047 1.043 1.038 1.033 1.026 1.019 1.012 1.003 0.994 0.984 0.973 0.961 0.949

1.049 1.045 1.041 1.036 1.030 1.023 1.016 1.008 0.999 0.989 0.979 0.968 0.955 0.943

1.051 1.047 1.043 1.038 1.032 1.026 1.019 1.012 1.003 0.994 0.984 0.973 0.961 0.949 0.936

1.047 1.043 1.039 1.033 1.028 1.021 1.014 1.006 0.997 0.988 0.977 0.966 0.954 0.941

1.043 1.038 1.034 1.028 1.022 1.015 1.008 0.999 0.990 0.980 0.970 0.958 0.946

1.037 1.032 1.027 1.022 1.015 1.008 1.000 0.992 0.982 0.972 0.961 0.949

1.030 1.025 1.020 1.014 1.007 1.000 0.992 0.983 0.973 0.963 0.952

1.022 1.017 1.012 1.006 0.999 0.991 0.983 0.974 0.964 0.953

1.014 1.009 1.003 0.996 0.989 0.981 0.973 0.963 0.953

1.004 0.999 0.993 0.986 0.979 0.971 0.962 0.952

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Table E12B-2.8. Fast Flux Distribution by Pin in MFF-5 at EOC 12B-2

CORE POSITION 1304

0.975 0.977 0.978 0.978 0.978 0.977 0.975 0.973

0.980 0.982 0.984 0.985 0.985 0.985 0.983 0.981 0.978

0.984 0.987 0.989 0.991 0.991 0.991 0.990 0.989 0.986 0.983

0.986 0.990 0.993 0.995 0.996 0.997 0.997 0.995 0.993 0.990 0.987

0.987 0.992 0.996 0.998 1.000 1.002 1.002 1.001 0.999 0.997 0.994 0.989

0.988 0.993 0.997 1.001 1.003 1.005 1.006 1.006 1.004 1.002 0.999 0.996 0.991

0.987 0.992 0.998 1.002 1.005 1.007 1.009 1.009 1.009 1.007 1.004 1.001 0.997 0.992

0.985 0.991 0.997 1.002 1.006 1.009 1.010 1.011 1.011 1.010 1.008 1.005 1.001 0.997 0.991

0.989 0.995 1.000 1.005 1.009 1.011 1.013 1.013 1.013 1.011 1.009 1.005 1.001 0.996

0.992 0.998 1.003 1.008 1.011 1.013 1.014 1.014 1.013 1.011 1.008 1.004 0.999

0.995 1.001 1.006 1.009 1.012 1.014 1.014 1.014 1.012 1.010 1.006 1.002

0.998 1.003 1.007 1.010 1.013 1.014 1.014 1.013 1.011 1.008 1.004

0.999 1.004 1.008 1.010 1.012 1.013 1.012 1.011 1.008 1.005

1.000 1.004 1.008 1.010 1.011 1.011 1.010 1.008 1.005

1.001 1.004 1.007 1.008 1.009 1.008 1.007 1.004

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Table E12B-2.9. MFF-3 and MFF-5 Duct Wall Fast Flux Data at EOC 12B-2

	Flux > 0.1 MeV (n/cm^2-sec)	
Side	MFF-3	MFF-5
E	2.4719E+15	2.7313E+15
SE	2.4977E+15	2.7008E+15
SW	2.3609E+15	2.6691E+15
W	2.2436E+15	2.7053E+15
NW	2.2302E+15	2.7546E+15
NE	2.3197E+15	2.7813E+15

Table E12B-2.10. Relative Fission Rates in MFF-3 and MFF-5 at EOC 12B-2

	Fission Rate*	
Isotope	MFF-3	MFF-5
U-235	8.103E-01	8.327E-01
U-238	8.350E-02	8.482E-02
Pu-239	1.049E-01	8.178E-02
Pu-240	1.152E-03	6.584E-04
Pu-241	1.472E-04	6.200E-05
Pu-240	5.347E-07	1.697E-07
Am-241	8.853E-07	2.506E-07
Total	1.654E+17	1.921E+17

* The fission rates for the seven isotopes are relative values that sum to 1.0. The total given at the bottom of the table is the total fission rate (fissions/sec) in the assembly.

Table E12B-2.11. Composition of MFF-3 at EOC 12B-2

Axial	Axial Range (cm)			Atom Density (a/b-cm)	
Level*	Lower	Upper	Constituent	Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	3.0870E-03	2.0355E-03
			U-238	6.3240E-03	5.9909E-03
			Pu-239	0.0000E+00	2.1774E-04
			Pu-240	0.0000E+00	8.4961E-06
			Pu-241	0.0000E+00	1.9474E-07
			Pu-242	0.0000E+00	3.0681E-09
			Am-241	0.0000E+00	7.1636E-09
			FP	0.0000E+00	9.3806E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
5	-30.76	-15.38			
			U-235	3.0870E-03	1.8440E-03
			U-238	6.3240E-03	5.9070E-03
			Pu-239	0.0000E+00	2.5318E-04
			Pu-240	0.0000E+00	1.0865E-05
			Pu-241	0.0000E+00	2.8370E-07
			Pu-242	0.0000E+00	5.2316E-09
			Am-241	0.0000E+00	1.0473E-08
			FP	0.0000E+00	1.1467E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03

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			HT-9	2.2539E-02	2.2539E-02
6	-15.38	0.00			
			U-235	3.0870E-03	1.7412E-03
			U-238	6.3240E-03	5.8626E-03
			Pu-239	0.0000E+00	2.7276E-04
			Pu-240	0.0000E+00	1.2974E-05
			Pu-241	0.0000E+00	3.7170E-07
			Pu-242	0.0000E+00	7.6203E-09
			Am-241	0.0000E+00	1.3669E-08
			FP	0.0000E+00	1.2519E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
7	0.00	15.38			
			U-235	3.0870E-03	1.7729E-03
			U-238	6.3240E-03	5.8764E-03
			Pu-239	0.0000E+00	2.6653E-04
			Pu-240	0.0000E+00	1.2241E-05
			Pu-241	0.0000E+00	3.4026E-07
			Pu-242	0.0000E+00	6.7403E-09
			Am-241	0.0000E+00	1.2483E-08
			FP	0.0000E+00	1.2200E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
8	15.38	30.76			
			U-235	3.0870E-03	1.9394E-03
			U-238	6.3240E-03	5.9461E-03
			Pu-239	0.0000E+00	2.3414E-04
			Pu-240	0.0000E+00	8.9581E-06
			Pu-241	0.0000E+00	2.1173E-07
			Pu-242	0.0000E+00	3.4947E-09
			Am-241	0.0000E+00	7.7742E-09
			FP	0.0000E+00	1.0534E-03
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02
9	30.76	46.14			
			U-235	3.0870E-03	2.2028E-03
			U-238	6.3240E-03	6.0511E-03
			Pu-239	0.0000E+00	1.8385E-04
			Pu-240	0.0000E+00	5.5699E-06
			Pu-241	0.0000E+00	1.0279E-07
			Pu-242	0.0000E+00	1.2816E-09
			Am-241	0.0000E+00	3.7655E-09
			FP	0.0000E+00	7.8518E-04
			Zr	2.7290E-03	2.7290E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E-02	2.2539E-02

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E10C-1.11. Therefore, the compositions in these five axial levels are not repeated in this table.

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Table E12B-2.12. Composition of MFF-5 at EOC 12B-2

Axial Level*	Axial Range (cm) Lower	Upper	Constituent	Atom Density (a/b-cm) Fresh	End of Cycle
4	-46.14	-30.76			
			U-235	2.9371E-03	2.1614E-03
			U-238	6.4484E-03	6.1976E-03
			Pu-239	0.0000E+00	1.7298E-04
			Pu-240	0.0000E+00	4.8095E-06
			Pu-241	0.0000E+00	8.3280E-08
			Pu-242	0.0000E+00	9.5536E-10
			Am-241	0.0000E+00	2.0173E-09
			FP	0.0000E+00	6.8706E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
5	-30.76	-15.38			
			U-235	2.9371E-03	2.0106E-03
			U-238	6.4484E-03	6.1345E-03
			Pu-239	0.0000E+00	2.0337E-04
			Pu-240	0.0000E+00	6.2206E-06
			Pu-241	0.0000E+00	1.2308E-07
			Pu-242	0.0000E+00	1.6476E-09
			Am-241	0.0000E+00	2.9602E-09
			FP	0.0000E+00	8.4581E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
6	-15.38	0.00			
			U-235	2.9371E-03	1.9268E-03
			U-238	6.4484E-03	6.1005E-03
			Pu-239	0.0000E+00	2.2087E-04
			Pu-240	0.0000E+00	7.4912E-06
			Pu-241	0.0000E+00	1.6310E-07
			Pu-242	0.0000E+00	2.4269E-09
			Am-241	0.0000E+00	3.9038E-09
			FP	0.0000E+00	9.2832E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
7	0.00	15.38			
			U-235	2.9371E-03	1.9489E-03
			U-238	6.4484E-03	6.1096E-03
			Pu-239	0.0000E+00	2.1613E-04
			Pu-240	0.0000E+00	7.1162E-06
			Pu-241	0.0000E+00	1.5092E-07
			Pu-242	0.0000E+00	2.1816E-09
			Am-241	0.0000E+00	3.6051E-09
			FP	0.0000E+00	9.0711E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
8	15.38	30.76			
			U-235	2.9371E-03	2.0757E-03

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			U-238	6.4484E-03	6.1601E-03
			Pu-239	0.0000E+00	1.8914E-04
			Pu-240	0.0000E+00	5.2528E-06
			Pu-241	0.0000E+00	9.5354E-08
			Pu-242	0.0000E+00	1.1624E-09
			Am-241	0.0000E+00	2.2789E-09
			FP	0.0000E+00	7.8400E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01
9	30.76	46.14			
			U-235	2.9371E-03	2.2784E-03
			U-238	6.4484E-03	6.2387E-03
			Pu-239	0.0000E+00	1.4721E-04
			Pu-240	0.0000E+00	3.2628E-06
			Pu-241	0.0000E+00	4.6353E-08
			Pu-242	0.0000E+00	4.3117E-10
			Am-241	0.0000E+00	1.1113E-09
			FP	0.0000E+00	5.8230E-04
			Zr	2.7574E-03	2.7574E-03
			Na-23	8.2880E-03	8.2880E-03
			HT-9	2.2539E+00	2.2254E-01

* Compositions of materials in axial levels 1, 2, 3, 10 and 11 are assumed not to change with exposure, and thus remain the same as listed in Table E11B-1.12. Therefore, the compositions in these five axial levels are not repeated in this table.

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6.0 Sodium Temperatures

6.1 Methods

Details of the sodium temperature calculation methods can be found in Appendix B. The calculation of sodium temperatures with the SUPERENERGY code based on two dimensional diffusion theory methods (Bennett 1994) with generic axial flux and power profiles from 3-D calculations was a normal part of the core reload design process. The results of these calculations were reported in core reload design and operating reports for cycles 10C through 12B.

There were two sources of sodium temperature analyses for MFF3 and MFF-5. The output files of SUPERENERGY temperature calculations that were previously part of the core reload design process for Cycles 11A through 12B were located, and the outlet temperatures and subchannel temperatures for MFF-3 and MFF-5 for these cycles were obtained from these files. No SUPERENERGY output files were available for Cycle 10C. Therefore, the full calculational sequence was performed to generate the temperature distributions for BOC 10C-1 and EOC 10C-3 for MFF-3 and MFF-5.

Data provided for MFF-3 and MFF-5 for each BOC and EOC include:

- assembly outlet temperatures,
- sodium subchannel temperatures at three axial elevations corresponding to the top of the fuel column, the top of the upper axial reflector in driver fuel pins, and the top of the fuel pin bundle.

Fuel pin cladding temperatures are not available, but can be computed from the data provided

The SUPERENERGY code is a subchannel code that was designed specifically for hexagon shaped, wire wrapped pin bundles and is used to calculate the FFTF core assembly mixed-mean outlet temperatures, the assembly subchannel temperatures of all core assemblies, the core assembly duct wall temperatures, and the temperature of the reflector assembly coolant channels. The assembly mixed mean outlet temperatures are used as a basis for comparison to the FFTF above-core instrumentation data and to show that the core loading plans are in compliance with FFTF technical specifications prior to reactor operation. The subchannel temperatures are used in design analyses of test pins, post irradiation data correlation of test pins, and for lifetime analyses of driver fuel pins. The duct wall temperatures are used in the structural analyses of the individual assemblies and of the core restraint system. The flow field is described in terms of two correlated parameters, a subchannel mixing parameter and a swirl flow parameter. These two parameters, along with the energy equation and a subchannel flow split model, can completely describe the temperature field in a pin bundle without the use of momentum and continuity. The mixing parameters and flow split correlations are based on extensive experimental test data.

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6.2 Assembly Outlet Temperatures

Tables 11 and 12 list the calculated fission power and assembly outlet temperature for MFF-3 and MFF-5 for the beginning and end of each operating cyle. The measured outlet temperatures were obtained from the cycle operating reports. The corresponding assembly flow rates are also shown. The assembly flow rates varied slightly from cycle to cycle as the core loadings changed. The assembly flows are based on a calculated core pressure drop at the total reactor flow rate of 16.74×10^6 lb/hr.

Table 11. Summary of Irradiation History and Data for MFF-3

Assembly	Reactor Cycle[a]	Power[e] (MW)	Outlet Temp. (Deg.F)		Flow Rate[d] (lb/hr)
			Calculated[b]	Measured[c]	
MFF-3 in core location 2404	B10C-1	7.939	1070	1076	203000
	E10C-1	7.721	(g)	(h)	(g)
	B/E10C-2[f]	7.728	(g)	(h)	(g)
	B10C-3	7.696	(g)	(h)	(g)
	E10C-3	7.525	1051	1055	203000
	B11A-1[i]	7.389	1055	1057	202240
	B11A-2[i]	7.405	(i)	1063	(i)
	B11A-3	7.267	(i)	(i)	(i)
	E11A-3	7.004	1037	1042	202240
	B11B-1	7.014	1037	1025	204240
	E11B-1	6.770	1025	1031	204240
	B11B-2	6.644	1029	1037	197960
	E11B-2	6.310	1011	1018	197960
	B11C	6.274	1011	1023	197790
	E11C	6.133	1001	1014	197790
	B12A-1	5.889	995	1009	193950
	E12A-1	5.802	990	999	193950
	B12A-2	5.759	989	997	193800
	E12A-2	5.679	983	997	193800
	B12B-1	5.914	995	1007	195840
	E12B-1	5.811	989	1000	195840
	B12B-2	5.714	985	993	195840
	E12B-2	5.618	980	992	195840

[a] The letter „B“ preceding the cycle number indicates the data in the row are for beginning-of-cycle conditions. The letter „E“ preceding the cycle number indicates the data in the row are for end-of-cycle conditions.

[b] Calculated beginning of Cycle 10C-1 and end of Cycle 10C-3 temperatures were based on two-dimensional analysis using the three-dimensional database and the methods described in Appendix B, while temperatures for the other cycles were based on previous Core Reload Design Reports (RDR) analyses using the same methods.

[c] Measured assembly outlet temperatures were obtained from Outage and Operating Reports

[d] Flow rates are based on a calculated core pressure drop at a total reactor flow rate of 16.74E+06 lb/hr.

[e] Assembly power data in this table were obtained from three-dimensional (3DBF [Nelson 1990]) calculations .

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[f] Because of the short length of cycle 10C-2, assembly power, outlet temperature and flow rates are essentially the same during the cycle.
[g] No Data were reported in the cycle 10C RDR.
[h] No Data were reported in the cycle 10C Outage and operating Report.
[i] Because of the short length of cycles 11A-1 and 11A-2, no data are given in this report for E11A-1 and E11A-2. End-of-cycle data are essentially the same as beginning of cycle data. Also, outlet temperature and assembly flow rates for cycle B11A-2 and B11A-3 are essentially the same as tabulated for B11A-1.

Table 12. Summary of Irradiation History and Data for MFF-5

Assembly	Reactor Cycle[a]	Power[e] (MW)	Outlet Temp. (Deg.F)		Flow Rate[d] (lb/hr)
			Calculated[b]	Measured[c]	
MFF-5 in core location 1304	B11B-1	7.553	1059	1047	200400
	E11B-1	7.286	1049	1046	200400
	B11B-2	7.466	1078	1078	194240
	E11B-2	7.017	1052	1055	194240
	B11C	6.978	1056	1058	194070
	E11C	6.791	1040	1048	194070
	B12A-1	7.128	1071	1080	190310
	E12A-1	6.933	1058	1053	190310
	B12A-2	6.978	1065	1064	190160
	E12A-2	6.793	1051	1050	190160
	B12B-1	6.867	1052	1056	192170
	E12B-1	6.684	1040	1044	192170
	B12B-2	6.697	1043	1044	192170
	E12B-2	6.524	1032	1035	192170

6.3Sodium Subchannel Temperatures

Sodium subchannel temperatures for MFF-3 and MFF-5 are provided to provide information to guide post irradiation examinations of pins from these assemblies. All temperatures are in degrees Fahrenheit. The assembly mixed mean outlet temperatures are used as a basis for comparison to the FFTF above-core instrumentation data and to show that the core loading plans are in compliance with FFTF technical specifications prior to reactor operation. The subchannel temperatures are used in design analyses of test pins, post irradiation data correlation of test pins, and for lifetime analyses of driver fuel pins. The duct wall temperatures are used in the structural analyses of the individual assemblies and of the core restraint system. The following table shows the table numbering scheme for the subchannel temperatures, which follows the same naming convention described in Section 5.2.

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Table 13. Summary of Temperature Data Included for each Cycle

Table No.	Description	Created for BOC or EOC?
13	Subchannel temperatures at top of fuel for MFF-3	BOC & EOC
14	Subchannel temperatures at top of driver fuel axial reflector for MFF-3	BOC & EOC
15	Subchannel temperatures at top of fuel bundle for MFF-3	BOC & EOC
16	Subchannel temperatures at top of fuel for MFF-5	BOC & EOC
17	Subchannel temperatures at top of driver fuel axial reflector for MFF-5	BOC & EOC
18	Subchannel temperatures at top of fuel bundle for MFF-5	BOC & EOC

A map relating the subchannel temperatures to the fuel pins and duct can be found in Appendix B. The row of numbers just outside the asterisks on each map are calculated duct wall temperatures, and the outside row of temperatures on each map are the temperatures of the sodium between assemblies. The direction north is the same as the HEDPIN pin distributions. As with the assembly outlet temperatures, subchannel temperatures were not computed when short cycles and minor 1oading changes resulted in no significant temperature changes. Subchannel temperatures at the 44.0 inch elevation correspond to the top of the fuel column. Subchannel temperatures at the 50.5 inch elevation correspond to the top of the upper axial reflector in fuel assemblies. Subchannel temperatures at the 92.0 inch elevation correspond to the top of the fuel pin bundle.

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Table B10C-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 10C-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          902            923   925   925   924   922   921   919           888

                              947        960   961   960   958   956   954   951       937
                                    *   *   *   *   *   *   *   *   *   *   *   *
                                 *  991   995   996   994   991   988   985   983  983  *

                                *       1032  1043  1043  1041  1038  1032  1020       *
                           936  965  *  993  1032  1057  1063  1062  1059  1055  1045  1021  987  *  956  923

                                   *       1059  1085  1092  1092  1088  1083  1072  1045       *
                              938  968  *  996  1045  1086  1101  1103  1101  1097  1089  1071  1032  990  *  959  927

                                   *       1069  1104  1116  1117  1114  1110  1103  1087  1052       *
                         941  971  * 1000  1051  1098  1117  1122  1120  1117  1112  1102  1079  1034  990  *  960  928

                              *       1074  1111  1125  1128  1126  1122  1118  1109  1091  1052       *
                     943  974  * 1004  1055  1103  1124  1130  1129  1126  1122  1116  1105  1080  1034  989  *  959  929

                           *       1077  1115  1130  1133  1131  1128  1124  1119  1110  1090  1051       *
                   944  976  * 1007  1058  1107  1128  1134  1133  1130  1126  1122  1116  1105  1079  1032  988  *  959  929

                        *       1079  1118  1133  1136  1134  1131  1127  1124  1118  1109  1089  1049       *
              944  977  * 1010  1058  1108  1131  1137  1136  1133  1130  1126  1122  1116  1103  1077  1029  987  *  958  929

                     *       1073  1116  1135  1139  1138  1134  1130  1127  1123  1117  1107  1084  1042       *
           943  977  * 1009  1047  1101  1130  1139  1139  1136  1133  1129  1125  1121  1114  1099  1069  1020  987  *  958  928
           923  965  * 1005                                                 *                                 989  *  946  902
           949  978  * 1007  1047  1102  1130  1140  1140  1137  1134  1130  1126  1122  1115  1100  1070  1023  994  *  965  935
                     *       1074  1118  1137  1141  1139  1136  1132  1128  1124  1119  1109  1086  1046       *

              951  981  * 1010  1060  1111  1135  1141  1140  1137  1133  1129  1125  1119  1107  1081  1036  998  *  969  939
                        *       1082  1123  1138  1141  1139  1135  1132  1128  1123  1113  1094  1056       *

                 953  984  * 1013  1064  1114  1135  1140  1139  1136  1132  1128  1122  1111  1086  1041 1000  *  972  942
                        *       1085  1123  1138  1140  1138  1134  1131  1126  1117  1098  1060       *

                    953  985  * 1016  1066  1113  1134  1139  1137  1134  1130  1124  1113  1089  1044 1001  *  973  945
                              *       1086  1122  1135  1137  1135  1131  1127  1118  1100  1062       *

                       953  986  * 1018  1066  1111  1129  1133  1131  1128  1123  1113  1090  1045 1001  *  974  946
                                 *       1084  1117  1127  1128  1126  1122  1115  1099  1063       *

                          953  986  * 1018  1063  1101  1114  1116  1114  1110  1103  1085  1044 1001  *  975  947
                                    *       1076  1100  1106  1105  1103  1098  1087  1058       *

                             950  984  * 1016  1050  1072  1078  1078  1076  1072  1062  1036 1001  *  974  947
                                       *       1048  1058  1059  1059  1057  1052  1038       *

                                         * 1011  1010  1011  1012  1013  1012  1011  1007 1002  *
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                      964         975   976   976   976   975   973   970       956

                                   915            938   939   939   938   937   935   931           907
```


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Table B10C-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 10C-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                             916             934   936   936   935   934   933   931            900

                                 961         971   973   972   970   968   966   965        950
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    * 1005  1007  1008  1007  1004  1001   999   997  998  *

                                  *        1027  1037  1038  1036  1033  1027  1016        *
                          951  979  * 1005  1027  1047  1054  1054  1051  1046  1036  1018 1001  *  969  935

                                   *        1048  1073  1082  1082  1079  1073  1061  1036        *
                         954  982  * 1008  1039  1074  1090  1094  1092  1088  1079  1061  1028 1004  *  972  938

                                   *        1059  1093  1107  1110  1108  1104  1095  1077  1044        *
                        956  985  * 1012  1046  1087  1109  1115  1115  1112  1106  1094  1070  1031 1004  *  973  940

                                  *        1064  1101  1119  1124  1123  1119  1114  1103  1082  1046        *
                       958  987  * 1016  1050  1093  1117  1126  1126  1124  1119  1112  1099  1072  1031 1004  *  973  941

                                 *        1068  1106  1125  1130  1129  1127  1123  1116  1105  1083  1045        *
                      959  990  * 1019  1052  1096  1121  1131  1132  1129  1126  1121  1114  1099  1071  1030 1003  *  973  942

                                *        1068  1108  1128  1134  1134  1131  1127  1123  1116  1104  1081  1042        *
                   959  991  * 1022  1051  1096  1123  1134  1135  1133  1129  1126  1121  1113  1097  1068  1026 1003  *  973  942

                              *        1062  1104  1128  1136  1137  1134  1130  1127  1122  1115  1101  1075  1035        *
                958  990  * 1021  1042  1088  1121  1135  1138  1136  1133  1129  1125  1120  1110  1092  1059  1019 1003  *  973  942
                938  979  * 1019                                                                                1006  *  961  915
                962  991  * 1019  1041  1089  1121  1136  1139  1137  1134  1130  1126  1120  1111  1093  1061  1022 1010  *  980  948
                              *        1063  1106  1130  1138  1139  1136  1132  1128  1124  1117  1103  1078  1039        *

                   964  994  * 1022  1053  1100  1127  1138  1139  1136  1133  1129  1124  1116  1101  1073  1034 1014  *  984  952
                              *        1072  1113  1133  1139  1138  1135  1131  1127  1121  1109  1086  1049        *

                      966  996  * 1026  1058  1103  1128  1137  1138  1135  1132  1127  1119  1105  1078  1039 1016  *  986  955
                                 *        1076  1114  1132  1137  1136  1133  1129  1123  1112  1090  1054        *

                         967  998  * 1029  1061  1103  1127  1134  1135  1132  1128  1121  1107  1081  1042 1016  *  988  958
                                    *        1076  1112  1129  1133  1132  1128  1123  1113  1092  1056        *

                            967 1000  * 1031  1061  1100  1120  1126  1126  1123  1117  1105  1081  1042 1016  *  988  959
                                       *        1074  1106  1119  1122  1120  1115  1107  1089  1055        *

                               966  999  * 1032  1058  1089  1103  1107  1105  1101  1093  1074  1040 1016  *  989  960
                                          *        1066  1088  1095  1096  1094  1088  1076  1050        *

                                  964  997  * 1030  1046  1063  1069  1070  1068  1064  1054  1033 1016  *  989  961
                                             *        1044  1053  1055  1055  1053  1048  1036        *

                                               * 1026  1025  1026  1027  1027  1027  1026  1022 1019  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                             978         989   989   990   990   989   987   984        970

                                          929            951   951   951   951   949   947   944            920
```


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Table B10C-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 10C-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                              939             955   957   959   960   960   960   961            924

                                  982         991   993   994   994   994   994   994        977
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1025  1026  1027  1027  1027  1026  1026  1026 1027  *

                                   *        1033  1038  1040  1039  1038  1035  1032        *
                              975 1000  * 1025  1033  1041  1046  1047  1045  1042  1038  1033 1029  *  993  956

                                        *        1042  1053  1059  1061  1059  1054  1048  1039        *
                                 975 1002  * 1027  1039  1053  1063  1067  1067  1064  1057  1048  1038 1031  *  996  960

                                      *        1048  1064  1075  1080  1080  1076  1068  1057  1044        *
                            976 1003  * 1029  1043  1062  1076  1084  1087  1085  1078  1068  1055  1041 1033  *  999  963

                                    *        1053  1073  1087  1095  1098  1095  1088  1077  1063  1047        *
                          977 1004  * 1031  1047  1068  1086  1097  1102  1102  1097  1088  1074  1058  1042 1033  * 1000  966

                                 *        1055  1077  1094  1105  1110  1110  1105  1095  1082  1065  1048        *
                       977 1006  * 1033  1048  1071  1090  1104  1112  1114  1111  1104  1092  1077  1059  1042 1034  * 1002  968

                              *        1055  1078  1097  1110  1117  1119  1116  1109  1097  1082  1064  1046        *
                    976 1006  * 1035  1047  1069  1091  1107  1117  1121  1120  1115  1106  1092  1075  1057  1041 1034  * 1003  970

                           *        1052  1074  1095  1111  1120  1124  1123  1118  1109  1095  1078  1060  1044        *
                 975 1006  * 1035  1043  1064  1086  1105  1117  1124  1125  1121  1115  1103  1088  1070  1052  1040 1035  * 1004  971
                 959  997  * 1034                                                                                  1037  *  990  942
                 983 1009  * 1035  1044  1064  1087  1106  1118  1125  1126  1122  1115  1104  1089  1071  1054  1041 1039  * 1007  974
                           *        1053  1075  1097  1113  1122  1126  1124  1119  1110  1097  1080  1062  1047        *

                    983 1011  * 1037  1050  1073  1094  1111  1121  1124  1123  1118  1109  1096  1079  1061  1046 1041  * 1010  978
                              *        1059  1082  1102  1115  1122  1123  1120  1113  1102  1087  1069  1052        *

                       984 1012  * 1039  1054  1077  1097  1111  1118  1120  1117  1110  1099  1083  1066  1050 1042  * 1012  980
                                 *        1063  1085  1102  1113  1117  1117  1112  1103  1089  1072  1056        *

                          985 1014  * 1042  1057  1078  1095  1106  1111  1111  1106  1097  1084  1068  1052 1043  * 1013  983
                                    *        1065  1084  1098  1106  1108  1105  1098  1087  1073  1057        *

                             985 1015  * 1044  1057  1076  1089  1097  1099  1097  1090  1080  1066  1052 1043  * 1014  985
                                       *        1063  1079  1089  1093  1093  1089  1081  1070  1056        *

                                984 1015  * 1045  1056  1069  1078  1082  1082  1079  1072  1062  1051 1042  * 1015  986
                                          *        1059  1069  1075  1077  1075  1071  1063  1054        *

                                   983 1015  * 1044  1052  1059  1063  1064  1064  1061  1056  1048 1042  * 1015  987
                                             *        1051  1055  1057  1058  1057  1054  1049        *

                                               * 1043  1043  1044  1045  1046  1046  1046  1045 1043  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               999        1009  1010  1010  1010  1010  1009  1007        996

                                            952             974   974   974   973   972   971   969            946
```


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Table E10C-3.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 10C-3

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                              899             915   916   916   915   914   912   910            883

                                  940         949   951   950   948   946   943   941        927
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  979   982   983   982   979   976   973   971  970  *

                                   *        1017  1028  1029  1027  1023  1018  1006        *
                           934  957  *  980  1017  1042  1047  1047  1044  1040  1030  1007  974  *  945  915

                                    *        1042  1068  1075  1074  1072  1067  1056  1030        *
                           936  960  *  983  1029  1069  1082  1085  1083  1079  1072  1056  1017  976  *  948  918

                                    *        1052  1085  1096  1098  1096  1092  1085  1070  1036        *
                           938  963  *  987  1035  1079  1097  1102  1101  1098  1093  1084  1063  1019  976  *  948  919

                                   *        1056  1091  1105  1107  1106  1103  1098  1091  1073  1036        *
                        940  966  *  990  1038  1083  1103  1109  1108  1106  1102  1097  1086  1063  1018  975  *  947  919

                                *        1059  1095  1109  1112  1110  1107  1104  1099  1091  1072  1035        *
                     941  968  *  993  1041  1086  1106  1112  1112  1109  1106  1102  1097  1086  1062  1016  973  *  947  919

                             *        1059  1096  1111  1114  1113  1110  1106  1103  1098  1089  1070  1032        *
                  941  968  *  995  1040  1087  1108  1115  1114  1111  1108  1105  1101  1095  1084  1059  1013  972  *  946  918

                          *        1054  1094  1112  1116  1115  1112  1108  1105  1102  1097  1087  1065  1025        *
               939  967  *  994  1030  1080  1107  1116  1116  1114  1110  1107  1104  1100  1093  1079  1050  1004  972  *  945  917
               917  955  *  991                                                                                  973  *  934  892
               936  964  *  992  1029  1080  1108  1117  1117  1114  1111  1107  1104  1100  1094  1080  1051  1006  978  *  951  923
                          *        1054  1095  1113  1118  1116  1113  1109  1106  1102  1097  1088  1067  1028        *

                  938  967  *  994  1041  1089  1111  1117  1116  1113  1110  1106  1103  1097  1086  1061  1018  982  *  955  927
                             *        1062  1100  1114  1117  1115  1112  1108  1105  1100  1092  1073  1037        *

                     939  969  *  997  1045  1091  1111  1116  1115  1112  1109  1105  1100  1089  1066  1023  983  *  957  929
                             *        1064  1100  1114  1116  1114  1111  1107  1103  1094  1076  1040        *

                        940  970  *  999  1046  1091  1109  1114  1113  1110  1106  1101  1091  1068  1025  984  *  958  931
                                   *        1064  1099  1111  1113  1111  1107  1103  1095  1078  1042        *

                           940  971  * 1001  1046  1088  1105  1108  1107  1104  1099  1090  1068  1026  984  *  959  933
                                      *        1062  1093  1103  1104  1102  1098  1092  1076  1042        *

                              939  970  * 1001  1043  1078  1091  1092  1090  1087  1080  1063  1024  984  *  959  933
                                         *        1054  1077  1083  1082  1080  1075  1065  1038        *

                                 936  968  *  998  1030  1051  1056  1056  1054  1051  1042  1016  983  *  959  933
                                            *        1028  1037  1039  1038  1036  1031  1019        *

                                               *  994   993   994   994   995   994   993   989  985  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                           949         959   960   960   960   960   958   954        941

                                        903            925   925   925   925   923   921   918           895
```


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Table E10C-3.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 10C-3

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                            913             926   927   927   927   925   924   922            894

                                953         961   962   961   959   957   955   954        940
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  992   994   995   993   991   988   985   984  984  *

                                 *        1013  1022  1024  1022  1018  1013  1003        *
                           949  971  *  992  1012  1032  1038  1038  1035  1031  1021  1003  987  *  957  926

                                  *        1033  1056  1064  1065  1062  1057  1045  1022        *
                             951  974  *  995  1024  1057  1072  1076  1074  1070  1062  1045  1013  989  *  960  929

                                  *        1042  1074  1088  1091  1089  1086  1078  1061  1029        *
                        953  977  *  999  1030  1069  1089  1096  1096  1093  1088  1077  1054  1016  989  *  960  931

                                 *        1047  1082  1099  1103  1103  1100  1095  1085  1065  1029        *
                      955  979  * 1002  1033  1074  1097  1105  1106  1103  1100  1093  1080  1055  1015  988  *  960  931

                                *        1050  1086  1104  1109  1109  1106  1102  1097  1086  1065  1028        *
                   956  981  * 1005  1036  1076  1100  1109  1110  1108  1105  1101  1094  1080  1054  1013  987  *  960  931

                             *        1050  1087  1106  1112  1112  1109  1106  1102  1096  1085  1062  1025        *
                955  982  * 1007  1034  1076  1102  1112  1113  1111  1108  1104  1100  1093  1078  1050  1010  987  *  959  931

                          *        1044  1083  1106  1114  1114  1112  1108  1105  1101  1094  1081  1056  1018        *
          954  981  * 1006  1025  1068  1098  1112  1115  1113  1110  1107  1103  1098  1090  1072  1041  1002  987  *  959  931
          932  969  * 1004                                                                                  989  *  948  905
          949  977  * 1004  1024  1068  1099  1113  1116  1114  1111  1107  1104  1099  1090  1073  1042  1005  993  *  965  935
                          *        1044  1085  1107  1115  1115  1113  1109  1106  1102  1095  1083  1058  1022        *

             951  979  * 1006  1035  1078  1104  1114  1115  1113  1110  1106  1102  1094  1080  1053  1016  996  *  968  939
                          *        1052  1090  1109  1115  1114  1112  1108  1104  1098  1087  1066  1031        *

                952  981  * 1009  1039  1081  1105  1113  1114  1111  1108  1104  1097  1084  1058  1021  998  *  970  942
                          *        1055  1091  1108  1113  1112  1110  1106  1100  1090  1069  1034        *

                   953  983  * 1012  1041  1081  1103  1110  1111  1108  1104  1098  1085  1060  1023  998  *  972  944
                             *        1056  1089  1105  1109  1108  1105  1100  1090  1070  1036        *

                      952  984  * 1013  1041  1078  1097  1102  1102  1099  1094  1082  1060  1023  998  *  972  945
                                *        1054  1083  1095  1098  1096  1092  1084  1067  1035        *

                         952  983  * 1014  1038  1067  1081  1084  1082  1079  1071  1053  1021  998  *  973  946
                                   *        1045  1066  1073  1074  1071  1066  1055  1030        *

                            950  981  * 1012  1027  1042  1048  1049  1047  1043  1034  1014  998  *  973  946
                                      *        1025  1033  1035  1035  1033  1028  1017        *

                                        * 1008  1007  1007  1008  1009  1008  1007  1004 1000  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     963         973   973   973   973   973   971   968        955

                                   916             937   938   937   937   935   933   930            908
```


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Table E10C-3.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 10C-3

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                              935             946   948   949   950   950   950   950            918

                                  974         980   981   981   981   981   980   980        965
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1010  1011  1012  1012  1011  1010  1010  1010 1011  *

                                   *        1019  1023  1024  1024  1022  1019  1016        *
                           971  991  * 1011  1019  1026  1030  1031  1029  1026  1022  1017 1013  *  980  947

                                    *        1027  1037  1042  1044  1042  1038  1031  1023        *
                           972  992  * 1012  1024  1037  1046  1050  1050  1047  1040  1032  1021 1014  *  983  950

                                    *        1033  1048  1058  1062  1063  1059  1051  1040  1028        *
                           972  994  * 1015  1028  1046  1059  1066  1069  1067  1061  1051  1038  1024 1015  *  985  953

                                   *        1037  1055  1069  1077  1079  1077  1070  1059  1045  1030        *
                      973  995  * 1017  1031  1051  1067  1078  1083  1083  1078  1069  1057  1041  1025 1016  *  986  955

                                *        1039  1059  1075  1086  1090  1090  1085  1076  1063  1047  1030        *
                 973  996  * 1019  1033  1053  1071  1084  1092  1093  1091  1084  1073  1058  1041  1024 1016  *  987  957

                           *        1039  1059  1077  1090  1097  1098  1095  1089  1078  1063  1045  1028        *
              973  997  * 1020  1032  1052  1071  1087  1096  1100  1099  1094  1086  1073  1056  1038  1023 1016  *  988  958

                        *        1036  1056  1075  1090  1099  1102  1101  1097  1088  1075  1059  1041  1026        *
        971  997  * 1021  1028  1046  1067  1084  1096  1102  1103  1100  1094  1083  1068  1051  1034  1021 1017  *  989  959
        953  987  * 1019                                                                                 1018  *  976  931
        969  995  * 1020  1028  1047  1067  1085  1097  1102  1103  1100  1094  1084  1069  1052  1035  1023 1020  *  991  960
                        *        1036  1057  1076  1091  1100  1103  1102  1098  1089  1077  1060  1043  1028        *

           970  996  * 1022  1034  1054  1074  1089  1098  1102  1101  1096  1088  1075  1059  1042  1027 1022  *  993  963
                        *        1042  1063  1081  1093  1099  1101  1098  1091  1081  1066  1049  1033        *

                 970  998  * 1024  1037  1058  1076  1089  1096  1097  1095  1088  1077  1063  1046  1031 1023  *  995  966
                           *        1045  1065  1081  1091  1095  1094  1090  1081  1068  1052  1036        *

                    971  999  * 1026  1039  1059  1074  1084  1089  1088  1084  1075  1063  1047  1032 1024  *  996  968
                              *        1046  1064  1076  1083  1085  1083  1077  1066  1052  1037        *

                       971  999  * 1027  1040  1056  1068  1075  1077  1075  1069  1059  1046  1032 1024  *  997  970
                                 *        1045  1058  1067  1072  1072  1068  1060  1049  1036        *

                          970 1000  * 1028  1038  1050  1057  1061  1061  1058  1052  1042  1031 1024  *  998  971
                                    *        1041  1049  1054  1056  1055  1050  1043  1034        *

                             969  999  * 1028  1034  1040  1043  1044  1044  1041  1036  1029 1024  *  998  972
                                       *        1033  1036  1038  1039  1038  1035  1030        *

                                         * 1026  1026  1027  1027  1028  1028  1027  1026 1024  *
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                      984         994   994   994   994   994   992   991        980

                                   939             960   960   960   959   958   956   954            933
```


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Table B11A-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11A-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          893             920   921   921   920   918   916   914            889

                              937         952   953   952   950   948   946   944        932
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  980   983   984   982   980   977   974   972  973  *

                                    *       1019  1029  1030  1027  1024  1018  1007        *
                             926  954  *  981  1019  1043  1049  1048  1045  1040  1031  1008  977  *  950  922

                                  *       1045  1071  1077  1076  1073  1068  1057  1031        *
                           928  957  *  984  1032  1072  1085  1087  1085  1081  1074  1057  1019  979  *  953  925

                                  *       1054  1088  1100  1101  1098  1094  1087  1072  1038        *
                         931  960  *  988  1037  1083  1101  1106  1104  1101  1096  1087  1065  1022  980  *  954  926

                                *       1059  1095  1109  1111  1110  1107  1102  1094  1076  1040        *
                       932  963  *  992  1041  1087  1107  1113  1113  1110  1106  1101  1090  1067  1022  979  *  954  927

                              *       1061  1098  1113  1116  1115  1112  1109  1104  1095  1077  1039        *
                     933  965  *  994  1043  1089  1110  1117  1116  1114  1111  1107  1102  1090  1066  1021  979  *  953  927

                           *       1061  1099  1115  1119  1118  1115  1112  1108  1104  1095  1075  1037        *
                  934  965  *  996  1041  1089  1112  1119  1119  1117  1114  1111  1107  1101  1089  1064  1018  978  *  953  927

                        *       1055  1096  1115  1120  1120  1117  1114  1111  1108  1103  1092  1071  1031        *
               932  964  *  995  1030  1081  1109  1119  1121  1119  1116  1113  1110  1106  1099  1085  1056  1010  978  *  953  926
               908  951  *  991                                                                                    981  *  958  935
               935  964  *  992  1029  1081  1109  1120  1121  1119  1116  1113  1110  1106  1100  1085  1057  1012  985  *  981  977
                        *       1055  1096  1115  1121  1120  1118  1115  1112  1109  1104  1094  1072  1034        *

                  937  966  *  994  1041  1090  1113  1120  1120  1118  1115  1112  1109  1103  1091  1067  1024  988  *  985  982
                           *       1062  1101  1116  1120  1119  1117  1114  1111  1106  1097  1079  1042        *

                     938  968  *  997  1044  1091  1113  1119  1119  1117  1114  1110  1105  1094  1071  1028  989  *  987  985
                           *       1064  1101  1116  1119  1118  1115  1112  1108  1099  1081  1045        *

                        938  969  *  999  1046  1091  1111  1117  1116  1114  1111  1106  1095  1072  1029  989  *  988  987
                              *       1064  1099  1113  1115  1114  1111  1107  1099  1082  1046        *

                           938  970  * 1000  1045  1088  1106  1110  1109  1107  1102  1093  1071  1029  988  *  988  988
                                     *       1062  1094  1105  1106  1104  1101  1094  1079  1045        *

                              937  969  * 1000  1042  1078  1091  1093  1092  1089  1082  1065  1026  986  *  987  988
                                           *       1054  1077  1083  1083  1081  1077  1066  1039        *

                                 934  966  *  997  1030  1051  1056  1057  1055  1051  1042  1017  985  *  986  986
                                           *       1028  1037  1039  1038  1036  1032  1019        *

                                             *  993   992   993   994   994   994   993   989  985  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          948         959   959   960   960   959   958   955        960

                                       901            924   924   924   924   923   922   919            934
```


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Table B11A-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    50.500 in
                           904             931   932   932   931   930   929   927            901

                               949         963   965   964   962   961   959   957        945
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  993   995   996   995   992   990   987   986  988  *

                                   *        1014  1024  1025  1023  1019  1014  1004        *
                          938  966  *  993  1014  1034  1040  1039  1037  1032  1023  1006  991  *  962  933

                                 *        1035  1059  1067  1067  1064  1058  1047  1024        *
                        940  969  *  996  1026  1060  1075  1078  1076  1072  1064  1046  1016  993  *  966  936

                                 *        1045  1077  1091  1094  1092  1088  1080  1063  1031        *
                      942  971  * 1000  1032  1072  1093  1099  1099  1096  1090  1079  1056  1019  994  *  967  939

                               *        1050  1086  1103  1107  1107  1103  1098  1088  1068  1033        *
                    944  974  * 1003  1035  1077  1101  1109  1110  1108  1104  1097  1084  1059  1020  994  *  967  940

                             *        1052  1089  1108  1113  1113  1111  1107  1101  1091  1069  1033        *
                  945  976  * 1006  1037  1079  1104  1113  1115  1113  1110  1106  1099  1085  1058  1019  994  *  968  940

                           *        1052  1090  1110  1116  1117  1114  1111  1108  1102  1090  1067  1031        *
              945  977  * 1008  1035  1078  1105  1115  1118  1116  1113  1110  1106  1098  1083  1055  1016  994  *  968  941

                       *        1045  1085  1109  1117  1119  1117  1114  1111  1107  1100  1087  1062  1024        *
          944  976  * 1007  1026  1069  1101  1115  1119  1118  1116  1113  1109  1104  1096  1078  1047  1009  995  *  968  941
          921  964  * 1004                                                                                    998  *  974  950
          948  977  * 1005  1025  1069  1101  1115  1119  1119  1116  1113  1110  1105  1096  1078  1048  1011 1001  *  997  993
                       *        1044  1086  1109  1118  1119  1118  1115  1112  1108  1101  1088  1064  1028        *

              950  979  * 1007  1035  1079  1106  1117  1119  1118  1115  1112  1108  1100  1086  1059  1022 1004  * 1000  997
                           *        1053  1091  1111  1118  1118  1116  1113  1110  1104  1093  1071  1036        *

                 951  981  * 1009  1040  1082  1106  1116  1117  1116  1113  1109  1102  1089  1063  1026 1005  * 1003 1000
                           *        1056  1092  1110  1116  1116  1114  1111  1105  1095  1074  1040        *

                    951  982  * 1012  1041  1082  1104  1113  1114  1112  1108  1102  1089  1064  1027 1004  * 1003 1003
                           *        1056  1090  1107  1112  1111  1108  1103  1094  1074  1040        *

                       951  983  * 1013  1041  1078  1098  1104  1105  1102  1097  1086  1063  1027 1003  * 1003 1004
                                    *        1053  1084  1097  1100  1098  1095  1087  1070  1039        *

                          949  982  * 1013  1037  1067  1081  1085  1084  1080  1073  1055  1024 1002  * 1003 1004
                                           *        1045  1066  1074  1075  1073  1068  1056  1032        *

                             947  980  * 1011  1026  1042  1048  1049  1048  1044  1035  1016 1000  * 1001 1002
                                           *        1024  1032  1035  1035  1033  1028  1017        *

                                        * 1008  1006  1007  1008  1008  1008  1007  1004 1001  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     962         972   972   973   973   973   971   968        976

                                   914             936   937   937   936   936   934   932            949
```


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Table B11A-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    92.000 in
                           929             951   953   955   956   957   957   958            926

                               972         984   986   987   987   987   987   988        973
                                      *   *   *   *   *   *   *   *   *   *   *   *
                                  * 1014  1016  1017  1017  1017  1016  1016  1017 1018  *

                                *        1022  1026  1028  1028  1027  1024  1022        *
                        964  989  * 1014  1021  1029  1033  1034  1033  1031  1027  1023 1020  *  989  956

                                   *        1029  1040  1045  1047  1046  1042  1036  1029        *
                           964  990  * 1015  1026  1040  1049  1053  1054  1050  1044  1036  1028 1023  *  992  959

                                *        1035  1050  1061  1066  1066  1062  1055  1045  1034        *
                        965  991  * 1017  1030  1048  1062  1070  1072  1070  1064  1055  1043  1031 1024  *  994  963

                             *        1039  1058  1072  1080  1082  1080  1074  1064  1051  1037        *
                    966  993  * 1019  1033  1053  1070  1081  1086  1086  1082  1074  1061  1047  1033 1025  *  996  965

                          *        1041  1061  1078  1089  1094  1094  1089  1081  1068  1053  1037        *
                 966  994  * 1020  1034  1055  1074  1088  1095  1098  1095  1089  1078  1063  1047  1033 1026  *  997  968

                       *        1040  1061  1080  1093  1100  1102  1100  1093  1083  1068  1052  1036        *
            965  994  * 1021  1033  1053  1074  1090  1100  1104  1103  1099  1090  1078  1062  1045  1032 1027  *  999  970

                    *        1037  1057  1077  1093  1102  1106  1106  1101  1093  1081  1065  1048  1035        *
      964  993  * 1021  1029  1048  1069  1087  1099  1106  1107  1105  1098  1088  1074  1057  1041  1031 1028  * 1000  971
      943  982  * 1020                                                                                1030  * 1005  979
      968  995  * 1021  1029  1048  1069  1087  1100  1106  1108  1105  1099  1089  1075  1058  1042  1032 1031  * 1026 1021
                    *        1037  1058  1078  1094  1103  1107  1107  1102  1094  1082  1066  1050  1037        *

            968  996  * 1022  1034  1056  1076  1092  1102  1106  1105  1101  1093  1080  1065  1049  1036 1032  * 1028 1024
                       *        1043  1064  1083  1096  1103  1105  1102  1096  1086  1071  1055  1041        *

               968  997  * 1024  1038  1059  1078  1091  1099  1101  1099  1092  1082  1068  1052  1038 1032  * 1029 1026
                          *        1046  1066  1083  1093  1098  1098  1093  1085  1073  1058  1043        *

                  968  998  * 1026  1040  1060  1076  1086  1091  1091  1087  1079  1067  1053  1039 1031  * 1030 1028
                             *        1047  1065  1078  1086  1088  1086  1080  1070  1057  1043        *

                     968  998  * 1028  1040  1057  1069  1077  1079  1077  1072  1062  1050  1038 1030  * 1030 1030
                                *        1045  1059  1069  1073  1074  1070  1063  1053  1041        *

                        968  998  * 1028  1038  1050  1058  1062  1063  1060  1054  1045  1035 1029  * 1029 1030
                                   *        1041  1050  1055  1057  1056  1052  1046  1037        *

                           966  998  * 1028  1034  1040  1044  1045  1045  1042  1038  1032 1027  * 1028 1029
                                      *        1033  1037  1039  1040  1039  1036  1032        *

                                    * 1026  1026  1027  1028  1028  1029  1028  1027 1026  *
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   983         994   995   995   995   995   995   993       1002

                               938             961   961   961   961   961   960   959            977
```


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Table E11A-3.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11A-3

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          885          911   913   913   912   910   909   907          883

                              927        942   943   942   941   938   936   934       923
                                       *   *   *   *   *   *   *   *   *   *   *   *
                                    *  968   971   972   971   968   966   963   961  961  *

                                  *       1005  1015  1016  1014  1010  1005   994       *
                           916  943  *  969  1005  1029  1034  1033  1030  1026  1017   995  965  *  940  914

                                    *       1029  1054  1060  1060  1057  1053  1042  1018       *
                        918  946  *  972  1017  1055  1068  1070  1068  1065  1058  1042  1006  967  *  942  917

                                  *       1038  1070  1082  1083  1081  1078  1071  1057  1024       *
                     920  948  *  975  1022  1065  1083  1087  1086  1084  1079  1070  1050  1008  967  *  943  918

                               *       1042  1076  1090  1092  1091  1088  1084  1077  1060  1025       *
                  922  951  *  978  1025  1069  1088  1094  1094  1091  1088  1083  1073  1051  1008  966  *  943  918

                           *       1044  1079  1093  1096  1095  1093  1090  1086  1078  1060  1024       *
               923  952  *  981  1026  1070  1090  1097  1097  1095  1092  1089  1083  1073  1050  1006  965  *  942  918

                        *       1043  1079  1094  1098  1097  1095  1092  1089  1085  1077  1058  1022       *
            922  953  *  982  1024  1069  1091  1098  1098  1096  1094  1091  1088  1082  1071  1047  1003  965  *  941  917

                     *       1037  1076  1094  1099  1099  1097  1094  1091  1088  1084  1074  1053  1015       *
      921  951  *  981  1014  1062  1088  1098  1099  1098  1095  1093  1090  1086  1080  1067  1039   995  964  *  941  916
      898  938  *  977                                                                              967  *  946  925
      924  951  *  977  1013  1062  1088  1098  1100  1098  1095  1093  1090  1087  1080  1067  1040   997  970  *  967  964
                  *       1036  1076  1094  1099  1099  1097  1094  1091  1088  1084  1074  1054  1018       *

            925  953  *  980  1023  1069  1091  1098  1099  1097  1094  1092  1088  1083  1072  1049  1008  973  *  971  969
                        *       1043  1080  1095  1099  1098  1095  1093  1090  1086  1078  1060  1025       *

                  926  954  *  982  1027  1071  1091  1097  1097  1095  1093  1089  1084  1074  1052  1011  974  *  973  971
                              *       1045  1080  1094  1097  1096  1094  1091  1087  1079  1062  1028       *

                     926  955  *  983  1027  1070  1089  1095  1094  1092  1089  1085  1075  1053  1012  973  *  973  973
                                 *       1045  1078  1091  1093  1092  1090  1086  1078  1062  1028       *

                        926  956  *  984  1027  1067  1084  1088  1088  1085  1081  1072  1052  1012  972  *  973  974
                                    *       1043  1073  1083  1084  1083  1080  1073  1059  1027       *

                           924  955  *  984  1024  1058  1070  1072  1071  1068  1061  1045  1009  971  *  972  974
                                       *       1035  1057  1063  1063  1061  1057  1046  1021       *

                              922  952  *  982  1012  1032  1037  1037  1036  1032  1024  1000  969  *  971  972
                                          *       1010  1018  1020  1020  1018  1014  1002       *

                                       *  977   976   977   978   978   978   977   973  970  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                    935          945   945   946   946   945   944   941       947

                                 891          912   913   913   912   912   910   908          923
```


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Table E11A-3.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11A-3

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    50.500 in
                           897             922   923   924   923   922   920   919            895

                               939         953   954   954   952   950   948   947        936
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  980   983   984   982   980   978   975   974  975  *

                                  *        1001  1010  1011  1010  1006  1001   992        *
                           928  955  *  981  1000  1019  1025  1025  1023  1018  1009   993  978  *  952  925

                                     *        1020  1043  1051  1051  1048  1043  1032  1010        *
                           930  957  *  983  1011  1044  1058  1062  1060  1056  1049  1032  1002  980  *  955  928

                                     *        1029  1060  1074  1077  1075  1071  1064  1048  1017        *
                        931  960  *  987  1017  1055  1075  1081  1081  1079  1074  1063  1041  1005  981  *  956  930

                                  *        1033  1067  1084  1089  1088  1085  1081  1072  1052  1019        *
                     933  962  *  990  1020  1059  1082  1090  1091  1089  1086  1080  1067  1043  1005  980  *  956  930

                           *        1035  1070  1088  1094  1094  1092  1088  1083  1073  1053  1018        *
                  934  963  *  992  1021  1061  1084  1094  1095  1094  1091  1087  1081  1067  1042  1004  980  *  956  931

                        *        1035  1071  1089  1096  1096  1095  1092  1088  1083  1072  1051  1015        *
               933  964  *  994  1019  1059  1085  1095  1097  1096  1094  1091  1087  1080  1065  1039  1001  979  *  955  930

                     *        1028  1066  1088  1097  1098  1096  1094  1091  1087  1081  1069  1045  1009        *
          932  963  *  992  1010  1051  1080  1094  1098  1097  1095  1093  1090  1085  1077  1060  1030   994  980  *  955  930
          911  951  *  990                                                                              983  *  962  940
          936  964  *  990  1009  1050  1080  1094  1098  1097  1095  1093  1090  1085  1077  1060  1031   996  985  *  982  979
                     *        1027  1066  1088  1097  1098  1096  1094  1091  1088  1082  1069  1046  1011        *

               938  965  *  992  1018  1059  1085  1095  1097  1096  1094  1091  1087  1080  1067  1041  1006  988  *  986  983
                        *        1035  1071  1090  1096  1097  1095  1092  1089  1084  1073  1053  1019        *

                  938  967  *  994  1022  1062  1085  1094  1096  1094  1092  1088  1082  1069  1045  1010  988  *  987  986
                           *        1037  1072  1089  1094  1094  1092  1089  1084  1075  1055  1022        *

                     938  968  *  996  1024  1061  1083  1091  1092  1090  1087  1081  1069  1046  1010  988  *  988  988
                              *        1037  1070  1085  1090  1089  1087  1082  1073  1055  1022        *

                        938  968  *  997  1023  1058  1077  1083  1083  1081  1076  1065  1044  1010  987  *  988  989
                                 *        1035  1063  1075  1078  1077  1074  1066  1050  1021        *

                           937  968  *  997  1020  1047  1061  1064  1063  1060  1053  1036  1006  985  *  987  989
                                    *        1026  1046  1053  1054  1053  1048  1037  1014        *

                              935  965  *  995  1009  1024  1029  1030  1029  1026  1017   999  984  *  986  987
                                       *        1007  1014  1017  1017  1015  1011  1000        *

                                          *  991   990   990   991   991   991   990   987  985  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       948         958   958   958   958   958   957   954        961

                                    904            924   925   925   924   923   922   920            937
```


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Table E11A-3.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11A-3

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    92.000 in
                           920             942   944   945   946   947   947   947            920

                               961         972   974   975   975   975   975   975        962
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1000  1002  1003  1003  1003  1002  1002  1002 1003  *

                                   *        1008  1012  1014  1014  1012  1010  1007        *
                          952  977  * 1000  1007  1015  1019  1020  1019  1016  1012  1008 1005  *  977  947

                                   *        1015  1025  1030  1032  1031  1027  1021  1014        *
                         953  978  * 1001  1012  1025  1033  1038  1038  1035  1029  1021  1013 1007  *  979  950

                                   *        1020  1035  1044  1049  1050  1046  1039  1029  1018        *
                        953  979  * 1003  1016  1032  1045  1053  1055  1054  1048  1039  1027  1015 1008  *  981  953

                                 *        1024  1041  1055  1062  1065  1063  1057  1047  1034  1021        *
                       954  980  * 1005  1018  1037  1053  1063  1069  1069  1065  1057  1045  1031  1017 1009  *  983  955

                                 *        1025  1045  1060  1071  1076  1076  1071  1063  1051  1036  1021        *
                      954  981  * 1006  1019  1039  1056  1069  1077  1079  1077  1071  1060  1047  1031  1017 1010  *  984  957

                                *        1025  1044  1062  1074  1081  1083  1081  1075  1065  1051  1035  1020        *
                    953  981  * 1007  1018  1037  1056  1071  1080  1084  1084  1080  1072  1060  1045  1029  1016 1010  *  985  959

                               *        1021  1040  1059  1073  1083  1086  1086  1082  1074  1062  1047  1031  1018        *
                  952  980  * 1007  1014  1031  1051  1068  1079  1086  1087  1085  1079  1070  1056  1040  1025  1014 1011  *  986  960
                  932  970  * 1006                                                                                  1013  *  991  968
                  955  981  * 1006  1014  1031  1051  1068  1080  1086  1087  1085  1079  1070  1056  1040  1025  1016 1014  * 1010 1006
                               *        1021  1041  1059  1074  1083  1087  1086  1082  1075  1063  1048  1032  1020        *

                    956  982  * 1007  1018  1038  1057  1072  1081  1085  1085  1081  1073  1061  1047  1031  1019 1015  * 1012 1009
                                *        1026  1046  1063  1076  1082  1084  1082  1076  1066  1053  1037  1023        *

                       956  983  * 1009  1022  1041  1059  1071  1078  1080  1078  1072  1062  1049  1034  1021 1015  * 1013 1011
                                *        1029  1048  1063  1073  1077  1077  1073  1065  1054  1040  1025        *

                          956  984  * 1011  1023  1042  1056  1066  1071  1071  1067  1060  1048  1035  1021 1014  * 1014 1013
                                     *        1030  1046  1058  1065  1068  1066  1060  1051  1038  1025        *

                             956  984  * 1012  1023  1039  1050  1057  1059  1058  1052  1044  1032  1020 1013  * 1014 1014
                                        *        1028  1041  1049  1054  1054  1051  1044  1034  1023        *

                                955  984  * 1012  1021  1032  1040  1043  1044  1041  1035  1027  1018 1011  * 1013 1014
                                           *        1024  1032  1037  1038  1037  1034  1028  1020        *

                                   954  983  * 1012  1017  1023  1026  1027  1027  1024  1020  1015 1010  * 1012 1013
                                              *        1017  1020  1021  1022  1021  1018  1015        *

                                                 * 1010  1010  1010  1011  1012  1012  1011  1010 1009  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                969         980   980   980   981   980   980   978        987

                                                927             949   949   949   948   948   947   946            964
```


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Table B11B-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11B-1

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 44.000 in

```
                          922             910   912   913   913   913   913   911            881

                              944         940   942   943   943   943   942   941        926
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  964   969   972   972   972   971   970   969  970  *

                                *        1012  1025  1028  1029  1029  1027  1016        *
                        967  966  *  966  1012  1041  1048  1050  1050  1050  1044  1019  976  *  948  919

                                 *        1041  1069  1077  1078  1079  1079  1073  1048        *
                        971  970  *  969  1025  1070  1084  1087  1088  1089  1087  1075  1033  979  *  953  926

                                 *        1050  1085  1096  1098  1099  1099  1099  1089  1056        *
                        974  974  *  973  1030  1079  1096  1101  1102  1102  1103  1100  1083  1036  980  *  955  929

                                 *        1054  1090  1102  1105  1105  1106  1106  1105  1094  1058        *
                    976  976  *  977  1034  1083  1101  1105  1106  1106  1107  1107  1103  1086  1037  980  *  956  931

                                 *        1057  1093  1105  1107  1107  1108  1108  1109  1107  1095  1058        *
                977  978  *  979  1036  1085  1104  1108  1108  1108  1108  1109  1109  1105  1087  1037  979  *  956  931

                                 *        1058  1096  1108  1110  1110  1109  1109  1110  1110  1109  1097  1058        *
           976  979  *  981  1036  1087  1106  1110  1110  1110  1110  1110  1111  1111  1107  1087  1035  978  *  955  931

                                 *        1053  1095  1109  1112  1112  1111  1111  1111  1112  1112  1110  1095  1053        *
      975  977  *  980  1025  1081  1106  1113  1113  1112  1112  1112  1112  1113  1113  1106  1082  1024  976  *  954  930
      966  972  *  977                                                                                       977  *  939  900
      968  973  *  977  1024  1082  1107  1114  1114  1114  1113  1113  1114  1114  1114  1108  1083  1027  983  *  951  918
                                 *        1054  1097  1112  1115  1115  1114  1114  1114  1115  1115  1112  1098  1056        *

           970  976  *  981  1038  1091  1111  1116  1116  1116  1116  1116  1116  1116  1116  1111  1092  1041  986  *  954  921
                                 *        1062  1101  1114  1117  1117  1117  1117  1117  1117  1115  1102  1064        *

                972  978  *  984  1042  1093  1113  1118  1118  1118  1119  1119  1119  1114  1095  1045  988  *  956  923
                                 *        1065  1103  1116  1119  1119  1119  1120  1120  1117  1105  1067        *

                    973  980  *  986  1044  1095  1114  1120  1121  1121  1121  1121  1116  1097  1046  988  *  956  924
                                 *        1066  1105  1117  1121  1121  1122  1122  1119  1107  1069        *

                       973  981  *  988  1046  1096  1114  1119  1120  1121  1121  1117  1098  1047  987  *  956  924
                                 *        1067  1104  1115  1118  1119  1119  1118  1107  1069        *

                          971  981  *  990  1045  1090  1105  1109  1110  1111  1108  1093  1045  985  *  955  924
                                       *        1062  1090  1098  1101  1102  1101  1094  1064        *

                             968  978  *  988  1033  1061  1069  1071  1073  1073  1066  1034  983  *  953  923
                                       *        1031  1044  1048  1050  1051  1049  1036        *

                                         *  982   982   984   986   988   990   991   988  983  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                      957         954   956   957   959   960   960   958        943

                                 931             924   926   927   928   928   928   926            902
```


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Table B11B-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    44.000 in
                           884             909   911   910   909   907   906   904            880

                               926         940   941   940   938   936   933   931        920
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  967   970   970   968   966   963   960   958  958  *

                                   *        1004  1014  1014  1011  1007  1002   991        *
                              915  942  *  968  1004  1028  1032  1030  1027  1023  1014   992  962  *  937  910

                                  *        1029  1053  1058  1057  1054  1048  1038  1014        *
                             918  945  *  971  1017  1054  1066  1067  1065  1061  1054  1038  1002  964  *  939  913

                                 *        1038  1069  1079  1079  1077  1073  1066  1052  1020        *
                            920  948  *  975  1022  1064  1081  1084  1082  1079  1074  1065  1045  1004  964  *  940  915

                                *        1042  1075  1087  1089  1086  1083  1079  1071  1055  1021        *
                       921  950  *  978  1025  1068  1086  1091  1089  1086  1082  1077  1067  1046  1004  964  *  940  915

                              *        1044  1078  1091  1093  1090  1087  1084  1080  1072  1055  1020        *
                     923  952  *  981  1027  1070  1089  1093  1092  1089  1086  1082  1077  1067  1045  1003  963  *  940  915

                            *        1044  1079  1093  1095  1093  1089  1086  1083  1079  1071  1053  1018        *
                923  953  *  983  1025  1070  1090  1095  1094  1091  1088  1085  1081  1076  1066  1043  1000  963  *  940  915

                         *        1039  1077  1093  1097  1095  1091  1088  1085  1082  1078  1069  1049  1012        *
921  952  *  982  1015  1063  1088  1096  1096  1093  1090  1087  1084  1080  1075  1062  1035   993  963  *  940  915
899  939  *  978                                                  *                              966  *  945  924
925  953  *  979  1015  1063  1088  1097  1096  1094  1090  1087  1084  1081  1075  1063  1037   995  970  *  967  964
                         *        1038  1077  1093  1097  1095  1092  1089  1086  1083  1079  1070  1051  1015        *

                927  955  *  981  1025  1070  1091  1097  1096  1093  1089  1086  1083  1078  1068  1046  1006  973  *  971  968
                            *        1045  1080  1094  1096  1094  1091  1088  1085  1081  1073  1056  1023        *

                   928  956  *  983  1028  1072  1091  1096  1094  1092  1089  1085  1080  1070  1049  1010  975  *  973  972
                               *        1047  1080  1093  1095  1093  1090  1087  1083  1075  1059  1026        *

                      929  957  *  985  1029  1071  1089  1094  1093  1090  1086  1082  1072  1051  1012  975  *  975  974
                                  *        1047  1079  1091  1092  1090  1087  1083  1076  1060  1027        *

                         928  958  *  987  1029  1069  1085  1088  1087  1084  1079  1071  1051  1012  975  *  975  976
                                     *        1045  1074  1084  1085  1082  1079  1072  1058  1027        *

                            928  958  *  987  1026  1060  1072  1074  1072  1068  1062  1046  1011  975  *  976  977
                                        *        1038  1059  1065  1064  1062  1057  1047  1023        *

                               926  956  *  984  1015  1035  1040  1040  1038  1035  1026  1003  975  *  975  976
                                           *        1014  1022  1024  1024  1022  1017  1006        *

                                              *  981   981   982   983   984   984   983   979  976  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           954         970   972   972   972   971   970   967        967

                                        926            959   960   960   960   958   956   953            957
```


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Table B11B-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
  axial height    50.500 in
                           937             922   924   925   925   925   925   924            895

                               958         953   955   956   956   955   955   954        941
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  979   982   985   986   985   984   983   983  985  *

                                   *        1007  1019  1023  1023  1023  1020  1010        *
                              983  981  *  980  1006  1031  1039  1041  1041  1040  1034  1013  990  *  962  934

                                 *        1031  1059  1068  1070  1071  1070  1063  1037        *
                            987  985  *  983  1019  1059  1076  1080  1081  1082  1079  1064  1027  993  *  968  942

                                 *        1040  1077  1090  1094  1095  1095  1093  1081  1046        *
                           989  988  *  987  1025  1070  1091  1097  1099  1099  1099  1094  1074  1031  994  *  971  946

                               *        1045  1083  1099  1103  1104  1104  1104  1101  1087  1049        *
                      991  991  *  990  1028  1074  1096  1104  1105  1106  1106  1105  1099  1078  1031  994  *  971  948

                           *        1048  1086  1102  1106  1107  1107  1108  1108  1104  1089  1049        *
                  992  993  *  993  1031  1077  1100  1107  1108  1108  1108  1109  1108  1101  1079  1031  993  *  971  949

                         *        1048  1088  1105  1109  1109  1109  1109  1110  1110  1106  1089  1048        *
             992  993  *  995  1030  1078  1101  1109  1110  1110  1110  1110  1111  1110  1102  1078  1028  991  *  970  948

                      *        1042  1086  1106  1111  1112  1111  1111  1111  1112  1112  1106  1087  1042        *
        990  992  *  994  1019  1070  1100  1111  1113  1112  1112  1112  1112  1113  1111  1101  1071  1018  990  *  970  948
        985  989  *  992                                                                                 992  *  955  916
        987  989  *  992  1018  1071  1101  1112  1114  1114  1113  1113  1114  1114  1112  1102  1072  1020  996  *  964  930
                      *        1043  1088  1108  1114  1115  1114  1114  1114  1115  1114  1109  1089  1045        *

             989  992  *  994  1031  1081  1106  1114  1116  1116  1116  1116  1116  1115  1107  1083  1034 1000  *  968  934
                         *        1052  1094  1111  1116  1117  1117  1117  1117  1116  1112  1095  1055        *

                  990  994  *  998  1036  1085  1109  1116  1118  1118  1118  1119  1117  1110  1087  1039 1001  *  969  935
                         *        1055  1096  1113  1118  1119  1119  1119  1119  1114  1098  1058        *

                     991  996  * 1000  1039  1087  1110  1118  1120  1120  1120  1119  1112  1089  1040 1001  *  969  936
                         *        1057  1097  1114  1119  1120  1120  1120  1116  1099  1059        *

                        990  997  * 1003  1040  1087  1108  1115  1117  1118  1117  1111  1089  1040 1000  *  969  937
                                  *        1057  1095  1109  1113  1114  1115  1112  1097  1058        *

                           989  996  * 1004  1038  1079  1096  1101  1103  1103  1099  1081  1038  998  *  968  936
                                  *        1051  1079  1089  1092  1093  1091  1082  1052        *

                              986  994  * 1002  1026  1050  1058  1061  1063  1062  1054  1026  996  *  966  935
                                         *        1025  1036  1041  1043  1044  1041  1028        *

                                           *  998   996   997  1000  1002  1003  1004  1001  997  *
                                              *   *   *   *   *   *   *   *   *   *   *   *   *
                                         973         968   969   971   972   973   973   971        957

                                    948             938   939   940   941   941   941   939            915
```


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Table B11B-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    50.500 in
                           895             919   921   921   920   919   917   916            891

                               937         951   952   951   949   947   945   944        932
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  978   981   981   980   977   975   972   971  972  *

                                   *         999  1008  1009  1007  1003   998   988        *
                              926  953  *  979   999  1018  1023  1022  1019  1014  1006   989  975  *  949  921

                                   *        1019  1041  1048  1048  1045  1039  1028  1006        *
                             929  956  *  982  1010  1042  1056  1059  1057  1052  1044  1028   999  978  *  952  924

                                   *        1028  1059  1071  1073  1071  1067  1059  1043  1013        *
                            931  959  *  986  1016  1054  1073  1078  1077  1074  1069  1058  1036  1002  978  *  953  926

                                  *        1033  1066  1081  1085  1084  1080  1075  1066  1047  1015        *
                        932  961  *  989  1020  1058  1080  1087  1087  1084  1080  1074  1062  1038  1002  978  *  953  928

                                 *        1035  1069  1086  1090  1089  1086  1083  1077  1067  1048  1014        *
                    933  963  *  992  1021  1060  1083  1091  1091  1088  1085  1081  1075  1062  1038  1001  978  *  953  928

                               *        1035  1070  1088  1093  1092  1089  1086  1082  1077  1067  1046  1012        *
                933  964  *  994  1020  1060  1083  1092  1093  1091  1088  1085  1081  1074  1060  1035   998  978  *  954  928

                           *        1029  1066  1087  1094  1094  1091  1088  1085  1081  1076  1064  1041  1006        *
932  963  *  993  1011  1051  1080  1092  1095  1093  1090  1087  1084  1079  1071  1055  1027   992  979  *  954  928
911  952  *  990                                                  *                              983  *  961  938
938  965  *  991  1010  1051  1080  1093  1095  1093  1090  1087  1084  1080  1072  1056  1028   995  986  *  982  979
                           *        1028  1067  1088  1095  1095  1092  1089  1086  1082  1076  1065  1043  1010        *

                940  967  *  993  1020  1060  1085  1094  1095  1092  1089  1086  1082  1076  1063  1038  1005  989  *  986  983
                           *        1036  1071  1089  1094  1094  1091  1088  1084  1079  1069  1050  1018        *

                   941  969  *  995  1024  1063  1085  1093  1093  1091  1088  1084  1078  1066  1042  1009  990  *  989  987
                           *        1038  1072  1088  1093  1092  1089  1086  1081  1071  1052  1021        *

                      941  970  *  997  1025  1063  1083  1090  1090  1088  1084  1078  1067  1044  1011  991  *  990  990
                             *        1039  1071  1085  1089  1088  1085  1080  1071  1053  1022        *

                         941  971  *  999  1025  1060  1078  1083  1082  1080  1074  1064  1043  1011  990  *  991  992
                                     *        1037  1065  1076  1079  1077  1073  1066  1050  1022        *

                            941  970  *  999  1022  1050  1063  1066  1064  1061  1053  1037  1009  990  *  991  993
                                           *        1029  1049  1056  1056  1054  1049  1039  1017        *

                               939  969  *  997  1012  1027  1033  1034  1032  1029  1020  1003  990  *  991  992
                                           *        1011  1019  1021  1021  1019  1015  1005        *

                                             *  995   994   996   997   998   998   997   994  992  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          968         984   985   986   986   985   984   981        983

                                 940             973   974   974   973   972   970   968            973
```


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Table B11B-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
  axial height    92.000 in
                            968             949   951   952   953   954   954   955            930

                                989         980   982   983   984   984   984   985        974
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1008  1009  1011  1012  1013  1013  1013  1014 1016  *

                                   *        1017  1023  1026  1027  1027  1025  1022        *
                              1015 1012  * 1009  1017  1026  1032  1034  1035  1033  1029  1024 1019  *  995  970

                                 *        1026  1039  1047  1050  1051  1048  1042  1032        *
                           1017 1015  * 1012  1023  1039  1050  1057  1059  1058  1053  1043  1030 1021  * 1000  978

                              *        1033  1051  1064  1071  1073  1072  1066  1055  1039        *
                         1019 1017  * 1015  1028  1048  1064  1074  1079  1079  1076  1067  1053  1034 1022  * 1003  983

                            *        1038  1059  1075  1085  1089  1089  1086  1077  1062  1042        *
                      1020 1019  * 1017  1032  1054  1073  1085  1092  1094  1092  1087  1075  1057  1035 1022  * 1004  986

                         *        1040  1063  1081  1093  1098  1100  1099  1094  1083  1065  1043        *
                   1021 1020  * 1020  1033  1056  1077  1091  1099  1102  1102  1100  1093  1079  1058  1035 1021  * 1005  988

                        *        1040  1063  1083  1097  1103  1106  1106  1104  1098  1085  1065  1041        *
                1020 1021  * 1021  1032  1055  1077  1093  1102  1107  1108  1107  1103  1094  1078  1056  1032 1020  * 1004  988

                      *        1036  1059  1081  1097  1105  1109  1110  1109  1106  1098  1082  1060  1036        *
   1020 1021  * 1022  1028  1048  1072  1091  1103  1109  1111  1111  1109  1104  1092  1073  1049  1027 1019  * 1004  988
   1013 1017  * 1021                                                                                 1019  *  984  948
   1011 1017  * 1022  1029  1049  1073  1092  1104  1110  1112  1112  1110  1105  1093  1074  1050  1028 1021  *  987  953
                      *        1037  1061  1083  1099  1108  1112  1113  1112  1109  1100  1084  1062  1038        *

      1011 1017  * 1023  1034  1058  1081  1098  1108  1112  1113  1112  1108  1099  1082  1059  1035 1023  *  989  955
                        *        1044  1068  1089  1103  1110  1113  1113  1111  1104  1090  1069  1044        *

         1011 1018  * 1025  1039  1063  1085  1100  1108  1112  1112  1109  1101  1086  1064  1038 1023  *  990  956
                        *        1048  1072  1091  1103  1109  1111  1109  1104  1092  1072  1047        *

            1010 1019  * 1027  1042  1065  1085  1098  1104  1107  1105  1099  1085  1065  1039 1023  *  991  957
                        *        1050  1072  1088  1098  1103  1103  1099  1089  1072  1048        *

               1009 1019  * 1029  1042  1063  1079  1089  1094  1094  1090  1080  1062  1039 1022  *  991  958
                           *        1049  1067  1079  1087  1089  1087  1080  1066  1046        *

                  1007 1019  * 1030  1040  1056  1067  1073  1075  1074  1067  1055  1036 1021  *  990  958
                              *        1044  1055  1063  1067  1068  1064  1055  1041        *

                     1005 1017  * 1029  1035  1042  1048  1050  1051  1049  1042  1031 1021  *  990  958
                                 *        1034  1038  1041  1043  1042  1039  1032        *

                                    * 1027  1025  1025  1026  1027  1027  1026  1025 1022  *
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                  999         996   996   996   996   996   996   994        981

                               970             966   965   965   965   965   964   962            939
```


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Table B11B-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
  axial height    92.000 in
                            918             939   941   942   943   944   944   945            916

                                959         969   971   972   972   973   973   973        960
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  998   999  1000  1000  1000  1000  1000  1001 1002  *

                                  *        1005  1009  1011  1011  1009  1007  1005        *
                         950  974  *  998  1005  1012  1016  1017  1016  1013  1010  1006 1004  *  975  944

                                *        1012  1022  1027  1029  1027  1023  1018  1011        *
                       951  975  *  999  1010  1022  1031  1034  1034  1031  1026  1018  1011 1007  *  978  947

                              *        1018  1032  1042  1046  1046  1042  1035  1026  1016        *
                     952  977  * 1001  1013  1030  1043  1050  1052  1050  1044  1035  1024  1014 1008  *  980  951

                            *        1022  1039  1052  1059  1061  1059  1053  1043  1031  1019        *
                   952  978  * 1002  1016  1035  1051  1061  1065  1065  1060  1052  1041  1028  1016 1010  *  982  953

                          *        1024  1043  1058  1068  1072  1071  1067  1059  1047  1033  1020        *
                 952  979  * 1004  1017  1037  1054  1067  1073  1075  1072  1066  1056  1043  1028  1016 1011  *  984  956

                        *        1023  1043  1060  1072  1078  1079  1076  1070  1060  1047  1032  1019        *
            952  979  * 1005  1016  1036  1054  1069  1077  1081  1080  1075  1067  1056  1041  1027  1016 1013  *  986  958

                     *        1020  1039  1057  1072  1080  1083  1082  1077  1070  1058  1044  1029  1018        *
          951  979  * 1005  1013  1030  1050  1066  1077  1083  1083  1081  1075  1065  1052  1037  1024  1016 1014  *  988  960
          933  969  * 1004                                                                                  1017  *  992  967
          957  982  * 1005  1013  1031  1050  1067  1078  1083  1084  1081  1075  1066  1053  1038  1025  1018 1018  * 1013 1008
                     *        1021  1040  1058  1072  1081  1084  1083  1078  1071  1060  1046  1032  1021        *

            958  983  * 1007  1018  1038  1056  1071  1079  1082  1081  1077  1070  1059  1045  1031  1022 1020  * 1015 1011
                       *        1026  1046  1063  1074  1080  1081  1079  1073  1063  1051  1037  1025        *

               959  984  * 1009  1021  1041  1058  1070  1077  1078  1076  1070  1060  1048  1035  1024 1020  * 1017 1014
                         *        1029  1048  1063  1072  1076  1075  1071  1063  1053  1040  1028        *

                  959  985  * 1010  1023  1042  1057  1066  1070  1070  1066  1059  1048  1036  1025 1020  * 1019 1017
                            *        1030  1047  1059  1065  1067  1065  1060  1051  1040  1029        *

                     960  986  * 1012  1024  1039  1051  1058  1060  1058  1053  1045  1035  1025 1020  * 1019 1019
                               *        1029  1042  1051  1055  1055  1052  1046  1037  1028        *

                        959  987  * 1013  1022  1034  1042  1046  1046  1044  1038  1031  1024 1020  * 1020 1020
                                  *        1025  1034  1039  1041  1041  1037  1032  1025        *

                           959  986  * 1013  1019  1026  1030  1032  1032  1030  1026  1022 1019  * 1019 1020
                                     *        1019  1023  1026  1027  1027  1025  1022        *

                                       * 1012  1013  1015  1017  1018  1019  1020  1019 1019  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                   989        1006  1007  1008  1009  1009  1009  1008       1011

                              965             998   999  1000  1000   999   998   997           1003
```


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Table E11B-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
  axial height    44.000 in
                           919             905   907   908   908   908   908   906            877

                               939         934   936   937   937   937   936   934        921
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  957   961   964   965   965   964   963   962  962  *

                                   *        1004  1016  1019  1020  1020  1018  1008        *
                              963  961  *  959  1003  1032  1038  1040  1041  1040  1035  1010  968  *  942  914

                                  *        1032  1059  1066  1068  1069  1069  1063  1038        *
                             967  965  *  962  1016  1059  1073  1076  1077  1078  1077  1065  1024  972  *  947  920

                                 *        1040  1074  1085  1087  1088  1089  1088  1079  1046        *
                            970  968  *  966  1022  1068  1085  1090  1091  1091  1092  1089  1073  1027  973  *  949  924

                                *        1044  1080  1091  1093  1094  1094  1095  1094  1083  1048        *
                        972  970  *  969  1025  1072  1090  1094  1095  1095  1096  1096  1092  1075  1028  972  *  949  925

                               *        1047  1083  1094  1096  1096  1096  1097  1097  1096  1085  1049        *
                      973  972  *  972  1027  1075  1092  1097  1097  1097  1097  1098  1098  1094  1077  1028  971  *  949  926

                             *        1048  1085  1096  1098  1098  1098  1098  1098  1099  1097  1086  1048        *
                 973  973  *  974  1027  1076  1095  1099  1099  1098  1098  1098  1099  1099  1095  1077  1026  970  *  948  925

                          *        1044  1084  1098  1101  1100  1100  1099  1099  1100  1101  1098  1084  1043        *
 971  972  *  973  1016  1071  1095  1101  1101  1100  1100  1100  1100  1101  1101  1095  1071  1015  968  *  947  924
 968  969  *  970                                                 *                                 969  *  933  895
 969  970  *  971  1016  1072  1096  1102  1103  1102  1101  1101  1102  1103  1102  1096  1073  1017  974  *  944  913
                          *        1044  1086  1100  1103  1103  1102  1102  1102  1103  1103  1101  1087  1046        *

                 972  973  *  974  1029  1080  1099  1104  1104  1104  1104  1104  1104  1104  1100  1081  1031  978  *  947  915
                             *        1052  1090  1103  1105  1105  1104  1105  1105  1105  1103  1091  1054        *

                      973  975  *  977  1033  1082  1101  1106  1106  1106  1106  1107  1106  1102  1084  1035  979  *  949  917
                                 *        1055  1092  1104  1107  1107  1107  1107  1108  1105  1093  1056        *

                           974  977  *  979  1035  1084  1103  1107  1108  1109  1109  1109  1104  1086  1036  979  *  949  918
                                    *        1056  1093  1105  1108  1109  1109  1109  1107  1095  1058        *

                              973  977  *  981  1036  1084  1102  1107  1108  1109  1109  1105  1087  1037  978  *  949  918
                                           *        1057  1092  1103  1106  1106  1107  1105  1095  1058        *

                                 972  977  *  982  1035  1079  1093  1097  1098  1098  1096  1082  1035  977  *  948  918
                                            *        1051  1079  1087  1089  1090  1089  1083  1053        *

                                    969  975  *  980  1023  1051  1058  1060  1062  1061  1055  1024  975  *  946  917
                                               *        1022  1034  1038  1039  1040  1039  1026        *

                                                  *  975   974   976   978   980   982   982   980  974  *
                                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                                954         947   949   950   952   952   952   950        936

                                                931             919   920   921   922   922   921   920            897
```


A7-0UO-EC1
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Table E11B-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11B-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          879            904   905   905   904   902   901   899           876

                              920        934   935   934   932   929   927   925       914
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  959   962   963   961   958   956   953   951  951  *

                                 *        996  1004  1005  1002   999   994   983       *
                            909  935  *  960   995  1018  1022  1021  1018  1014  1005   984  954  *  930  906

                                *       1019  1042  1048  1047  1043  1039  1029  1005       *
                           911  938  *  963  1007  1043  1055  1056  1054  1050  1044  1028   993  956  *  933  908

                                *       1027  1058  1067  1068  1065  1062  1056  1042  1011       *
                       913  940  *  967  1012  1052  1069  1072  1070  1067  1063  1054  1035   995  956  *  933  909

                              *       1031  1063  1075  1076  1074  1071  1067  1060  1044  1011       *
                   915  943  *  970  1014  1056  1074  1078  1077  1074  1071  1066  1057  1036   995  956  *  933  910

                         *       1032  1065  1078  1080  1078  1075  1072  1068  1060  1044  1010       *
                 915  944  *  972  1016  1057  1076  1080  1079  1077  1074  1070  1066  1056  1034   993  955  *  933  909

                       *       1032  1066  1079  1082  1080  1077  1074  1071  1067  1059  1042  1008       *
            915  945  *  973  1014  1057  1077  1082  1081  1078  1075  1072  1069  1064  1054  1032   991  954  *  932  909

                    *       1027  1063  1079  1083  1081  1078  1075  1072  1069  1065  1057  1038  1002       *
      914  944  *  972  1004  1050  1074  1082  1082  1080  1077  1074  1071  1068  1062  1050  1024   983  954  *  932  908
      893  931  *  969                                                                                  957  *  937  918
      918  944  *  969  1004  1050  1074  1082  1083  1080  1077  1074  1071  1068  1063  1051  1025   985  960  *  958  955
                    *       1026  1063  1079  1083  1081  1078  1075  1073  1070  1066  1057  1039  1005       *

            919  946  *  971  1013  1057  1077  1082  1081  1079  1076  1073  1070  1065  1055  1034   996  963  *  962  960
                       *       1032  1067  1080  1082  1080  1077  1074  1071  1068  1060  1044  1012       *

                  920  947  *  973  1016  1058  1076  1081  1080  1078  1075  1071  1067  1057  1037   999  965  *  964  963
                             *       1034  1066  1079  1081  1079  1076  1073  1069  1062  1046  1015       *

                        921  948  *  975  1017  1058  1075  1079  1078  1075  1072  1068  1059  1038  1000  965  *  965  965
                                   *       1034  1065  1076  1078  1076  1073  1069  1062  1047  1016       *

                           921  949  *  976  1017  1055  1071  1074  1072  1070  1065  1057  1038  1001  965  *  966  967
                                      *       1032  1060  1070  1070  1068  1065  1059  1045  1015       *

                              920  948  *  976  1014  1047  1058  1059  1058  1054  1048  1033   999  964  *  966  967
                                         *       1025  1046  1051  1051  1048  1044  1034  1011       *

                                 918  946  *  974  1003  1023  1027  1027  1026  1022  1014   992  964  *  965  967
                                            *       1002  1010  1012  1011  1009  1005   994       *

                                               *  970   970   971   973   973   973   972   969  965  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               944         960   961   962   962   961   959   956       957

                                            917            949   950   950   949   948   946   943           948
```


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Table E11B-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11B-1

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 50.500 in

```
                              934             917   919   920   920   920   919   919            890

                                  953         946   949   949   949   949   948   947        935
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  972   975   977   978   978   977   976   975  977  *

                                        *         998  1011  1014  1015  1014  1012  1002        *
                                 979  975  *  972   998  1022  1030  1032  1032  1031  1025  1004  982  *  956  929

                                           *        1022  1049  1058  1060  1061  1060  1053  1028        *
                              982  979  *  975  1010  1049  1065  1070  1071  1071  1068  1054  1018  985  *  961  936

                                           *        1031  1066  1079  1083  1084  1084  1082  1071  1037        *
                           985  982  *  979  1016  1060  1080  1086  1088  1088  1088  1083  1064  1022  986  *  964  940

                                     *        1035  1073  1088  1092  1093  1093  1093  1090  1076  1039        *
                        987  985  *  983  1019  1064  1086  1092  1094  1094  1095  1094  1088  1067  1022  986  *  964  942

                                  *        1038  1076  1091  1095  1096  1096  1096  1096  1093  1078  1040        *
                     988  987  *  986  1022  1067  1089  1095  1097  1097  1097  1097  1097  1090  1068  1022  985  *  964  942

                           *        1039  1078  1094  1098  1098  1098  1098  1098  1098  1095  1079  1039        *
                  988  988  *  988  1021  1067  1090  1098  1099  1098  1098  1099  1099  1098  1091  1068  1019  983  *  963  942

                        *        1033  1076  1095  1100  1100  1100  1099  1100  1100  1100  1095  1076  1032        *
               986  987  *  987  1010  1060  1089  1099  1101  1101  1100  1100  1101  1101  1099  1090  1061  1009  982  *  962  942
               987  986  *  985                                                                                    984  *  948  911
               988  986  *  985  1010  1061  1090  1100  1102  1102  1101  1101  1102  1102  1101  1091  1062  1011  988  *  957  925
                        *        1034  1077  1097  1102  1103  1102  1102  1102  1103  1102  1097  1078  1035        *

                  990  989  *  987  1022  1071  1095  1103  1104  1104  1104  1104  1104  1103  1096  1072  1025  992  *  960  928
                           *        1043  1083  1100  1104  1105  1105  1105  1105  1105  1100  1084  1044        *

                     991  991  *  990  1027  1074  1097  1104  1106  1106  1106  1106  1105  1098  1075  1029  993  *  962  930
                           *        1046  1085  1101  1106  1107  1107  1107  1107  1102  1086  1047        *

                        992  993  *  993  1030  1076  1098  1106  1107  1108  1108  1107  1100  1077  1030  992  *  962  930
                              *        1048  1086  1102  1106  1107  1108  1107  1103  1088  1048        *

                           991  993  *  995  1031  1076  1097  1103  1105  1106  1105  1099  1077  1030  991  *  961  931
                                     *        1048  1083  1097  1101  1102  1102  1099  1086  1048        *

                              990  993  *  996  1029  1068  1084  1089  1091  1091  1087  1070  1028  989  *  960  930
                                        *        1041  1068  1077  1080  1081  1080  1071  1041        *

                                 987  991  *  994  1017  1040  1048  1051  1052  1051  1043  1017  987  *  959  929
                                           *        1016  1027  1031  1033  1034  1031  1018        *

                                              *  991   989   990   991   993   995   995   992  988  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           969         961   962   963   964   965   965   963        950

                                        948            932   933   934   935   935   934   932            910
```


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Table E11B-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                           890             914   915   915   915   913   912   910            887

                               931         944   945   944   943   941   939   937        927
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  971   973   974   972   970   967   965   963  964  *

                                   *         991   999  1000   998   995   989   980        *
                          920  946  *  971   991  1008  1014  1013  1010  1006   997   981  967  *  942  916

                                     *        1009  1031  1038  1038  1035  1030  1019   998        *
                             922  949  *  974  1001  1032  1045  1048  1046  1042  1035  1019   990  969  *  944  919

                                     *        1018  1048  1060  1062  1060  1056  1049  1033  1004        *
                           924  951  *  977  1006  1042  1061  1066  1066  1063  1058  1048  1027   993  969  *  945  921

                                   *        1022  1054  1069  1073  1072  1069  1064  1055  1037  1005        *
                       925  953  *  980  1009  1047  1067  1074  1074  1072  1068  1063  1051  1028   993  969  *  946  921

                                 *        1024  1057  1073  1077  1077  1074  1071  1066  1056  1037  1004        *
                     926  955  *  983  1011  1048  1070  1078  1078  1076  1073  1069  1063  1051  1027   991  969  *  946  922

                               *        1024  1057  1074  1080  1079  1076  1073  1070  1065  1055  1035  1002        *
                  926  956  *  984  1009  1047  1070  1079  1080  1078  1075  1072  1068  1062  1049  1024   988  969  *  946  922

                           *        1017  1054  1074  1080  1080  1078  1075  1072  1069  1063  1052  1030   996        *
925  955  *  983  1000  1039  1067  1079  1081  1080  1077  1074  1071  1067  1059  1044  1016   982  969  *  946  922
905  944  *  981                                                *                                  972  *  953  932
930  956  *  981   999  1039  1067  1079  1081  1080  1077  1074  1071  1067  1060  1044  1017   984  975  *  973  970
           *        1017  1054  1074  1081  1081  1078  1075  1073  1069  1064  1053  1031   999        *

   932  958  *  983  1008  1047  1071  1079  1080  1078  1076  1073  1069  1063  1050  1027   994  978  *  976  974
              *        1024  1058  1075  1080  1080  1077  1074  1071  1066  1056  1037  1007        *

      933  959  *  985  1012  1050  1071  1078  1079  1077  1074  1070  1064  1053  1030   998  979  *  979  978
                 *        1026  1059  1074  1078  1078  1075  1072  1067  1058  1040  1010        *

         933  961  *  987  1013  1049  1069  1076  1076  1074  1070  1065  1053  1032   999  980  *  980  980
                    *        1026  1057  1071  1075  1073  1071  1066  1058  1040  1011        *

            933  961  *  988  1013  1046  1064  1069  1068  1065  1061  1051  1031   999  980  *  981  982
                       *        1024  1051  1062  1064  1063  1059  1052  1037  1010        *

               932  961  *  988  1010  1037  1049  1052  1051  1047  1040  1024   997  979  *  981  983
                          *        1017  1036  1042  1043  1041  1036  1026  1005        *

                  931  959  *  986  1000  1015  1020  1021  1020  1016  1008   991  979  *  981  982
                             *         999  1007  1009  1009  1007  1003   993        *

                                *  984   984   985   986   987   987   986   983  981  *
                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                               958         973   974   975   975   974   973   970        972

                                  931            962   963   963   963   962   960   957            964
```


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Table E11B-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              965             944   945   946   947   948   948   949            924

                                  983         973   975   976   976   977   977   978        967
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1000  1001  1003  1004  1004  1005  1005  1005 1007  *

                                   *        1008  1014  1017  1018  1018  1016  1013        *
                              1010 1006  * 1002  1009  1017  1023  1025  1026  1024  1020  1015 1010  *  987  963

                                 *        1017  1029  1037  1041  1041  1039  1033  1023        *
                            1013 1008  * 1004  1015  1030  1041  1047  1049  1048  1043  1034  1021 1012  *  992  971

                                *        1024  1041  1054  1061  1063  1062  1056  1045  1030        *
                          1015 1011  * 1007  1020  1039  1054  1064  1068  1069  1065  1057  1043  1025 1013  *  995  976

                               *        1029  1049  1065  1074  1078  1079  1075  1067  1052  1033        *
                      1016 1013  * 1010  1023  1044  1063  1075  1081  1083  1082  1076  1065  1047  1026 1013  *  996  978

                             *        1031  1053  1071  1082  1087  1089  1088  1083  1073  1055  1033        *
                 1017 1014  * 1012  1025  1047  1067  1080  1088  1091  1091  1089  1082  1068  1048  1025 1012  *  996  980

                           *        1031  1054  1073  1086  1092  1095  1095  1093  1087  1074  1055  1031        *
              1017 1015  * 1014  1024  1045  1067  1082  1091  1095  1096  1096  1092  1083  1068  1046  1023 1011  *  996  981

                        *        1028  1050  1071  1086  1094  1097  1098  1098  1095  1087  1072  1050  1026        *
           1016 1015  * 1014  1020  1039  1062  1080  1092  1097  1099  1099  1097  1092  1081  1063  1039  1018 1010  *  996  981
           1014 1014  * 1014                                          *                                    1010  *  977  943
           1012 1013  * 1014  1021  1040  1063  1082  1093  1098  1100  1100  1099  1093  1082  1063  1040  1019 1012  *  980  947
                        *        1029  1051  1073  1088  1097  1100  1101  1100  1097  1089  1073  1051  1028        *

              1012 1014  * 1016  1026  1049  1071  1087  1096  1100  1101  1101  1097  1088  1071  1049  1025 1014  *  982  949
                           *        1035  1059  1079  1092  1098  1101  1101  1099  1092  1079  1059  1034        *

                 1012 1015  * 1018  1031  1054  1075  1089  1097  1100  1100  1097  1089  1075  1053  1029 1014  *  983  950
                              *        1039  1062  1080  1092  1097  1099  1098  1092  1081  1062  1037        *

                    1011 1016  * 1020  1033  1055  1074  1086  1093  1095  1093  1087  1074  1054  1030 1014  *  983  951
                                 *        1041  1062  1078  1087  1091  1091  1087  1078  1061  1038        *

                       1010 1016  * 1022  1034  1053  1069  1078  1083  1083  1079  1069  1051  1029 1013  *  983  952
                                    *        1040  1057  1069  1076  1078  1076  1069  1056  1036        *

                          1008 1016  * 1023  1032  1046  1057  1063  1065  1063  1057  1044  1026 1013  *  983  952
                                       *        1035  1046  1053  1057  1057  1054  1045  1031        *

                             1005 1014  * 1022  1027  1034  1038  1041  1041  1039  1033  1022 1012  *  983  952
                                          *        1026  1030  1032  1033  1033  1030  1023        *

                                        * 1020  1018  1018  1018  1019  1019  1018  1016 1013  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     995         990   989   989   989   989   988   986        974

                                  969            960   959   959   959   958   957   955            933
```


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Table E11B-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                            912             933   934   936   937   938   938   938            912

                                951         962   963   964   964   965   965   965        953
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  989   990   991   991   991   991   991   991  992  *

                                  *         996  1000  1001  1001  1000   998   995        *
                           943  966  *  989   996  1003  1006  1007  1006  1004  1000   997  994  *  967  938

                                     *        1003  1012  1017  1019  1017  1014  1008  1002        *
                           944  967  *  990  1000  1013  1021  1024  1024  1021  1016  1008  1001  996  *  970  942

                                     *        1008  1022  1031  1035  1035  1032  1025  1016  1006        *
                        944  968  *  992  1004  1020  1032  1039  1041  1039  1033  1025  1014  1004  998  *  972  944

                                  *        1012  1029  1041  1048  1050  1048  1042  1033  1021  1008        *
                     945  970  *  993  1006  1025  1039  1049  1053  1053  1049  1041  1030  1017  1005  999  *  974  947

                              *        1014  1032  1046  1056  1060  1059  1055  1047  1036  1022  1009        *
                  945  970  *  995  1007  1026  1043  1055  1061  1063  1060  1054  1045  1032  1018  1006 1000  *  975  949

                           *        1013  1032  1048  1059  1065  1067  1064  1058  1049  1036  1021  1009        *
               944  971  *  996  1006  1025  1042  1056  1065  1068  1067  1063  1055  1044  1030  1016  1005 1002  *  977  951

                        *        1010  1028  1045  1059  1067  1070  1069  1065  1057  1047  1033  1018  1007        *
          944  970  *  996  1003  1019  1038  1054  1064  1069  1070  1068  1062  1053  1041  1026  1013  1005 1003  *  978  952
          926  961  *  995                                                                                1005  *  983  960
          950  973  *  995  1003  1020  1038  1054  1064  1070  1071  1068  1062  1053  1041  1027  1014  1007 1007  * 1003  998
                        *        1010  1029  1046  1059  1067  1070  1069  1065  1058  1047  1034  1020  1010        *

               950  974  *  997  1007  1026  1044  1058  1066  1069  1068  1064  1057  1046  1033  1020  1010 1008  * 1005 1001
                           *        1015  1034  1050  1061  1067  1068  1065  1060  1051  1039  1025  1014        *

                  951  975  *  999  1011  1030  1046  1057  1063  1065  1062  1057  1048  1036  1023  1012 1009  * 1006 1004
                              *        1018  1036  1050  1058  1062  1062  1058  1051  1040  1028  1016        *

                     951  976  * 1000  1012  1030  1044  1053  1057  1057  1053  1046  1036  1024  1013 1009  * 1008 1007
                                 *        1019  1034  1046  1052  1054  1052  1047  1038  1027  1017        *

                        951  977  * 1002  1013  1027  1038  1044  1047  1045  1040  1032  1023  1013 1008  * 1008 1008
                                    *        1017  1030  1038  1042  1042  1039  1033  1025  1016        *

                           951  977  * 1002  1011  1022  1029  1033  1033  1031  1026  1019  1012 1008  * 1009 1009
                                       *        1014  1022  1027  1029  1028  1025  1020  1013        *

                              951  977  * 1002  1008  1014  1018  1020  1019  1017  1014  1010 1007  * 1008 1009
                                          *        1008  1012  1014  1015  1015  1013  1010        *

                                       * 1002  1003  1004  1006  1007  1008  1008  1008 1007  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *   *
                                    979         995   996   997   998   998   998   997       1000

                                 956            987   988   989   989   988   987   986            993
```


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Table B11B-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                            970             980   984   986   987   987   986   984            949

                                975         982   986   987   988   987   986   984        967
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  979   984   987   988   988   987   986   984  984  *

                                  *        1024  1038  1042  1043  1043  1041  1030        *
                           970  974  *  978  1022  1052  1061  1063  1064  1064  1059  1032  989  *  966  943

                                 *        1051  1080  1089  1092  1094  1094  1088  1062        *
                          972  976  *  979  1034  1080  1096  1100  1102  1104  1103  1090  1047  992  *  969  944

                                 *        1059  1096  1108  1112  1114  1115  1115  1105  1071        *
                         974  978  *  982  1039  1089  1108  1114  1117  1118  1119  1116  1100  1051  994  *  970  945

                                *        1063  1102  1115  1119  1121  1122  1123  1122  1111  1074        *
                       975  980  *  984  1042  1093  1114  1120  1122  1123  1124  1125  1121  1103  1053  994  *  970  946

                                *        1066  1105  1119  1123  1124  1125  1126  1127  1126  1114  1076        *
                     976  981  *  987  1046  1097  1117  1123  1125  1125  1126  1128  1128  1124  1105  1054  994  *  970  945

                               *        1069  1109  1123  1126  1127  1128  1128  1129  1130  1129  1116  1076        *
                   976  982  *  988  1046  1100  1121  1127  1128  1128  1129  1130  1131  1131  1127  1107  1052  993  *  969  945

                             *        1065  1110  1126  1130  1131  1131  1131  1132  1133  1134  1131  1116  1071        *
                 974  981  *  987  1035  1096  1123  1131  1132  1132  1132  1132  1133  1135  1134  1128  1102  1042  992  *  968  944
                 931  957  *  983                                                                                    993  *  950  905
                 924  954  *  983  1035  1098  1126  1133  1135  1135  1135  1135  1136  1137  1136  1130  1104  1045  999  *  965  929
                             *        1068  1115  1132  1136  1136  1136  1136  1137  1137  1138  1135  1120  1076        *

                   927  957  *  987  1050  1110  1132  1138  1139  1139  1139  1139  1140  1140  1135  1114  1061 1004  *  969  933
                               *        1078  1122  1137  1140  1140  1140  1140  1141  1141  1139  1126  1085        *

                      930  961  *  991  1057  1115  1137  1142  1143  1143  1143  1144  1143  1139  1119  1065 1006  *  971  936
                               *        1084  1127  1141  1144  1145  1145  1145  1145  1143  1129  1089        *

                         932  964  *  995  1061  1119  1141  1146  1147  1147  1148  1147  1142  1122  1068 1007  *  973  937
                                 *        1088  1131  1145  1148  1148  1148  1148  1146  1133  1092        *

                            934  967  *  999  1065  1122  1143  1148  1148  1149  1148  1144  1124  1069 1006  *  973  938
                                         *        1090  1131  1144  1146  1147  1147  1145  1133  1093        *

                               935  969  * 1001  1066  1118  1134  1138  1138  1138  1136  1120  1069 1005  *  972  938
                                         *        1086  1119  1127  1129  1129  1129  1121  1088        *

                                  934  968  * 1000  1054  1087  1096  1098  1099  1099  1091  1057 1003  *  971  937
                                           *        1053  1068  1073  1075  1076  1074  1060        *

                                             *  995   997  1002  1006  1009  1011  1012  1009 1003  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          954         970   974   977   979   980   980   978        959

                                        911             942   945   946   947   948   947   945            913
```


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Table B11B-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          882          905   906   905   903   901   899   896          872

                              921      934   934   933   930   927   924   922      911
                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  959   962   962   959   956   952   949   947  947  *

                                *      998  1006  1005  1001   997   991   979      *
                        912  937  *  961   998  1021  1024  1021  1017  1011  1002   980  951  *  926  901

                             *      1023  1046  1050  1048  1043  1037  1026  1001      *
                    915  941  *  966  1011  1048  1059  1059  1055  1049  1041  1025   990  953  *  929  904

                           *      1033  1063  1072  1071  1067  1061  1054  1039  1007      *
                  918  945  *  970  1017  1059  1074  1076  1073  1068  1062  1052  1032   992  953  *  930  905

                         *      1038  1070  1081  1081  1077  1073  1067  1058  1041  1008      *
              920  948  *  974  1021  1064  1081  1084  1081  1076  1071  1065  1054  1032   992  953  *  930  906

                       *      1041  1074  1085  1086  1082  1078  1073  1067  1059  1041  1007      *
           922  950  *  977  1024  1067  1084  1087  1085  1080  1076  1071  1065  1054  1032   991  953  *  930  906

                     *      1042  1076  1088  1089  1085  1081  1076  1072  1066  1058  1040  1005      *
        923  952  *  980  1023  1067  1086  1090  1088  1083  1079  1074  1070  1064  1052  1029   988  953  *  930  906

                  *      1037  1074  1089  1092  1088  1084  1079  1075  1070  1065  1055  1036  1000      *
     922  951  *  979  1014  1061  1085  1092  1091  1086  1082  1077  1073  1068  1062  1048  1022   981  953  *  930  906
     895  936  *  976                                                                                  956  *  936  914
     923  951  *  977  1013  1061  1086  1092  1091  1087  1082  1078  1073  1069  1062  1049  1023   983  960  *  957  953
                  *      1037  1075  1090  1092  1089  1085  1080  1076  1072  1066  1057  1037  1003      *

        925  953  *  980  1024  1069  1088  1092  1089  1085  1081  1076  1072  1066  1055  1033   995  964  *  961  958
                     *      1043  1078  1090  1091  1088  1083  1079  1074  1069  1061  1044  1011      *

           926  955  *  982  1027  1070  1087  1090  1088  1084  1079  1075  1069  1058  1037   999  966  *  964  962
                        *      1045  1077  1089  1089  1086  1082  1077  1072  1063  1047  1015      *

              927  956  *  984  1028  1069  1085  1088  1085  1081  1077  1071  1060  1039  1001  967  *  966  965
                           *      1044  1076  1086  1086  1083  1078  1073  1065  1048  1017      *

                 927  956  *  985  1027  1066  1080  1082  1079  1075  1069  1060  1040  1002  967  *  967  967
                              *      1042  1070  1078  1078  1074  1069  1062  1047  1017      *

                    926  956  *  985  1024  1057  1067  1067  1064  1059  1052  1035  1001  967  *  968  969
                              *      1035  1055  1059  1057  1054  1048  1038  1013      *

                       924  954  *  983  1013  1032  1035  1034  1031  1027  1018   995  968  *  968  969
                                 *      1011  1019  1019  1018  1015  1010   998      *

                                   *  979   979   980   980   980   979   977   973  970  *
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                949          967   968   969   968   967   964   961      960

                           918            956   957   956   955   954   951   948          951
```


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Table B11B-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                            987             997  1001  1003  1004  1004  1003  1000            970

                                992         999  1002  1004  1004  1003  1002  1000        985
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  997  1000  1004  1005  1004  1003  1001   999 1000  *

                                   *        1020  1033  1038  1039  1039  1036  1025        *
                              986  990  *  994  1018  1043  1053  1055  1056  1055  1049  1027 1004  *  983  962

                                  *        1041  1070  1081  1084  1086  1085  1078  1052        *
                             987  991  *  995  1029  1070  1088  1094  1096  1097  1094  1079  1041 1008  *  986  964

                                  *        1050  1088  1103  1108  1110  1111  1109  1097  1061        *
                            989  993  *  997  1034  1081  1103  1111  1114  1115  1115  1111  1091  1046 1009  *  987  965

                                 *        1054  1095  1112  1117  1119  1121  1121  1118  1104  1065        *
                       990  995  *  999  1038  1085  1109  1118  1121  1122  1123  1123  1117  1095  1047 1009  *  987  965

                              *        1058  1099  1116  1122  1124  1125  1126  1126  1123  1107  1066        *
                    990  996  * 1002  1040  1089  1113  1122  1124  1125  1126  1127  1127  1120  1097  1048 1009  *  987  964

                           *        1059  1102  1120  1125  1127  1128  1128  1129  1130  1126  1109  1066        *
                 989  996  * 1003  1040  1091  1117  1125  1128  1128  1129  1130  1131  1130  1122  1097  1046 1008  *  986  964

                        *        1054  1101  1122  1129  1131  1131  1131  1132  1133  1133  1127  1107  1060        *
           987  994  * 1002  1028  1084  1117  1129  1132  1132  1132  1133  1134  1134  1132  1122  1091  1036 1007  *  986  963
           945  972  *  998                                                                                1009  *  966  921
           937  968  *  997  1028  1086  1119  1131  1134  1135  1135  1135  1136  1136  1135  1124  1093  1039 1014  *  978  941
                        *        1055  1105  1128  1135  1136  1136  1136  1137  1137  1137  1131  1111  1065        *

              940  970  * 1000  1042  1099  1127  1137  1139  1139  1139  1139  1140  1138  1130  1105  1054 1019  *  983  945
                           *        1067  1114  1134  1139  1140  1140  1140  1141  1141  1136  1118  1075        *

                 942  973  * 1003  1049  1105  1132  1141  1143  1143  1143  1143  1142  1134  1110  1059 1021  *  985  948
                           *        1072  1119  1138  1143  1144  1144  1145  1144  1139  1122  1079        *

                       944  976  * 1007  1054  1110  1136  1144  1146  1146  1146  1145  1137  1113  1062 1021  *  986  950
                                 *        1076  1122  1141  1146  1147  1147  1146  1142  1124  1082        *

                          946  979  * 1011  1057  1111  1136  1143  1145  1145  1144  1137  1114  1062 1020  *  986  951
                                       *        1078  1121  1137  1141  1142  1142  1138  1123  1082        *

                             946  981  * 1013  1057  1104  1124  1129  1130  1130  1126  1107  1060 1019  *  985  951
                                       *        1072  1105  1116  1119  1120  1118  1108  1076        *

                                945  980  * 1013  1045  1073  1083  1087  1088  1087  1078  1049 1017  *  984  950
                                           *        1044  1059  1064  1067  1068  1065  1051        *

                                             * 1009  1010  1014  1018  1022  1024  1025  1023 1018  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          967         983   986   990   992   994   994   992        974

                                      924             955   958   960   961   961   961   959            927
```


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Table B11B-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          892          915   916   915   914   912   910   908          883

                              932       944   944   943   941   938   936   935       923
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  970   972   972   970   967   964   961   960  961  *

                                    *       992  1000  1000   997   992   986   977       *
                             923  948  *  972   992  1010  1015  1013  1009  1003   994   978  964  *  938  911

                                      *       1013  1034  1040  1039  1034  1028  1016   994       *
                           926  951  *  975  1005  1036  1049  1050  1047  1041  1032  1015   987  966  *  941  915

                                    *       1023  1053  1064  1065  1061  1056  1047  1030  1001       *
                         929  955  *  980  1011  1048  1066  1070  1068  1064  1057  1045  1024   990  967  *  942  917

                                  *       1028  1061  1075  1077  1075  1070  1064  1054  1034  1002       *
                       931  958  *  984  1015  1054  1074  1080  1078  1074  1069  1062  1049  1025   990  967  *  943  918

                             *       1032  1065  1080  1083  1081  1077  1072  1065  1055  1035  1002       *
                    932  961  *  988  1018  1057  1078  1085  1084  1080  1075  1070  1062  1049  1025   989  967  *  943  919

                           *       1032  1067  1083  1087  1085  1081  1076  1071  1065  1054  1033  1000       *
                933  962  *  990  1017  1057  1080  1087  1087  1083  1079  1074  1069  1061  1047  1022   987  968  *  944  919

                        *       1027  1064  1083  1089  1088  1084  1079  1075  1070  1063  1051  1028   994       *
            932  962  *  990  1008  1049  1077  1088  1089  1086  1082  1077  1073  1067  1059  1042  1014   981  969  *  945  919
            907  948  *  988                                                                              973  *  951  929
            935  962  *  988  1008  1049  1078  1089  1090  1086  1082  1078  1073  1068  1059  1043  1016   984  976  *  972  968
                        *       1027  1064  1084  1090  1088  1085  1080  1076  1071  1064  1052  1030   998       *

                936  964  *  991  1018  1058  1081  1089  1088  1085  1081  1076  1071  1064  1050  1026   994  979  *  976  973
                           *       1034  1069  1085  1089  1087  1083  1079  1074  1068  1057  1037  1007       *

                   937  966  *  993  1022  1060  1081  1087  1087  1083  1079  1074  1066  1054  1031   999  981  *  979  977
                              *       1036  1069  1084  1087  1085  1081  1076  1070  1060  1041  1010       *

                       938  967  *  996  1023  1060  1079  1084  1083  1079  1074  1068  1055  1033  1001  982  *  981  981
                                 *       1036  1067  1080  1082  1080  1076  1070  1060  1042  1012       *

                          938  968  *  997  1023  1056  1073  1077  1075  1071  1065  1054  1033  1002  983  *  983  983
                                       *       1034  1061  1071  1072  1069  1064  1056  1040  1012       *

                             937  968  *  997  1019  1046  1058  1059  1057  1052  1044  1027  1000  983  *  984  985
                                          *       1026  1045  1050  1050  1046  1041  1029  1008       *

                                936  966  *  995  1009  1024  1028  1028  1026  1021  1012   995  984  *  984  985
                                           *       1008  1015  1017  1016  1013  1008   998       *

                                             *  993   992   993   994   994   994   992   989  986  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                           963         981   982   982   982   981   979   976       977

                                         932           969   970   970   969   968   965   962          967
```


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Table B11B-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1021            1031  1034  1036  1037  1038  1038  1037           1017

                               1029        1034  1036  1038  1038  1038  1038  1037       1027
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1036  1037  1039  1039  1039  1038  1038  1037 1037  *

                                 *       1040  1045  1048  1049  1048  1046  1042        *
                          1021 1028  * 1035  1039  1046  1052  1055  1055  1053  1049  1043 1039  * 1025 1012

                                 *       1045  1056  1064  1068  1069  1066  1060  1050        *
                        1021 1028  * 1034  1042  1056  1067  1074  1076  1075  1070  1061  1049 1040  * 1026 1012

                               *       1050  1066  1079  1087  1090  1089  1083  1072  1057        *
                      1020 1028  * 1035  1045  1063  1079  1089  1095  1096  1093  1084  1070  1052 1041  * 1027 1012

                             *       1053  1073  1090  1100  1105  1106  1103  1095  1080  1060        *
                    1019 1027  * 1035  1047  1068  1087  1100  1108  1110  1110  1104  1093  1075  1054 1041  * 1026 1011

                           *       1054  1077  1096  1108  1115  1117  1117  1112  1102  1084  1061        *
                 1018 1027  * 1036  1047  1070  1091  1107  1115  1120  1120  1118  1111  1097  1077  1053 1040  * 1025 1010

                         *       1053  1077  1099  1113  1121  1124  1125  1123  1117  1104  1084  1060        *
               1016 1026  * 1035  1045  1068  1092  1110  1120  1125  1127  1127  1123  1114  1098  1075  1051 1039  * 1024 1009

                       *       1048  1073  1097  1114  1124  1128  1130  1130  1127  1118  1102  1079  1055        *
          1013 1024  * 1034  1039  1061  1087  1108  1122  1128  1131  1132  1130  1125  1113  1093  1068  1047 1038  * 1023 1008
           974 1003  * 1031                                                                                 1038  *  998  957
           971 1001  * 1030  1038  1061  1088  1110  1124  1131  1133  1134  1132  1127  1115  1095  1070  1048 1040  * 1004  966
                       *       1047  1074  1100  1119  1129  1133  1135  1134  1131  1122  1106  1082  1058        *

              971 1001  * 1029  1043  1071  1099  1118  1129  1135  1136  1135  1131  1122  1104  1080  1055 1043  * 1007  969
                         *       1054  1083  1108  1124  1133  1136  1136  1134  1127  1113  1091  1065        *

                 971 1001  * 1030  1047  1078  1104  1122  1132  1136  1136  1133  1125  1109  1086  1059 1043  * 1008  972
                           *       1059  1089  1112  1126  1133  1135  1134  1128  1115  1095  1069        *

                    971 1002  * 1031  1050  1081  1105  1121  1129  1131  1130  1123  1109  1087  1061 1043  * 1009  973
                              *       1061  1090  1110  1122  1128  1128  1124  1113  1095  1070        *

                       971 1002  * 1032  1051  1079  1100  1113  1119  1119  1115  1104  1085  1060 1042  * 1009  974
                                 *       1060  1085  1101  1110  1114  1112  1105  1090  1068        *

                          970 1002  * 1033  1050  1072  1087  1095  1099  1097  1091  1077  1057 1041  * 1008  975
                                    *       1055  1072  1083  1089  1090  1087  1078  1062        *

                             969 1001  * 1032  1043  1056  1064  1069  1071  1069  1063  1051 1039  * 1008  975
                                       *       1043  1051  1057  1060  1061  1059  1052        *

                                         * 1030  1030  1033  1036  1039  1041  1042  1042 1039  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       990       1005  1007  1009  1011  1012  1013  1012        997

                                   949             979   980   981   982   982   982   981            952
```


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Table B11B-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                          915          933   935   936   937   937   938   938          908

                              952      962   963   964   964   964   964   965      950
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  988   989   990   990   990   989   989   990  992  *

                                 *      996   999  1001  1000   998   996   994      *
                        946  968  *  988   996  1003  1006  1007  1005  1002   999   995  994  *  964  933

                                *      1004  1013  1018  1019  1017  1013  1007  1000      *
                           947  969  *  990  1001  1014  1022  1025  1024  1021  1015  1007  1000  996  *  967  937

                                *      1010  1024  1033  1037  1036  1032  1024  1015  1005      *
                      949  971  *  992  1006  1023  1035  1041  1042  1039  1033  1024  1013  1003  998  *  970  941

                               *      1015  1032  1045  1051  1052  1049  1042  1032  1020  1008      *
                 950  972  *  994  1009  1028  1044  1053  1056  1055  1050  1041  1029  1016  1005 1000  *  973  944

                            *      1017  1037  1052  1061  1064  1062  1056  1047  1035  1022  1009      *
               950  974  *  996  1011  1031  1048  1060  1066  1066  1062  1055  1045  1031  1017  1006 1002  *  975  946

                          *      1017  1037  1054  1065  1070  1070  1067  1059  1049  1036  1021  1009      *
          950  975  *  998  1010  1030  1049  1063  1071  1073  1071  1065  1056  1044  1030  1016  1006 1004  *  977  949

                       *      1014  1034  1053  1066  1073  1075  1073  1067  1059  1047  1033  1018  1009      *
     950  975  *  999  1007  1025  1045  1061  1071  1075  1075  1071  1064  1054  1041  1026  1014  1007 1006  *  979  951
     930  964  *  998                                                                                  1009  *  983  957
     954  977  *  999  1007  1026  1046  1062  1072  1076  1076  1072  1065  1055  1042  1027  1015  1009 1010  * 1004  998
                 *      1016  1036  1054  1067  1074  1076  1074  1069  1060  1049  1035  1021  1012      *

          955  979  * 1001  1013  1034  1052  1066  1073  1075  1073  1068  1059  1048  1034  1021  1013 1012  * 1007 1001
                       *      1021  1042  1058  1069  1073  1073  1070  1063  1053  1040  1027  1016      *

               956  980  * 1003  1017  1037  1054  1065  1070  1071  1067  1060  1050  1038  1025  1016 1013  * 1009 1005
                            *      1025  1044  1058  1066  1069  1067  1062  1054  1043  1030  1019      *

                    957  982  * 1006  1019  1038  1052  1060  1064  1062  1057  1049  1039  1027  1018 1014  * 1011 1008
                                 *      1026  1042  1054  1059  1060  1057  1051  1042  1031  1021      *

                         957  983  * 1007  1020  1035  1046  1052  1053  1051  1045  1036  1027  1018 1014  * 1012 1010
                                      *      1025  1038  1046  1049  1048  1044  1038  1029  1020      *

                              957  983  * 1008  1018  1030  1037  1040  1040  1037  1031  1024  1017 1014  * 1013 1012
                                           *      1021  1030  1034  1036  1034  1031  1025  1019      *

                                   957  983  * 1009  1015  1022  1025  1027  1026  1024  1020  1016 1014  * 1013 1012
                                                *      1015  1019  1022  1022  1022  1020  1017      *

                                                 * 1008  1009  1011  1013  1014  1015  1015  1014 1014  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                984        1002  1003  1004  1005  1005  1004  1003       1005

                                           958          994   995   995   995   994   993   992          996
```


ANL-OUO-FCI
VOID

Table E11B-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              955             965   968   971   972   972   971   968            937

                                  958         965   969   970   971   971   970   967        952
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                        *  961   966   969   970   970   970   968   966  966  *

                                     *        1003  1016  1020  1021  1022  1020  1010        *
                                953  957  *  960  1001  1029  1037  1040  1041  1042  1037  1012  971  *  950  929

                                        *        1028  1055  1064  1067  1068  1069  1064  1040        *
                             955  958  *  961  1012  1055  1070  1074  1077  1078  1077  1066  1026  974  *  953  931

                                     *        1035  1070  1081  1085  1087  1089  1089  1080  1048        *
                          957  960  *  963  1017  1063  1082  1087  1089  1091  1092  1090  1075  1029  975  *  954  931

                                  *        1039  1075  1088  1091  1093  1095  1096  1095  1085  1051        *
                       958  962  *  965  1020  1067  1086  1092  1094  1095  1097  1098  1095  1078  1031  976  *  954  931

                              *        1042  1079  1091  1095  1096  1097  1098  1100  1099  1088  1052        *
                    959  963  *  968  1023  1071  1089  1095  1096  1097  1098  1100  1101  1097  1080  1032  975  *  954  931

                           *        1044  1082  1094  1098  1098  1099  1100  1101  1103  1101  1090  1053        *
                 959  964  *  969  1023  1073  1093  1098  1099  1100  1100  1101  1103  1104  1100  1081  1030  974  *  953  930

                        *        1041  1082  1098  1101  1101  1102  1102  1103  1104  1105  1103  1090  1048        *
           957  963  *  968  1013  1069  1094  1102  1103  1103  1103  1103  1105  1106  1106  1100  1077  1020  973  *  952  929
           917  941  *  964                                                                                 974  *  934  894
           910  938  *  964  1013  1071  1097  1104  1105  1105  1105  1105  1106  1108  1108  1102  1078  1023  979  *  948  915
                        *        1043  1087  1103  1106  1106  1106  1106  1107  1108  1109  1107  1093  1052        *

              913  941  *  967  1027  1082  1103  1108  1109  1109  1109  1109  1110  1111  1106  1087  1037  984  *  952  919
                           *        1053  1094  1107  1110  1110  1110  1110  1111  1112  1110  1098  1060        *

                 915  944  *  971  1033  1087  1107  1112  1112  1112  1113  1113  1113  1109  1091  1041  985  *  954  921
                           *        1057  1098  1111  1113  1114  1114  1114  1115  1113  1101  1063        *

                       917  947  *  975  1037  1090  1110  1115  1116  1116  1116  1116  1112  1093  1043  985  *  954  922
                                 *        1061  1101  1114  1116  1117  1117  1117  1115  1103  1065        *

                          919  949  *  978  1040  1092  1111  1116  1117  1117  1117  1113  1095  1044  985  *  954  923
                                       *        1063  1101  1112  1115  1115  1116  1114  1103  1066        *

                             919  950  *  980  1040  1088  1103  1106  1107  1107  1105  1090  1043  983  *  954  923
                                           *        1059  1089  1097  1098  1099  1098  1091  1061        *

                                919  949  *  979  1029  1059  1067  1070  1071  1070  1064  1032  981  *  952  922
                                           *        1028  1042  1046  1048  1049  1047  1034        *

                                              *  974   976   980   984   987   989   989   987  981  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           937         951   954   957   959   960   960   958        941

                                        897            925   928   929   930   930   930   928           899
```


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Table E11B-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          874             897   898   897   896   894   892   890            869

                              912         924   925   923   921   919   916   914        903
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  948   951   951   948   945   942   939   937  937  *

                                  *         984   992   991   988   984   979   968        *
                          902  926  *  949   984  1005  1009  1007  1003   998   990   968  940  *  918  895

                                    *        1007  1029  1033  1031  1028  1022  1012   989        *
                          905  929  *  953   995  1030  1041  1041  1038  1034  1027  1011   977  942  *  920  897

                                    *        1015  1044  1053  1053  1049  1045  1038  1024   994        *
                          907  932  *  957  1000  1040  1055  1057  1054  1051  1046  1037  1017   979  942  *  920  898

                                  *        1019  1050  1061  1061  1058  1054  1050  1042  1026   994        *
                      909  935  *  960  1003  1043  1060  1063  1061  1057  1053  1048  1038  1018   978  941  *  920  898

                              *        1021  1053  1064  1065  1062  1058  1054  1050  1042  1025   993        *
                  910  937  *  962  1005  1045  1062  1066  1064  1060  1056  1052  1047  1037  1016   977  940  *  919  898

                          *        1022  1054  1066  1067  1064  1060  1056  1053  1048  1040  1023   990        *
              910  938  *  964  1004  1045  1063  1068  1066  1062  1058  1055  1051  1045  1035  1013   974  939  *  919  898

                      *        1017  1052  1066  1068  1066  1062  1058  1054  1051  1046  1038  1019   985        *
          909  937  *  963   995  1039  1062  1069  1068  1064  1060  1056  1053  1049  1043  1031  1006   966  940  *  919  897
          884  923  *  960                                                                                  942  *  925  906
          910  936  *  961   994  1039  1062  1069  1068  1064  1060  1056  1053  1049  1043  1031  1007   968  946  *  944  942
                      *        1016  1052  1066  1069  1066  1062  1058  1055  1051  1047  1038  1020   987        *

              912  938  *  963  1004  1045  1064  1068  1066  1062  1058  1055  1051  1046  1036  1015   979  949  *  948  946
                          *        1022  1054  1066  1067  1064  1060  1057  1053  1049  1041  1025   994        *

                  912  939  *  965  1006  1046  1063  1066  1064  1061  1057  1053  1048  1038  1018   982  950  *  950  950
                              *        1023  1054  1064  1065  1062  1059  1055  1050  1043  1027   997        *

                      913  940  *  966  1007  1045  1061  1064  1062  1058  1054  1049  1039  1020   984  951  *  951  952
                                  *        1022  1052  1061  1062  1059  1055  1051  1043  1028   998        *

                          913  940  *  967  1006  1042  1056  1058  1056  1052  1047  1038  1020   984  951  *  952  954
                                      *        1020  1047  1054  1054  1051  1047  1040  1027   998        *

                              912  940  *  967  1003  1034  1043  1044  1041  1037  1030  1015   983  951  *  953  955
                                          *        1013  1032  1036  1035  1032  1027  1017   994        *

                                  910  938  *  964   992  1010  1014  1013  1010  1006   998   977  951  *  953  954
                                              *         991   998   999   997   995   990   979        *

                                                  *  961   961   961   962   962   961   959   956  953  *
                                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                                933         950   951   951   951   949   947   944        945

                                            905             939   940   940   939   937   935   932            937
```


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Table E11B-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11B-2

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 50.500 in

```
                              972             981   984   986   987   988   987   984            956

                                  975         981   984   986   986   986   985   983        970
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  978   981   985   986   985   984   983   981  982  *

                                    *        1000  1012  1016  1017  1017  1015  1005        *
                           968  972  *  976   998  1021  1030  1033  1034  1033  1027  1007  985  *  967  948

                                      *        1019  1046  1056  1060  1061  1061  1054  1030        *
                              970  973  *  976  1008  1046  1063  1068  1070  1072  1069  1056  1020  989  *  969  949

                                      *        1027  1062  1076  1081  1083  1085  1083  1072  1039        *
                             971  974  *  978  1012  1055  1076  1084  1087  1088  1089  1085  1066  1024  990  *  970  949

                                    *        1031  1068  1084  1090  1092  1093  1094  1092  1078  1042        *
                         972  976  *  980  1015  1060  1082  1090  1093  1094  1096  1096  1090  1070  1026  990  *  970  949

                                *        1034  1072  1088  1094  1096  1097  1098  1099  1096  1081  1043        *
                       972  977  *  982  1018  1063  1086  1094  1096  1097  1098  1100  1099  1093  1072  1026  989  *  969  949

                             *        1035  1075  1092  1097  1098  1099  1100  1101  1102  1098  1083  1043        *
                    972  978  *  983  1017  1065  1089  1097  1099  1100  1100  1101  1103  1102  1096  1072  1024  988  *  968  948

                          *        1030  1074  1094  1100  1101  1102  1102  1103  1104  1105  1100  1081  1037        *
                970  976  *  982  1006  1059  1089  1100  1102  1103  1103  1104  1105  1106  1104  1095  1066  1014  987  *  967  947
                931  955  *  978                                                                                     989  *  949  909
                923  950  *  977  1006  1060  1091  1102  1105  1105  1105  1106  1107  1107  1106  1096  1067  1017  993  *  961  927
                          *        1031  1078  1099  1105  1106  1106  1106  1107  1108  1108  1103  1084  1041        *

                    925  953  *  980  1019  1072  1098  1107  1108  1109  1109  1109  1110  1109  1102  1078  1031  997  *  964  930
                             *        1042  1086  1104  1109  1110  1110  1110  1111  1111  1107  1090  1051        *

                       927  955  *  983  1025  1078  1102  1110  1112  1112  1113  1113  1112  1105  1082  1035  999  *  966  933
                                *        1047  1090  1107  1112  1113  1114  1114  1114  1109  1093  1054        *

                          929  958  *  987  1029  1081  1105  1113  1115  1115  1115  1114  1107  1085  1037  999  *  967  934
                                   *        1050  1093  1110  1114  1115  1116  1115  1111  1095  1055        *

                             930  960  *  990  1032  1082  1105  1112  1114  1114  1113  1107  1085  1037  998  *  967  935
                                      *        1052  1092  1106  1110  1111  1111  1108  1094  1055        *

                                930  962  *  992  1032  1076  1094  1098  1100  1100  1096  1078  1035  996  *  966  934
                                         *        1046  1076  1086  1089  1090  1088  1079  1049        *

                                   929  961  *  991  1020  1047  1056  1059  1060  1059  1052  1024  994  *  965  934
                                            *        1020  1033  1038  1041  1042  1039  1026        *

                                               *  987   988   992   996   999  1001  1002  1000  995  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               949         963   966   969   971   973   973   971        955

                                            910             938   940   942   943   943   943   941            912
```


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Table E11B-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

885 907 908 907 906 904 903 901 879

922 934 935 933 931 929 927 925 915

* * * * * * * * * * * * * *

* 958 960 961 959 956 953 950 949 949 *

* 978 986 986 984 980 974 965 *

913 937 * 959 979 996 1000 999 995 990 982 966 952 * 929 905

* 997 1018 1024 1023 1019 1014 1003 982 *

915 939 * 963 989 1019 1032 1033 1031 1026 1018 1002 974 954 * 931 908

* 1006 1034 1046 1047 1044 1039 1031 1016 988 *

917 942 * 966 995 1030 1047 1052 1050 1046 1041 1030 1009 977 954 * 932 909

* 1011 1041 1055 1058 1056 1052 1047 1037 1019 988 *

919 945 * 970 998 1034 1054 1060 1059 1055 1051 1045 1033 1010 976 954 * 932 910

* 1013 1044 1059 1062 1061 1057 1053 1048 1038 1019 987 *

920 947 * 973 1000 1036 1057 1063 1063 1060 1056 1051 1045 1032 1009 975 953 * 932 910

* 1013 1045 1061 1065 1063 1060 1056 1052 1047 1036 1017 985 *

920 948 * 974 999 1036 1057 1065 1065 1062 1058 1054 1050 1043 1030 1006 972 953 * 932 910

* 1007 1042 1061 1066 1065 1062 1058 1054 1050 1044 1033 1012 979 *

919 947 * 974 990 1028 1054 1065 1066 1064 1060 1056 1053 1048 1040 1025 998 966 954 * 932 910

895 934 * 971 * 957 * 939 920

921 947 * 972 990 1028 1054 1065 1066 1064 1060 1056 1053 1048 1040 1025 999 968 960 * 958 956

* 1007 1042 1061 1066 1065 1062 1058 1055 1051 1045 1034 1013 982 *

922 949 * 974 998 1036 1058 1065 1065 1062 1058 1055 1050 1044 1031 1009 978 963 * 962 961

* 1013 1046 1061 1065 1064 1060 1057 1052 1047 1037 1019 990 *

923 950 * 976 1002 1038 1057 1064 1063 1060 1056 1052 1046 1034 1012 982 965 * 964 964

* 1015 1046 1060 1063 1061 1058 1054 1048 1039 1021 993 *

924 951 * 978 1003 1037 1055 1060 1059 1056 1052 1046 1035 1014 983 965 * 966 967

* 1015 1044 1056 1059 1057 1053 1048 1039 1022 994 *

924 952 * 979 1002 1033 1049 1053 1052 1048 1043 1032 1013 983 965 * 967 969

* 1013 1038 1048 1049 1046 1042 1034 1019 993 *

923 951 * 979 999 1024 1035 1037 1034 1030 1023 1007 982 965 * 968 970

* 1005 1022 1028 1028 1025 1020 1009 989 *

921 949 * 976 990 1003 1007 1007 1005 1001 993 977 966 * 968 970

* 988 995 996 996 993 989 979 *

* 974 974 974 975 975 975 973 970 968 *

* * * * * * * * * * * * * *

946 963 964 964 964 963 961 958 960

917 952 953 953 952 950 948 946 952

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Table E11B-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                             1004            1013  1016  1018  1019  1019  1019  1019           1001

                                1010        1015  1017  1018  1019  1018  1018  1017       1009
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    * 1016  1017  1018  1019  1018  1018  1017  1016 1016  *

                                  *        1019  1023  1026  1027  1027  1024  1021        *
                          1002 1008  * 1014  1018  1025  1030  1033  1033  1031  1027  1021 1017  * 1006  994

                                   *        1023  1033  1041  1045  1046  1043  1037  1028        *
                        1002 1008  * 1014  1021  1033  1043  1050  1052  1051  1047  1038  1026 1018  * 1006  993

                                 *        1027  1042  1054  1062  1065  1064  1059  1049  1034        *
                      1002 1008  * 1014  1023  1040  1054  1064  1069  1070  1068  1060  1046  1030 1019  * 1006  993

                               *        1030  1049  1064  1074  1079  1080  1077  1070  1056  1037        *
                    1001 1008  * 1014  1025  1044  1062  1074  1081  1084  1083  1079  1068  1051  1031 1019  * 1006  992

                             *        1031  1052  1070  1081  1087  1090  1090  1086  1076  1059  1038        *
                 1000 1007  * 1014  1025  1046  1065  1080  1088  1092  1093  1091  1085  1072  1052  1030 1018  * 1005  991

                          *        1030  1052  1072  1085  1093  1096  1097  1096  1090  1078  1059  1036        *
             998 1006  * 1014  1023  1044  1066  1082  1092  1097  1098  1098  1095  1087  1072  1050  1028 1016  * 1003  990

                      *        1025  1048  1070  1086  1095  1100  1101  1101  1098  1091  1076  1055  1032        *
      996 1004  * 1013  1017  1037  1061  1081  1093  1099  1102  1103  1101  1097  1086  1068  1044  1024 1015  * 1002  988
      959  985  * 1010                                                                                  1015  *  980  943
      954  982  * 1008  1016  1037  1062  1082  1095  1101  1104  1105  1103  1098  1087  1069  1045  1025 1017  *  985  951
                      *        1024  1049  1073  1090  1100  1104  1105  1105  1102  1094  1079  1057  1034        *

             954  982  * 1008  1020  1046  1071  1090  1100  1105  1106  1106  1102  1093  1077  1055  1031 1019  *  987  953
                          *        1030  1057  1080  1095  1103  1106  1107  1105  1098  1085  1065  1040        *

                  954  982  * 1009  1024  1052  1076  1093  1102  1106  1106  1103  1096  1081  1059  1035 1020  *  988  955
                               *        1035  1062  1083  1097  1103  1105  1104  1099  1087  1068  1044        *

                       954  982  * 1010  1027  1055  1077  1092  1099  1101  1100  1094  1081  1061  1036 1019  *  988  956
                                    *        1037  1063  1082  1093  1098  1098  1095  1085  1068  1044        *

                            954  983  * 1011  1028  1053  1072  1084  1089  1090  1086  1076  1058  1035 1018  *  988  957
                                         *        1036  1058  1073  1082  1085  1083  1076  1063  1042        *

                                 953  983  * 1011  1026  1046  1060  1068  1071  1070  1064  1051  1032 1017  *  988  957
                                              *        1031  1046  1056  1061  1063  1060  1051  1037        *

                                      952  981  * 1010  1020  1031  1039  1043  1045  1043  1038  1027 1016  *  987  958
                                                   *        1020  1027  1032  1035  1035  1033  1027        *

                                                * 1008  1008  1010  1013  1015  1017  1018  1018 1015  *
                                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                                                971         985   986   988   990   991   991   990        977

                                                934             960   961   962   963   963   963   962            936
```


A T-QUO-ECI
VOID

Table E11B-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                          907             924   926   927   928   928   928   928            903

                              941         950   952   952   952   952   952   953        941
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  974   976   976   976   976   975   975   976  977  *

                                  *         982   985   987   986   984   982   980        *
                          935  955  *  975   982   989   992   992   991   988   984   981  979  *  953  926

                                    *         989   998  1003  1004  1002   998   992   986        *
                          936  956  *  976   987   999  1006  1010  1009  1005  1000   992   985  981  *  956  930

                                    *         995  1008  1017  1020  1020  1016  1009  1000   990        *
                          936  958  *  978   991  1007  1018  1024  1026  1023  1017  1008   998   988  983  *  958  932

                                  *         999  1015  1027  1033  1034  1032  1025  1016  1004   992        *
                      937  959  *  980   993  1011  1026  1035  1038  1037  1032  1024  1013  1000   989  984  *  960  935

                              *        1001  1019  1033  1041  1044  1043  1038  1030  1019  1005   993        *
                  938  960  *  982   995  1013  1029  1040  1046  1047  1044  1037  1027  1014  1001   990  985  *  961  937

                          *        1001  1019  1035  1045  1050  1050  1047  1041  1031  1018  1004   992        *
              938  961  *  983   994  1012  1029  1042  1050  1052  1051  1046  1038  1027  1013   999   990  987  *  963  939

                      *         998  1016  1032  1045  1052  1054  1052  1048  1040  1029  1015  1001   991        *
          937  961  *  984   991  1007  1025  1040  1050  1054  1054  1051  1045  1035  1023  1009   997   990  988  *  965  940
          917  951  *  983                                                                                  991  *  970  948
          941  963  *  983   991  1008  1026  1040  1050  1054  1054  1051  1045  1036  1023  1010   998   991  992  *  988  984
                      *         998  1016  1033  1046  1052  1054  1053  1048  1040  1030  1017  1003   994        *

              942  964  *  985   996  1014  1031  1044  1051  1053  1051  1047  1039  1028  1016  1003   995  994  *  990  987
                          *        1003  1021  1037  1047  1051  1052  1048  1042  1033  1021  1008   998        *

                  942  965  *  987   999  1017  1033  1043  1048  1048  1045  1039  1030  1019  1007   997  995  *  992  990
                              *        1006  1023  1036  1044  1047  1045  1041  1033  1023  1011  1001        *

                      943  966  *  989  1001  1018  1030  1038  1041  1041  1036  1029  1019  1008   999  995  *  994  993
                                  *        1007  1021  1032  1037  1038  1036  1030  1022  1011  1001        *

                          943  967  *  990  1001  1015  1025  1030  1032  1029  1024  1016  1007   999  995  *  995  995
                                      *        1005  1017  1024  1027  1027  1023  1017  1009  1001        *

                              943  967  *  991  1000  1010  1016  1019  1019  1016  1011  1004   998  995  *  995  996
                                          *        1002  1010  1014  1015  1014  1010  1005   999        *

                                  942  967  *  991   997  1002  1005  1007  1006  1004  1000   997  995  *  995  996
                                              *         997  1000  1002  1003  1002  1000   997        *

                                                *  990   991   993   994   995   996   996   995  995  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                967         984   985   986   986   986   986   985        988

                                                943             976   977   977   977   976   975   974            980
```


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Table B11C.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11C

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 44.000 in

```
                          955          965   968   971   972   972   971   968          937

                              959          966   969   971   971   971   970   968        952
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  962   967   970   971   971   970   969   967  967  *

                                 *        1004  1017  1021  1023  1023  1021  1011        *
                           954  957  *  961  1003  1031  1039  1041  1043  1043  1038  1013  972  *  951  930

                                    *        1029  1057  1066  1069  1070  1071  1066  1041        *
                              956  959  *  962  1014  1057  1072  1076  1079  1080  1079  1067  1027  975  *  954  931

                                    *        1037  1072  1084  1087  1089  1091  1090  1082  1049        *
                         958  961  *  964  1018  1066  1084  1089  1092  1093  1094  1092  1076  1031  977  *  955  932

                                *        1041  1077  1090  1094  1096  1097  1098  1097  1087  1052        *
                      959  963  *  967  1022  1070  1089  1094  1096  1098  1099  1100  1097  1080  1032  977  *  955  933

                            *        1044  1081  1094  1097  1099  1100  1101  1102  1101  1090  1054        *
                   960  964  *  969  1025  1073  1092  1098  1099  1100  1101  1103  1103  1100  1082  1033  977  *  955  932

                         *        1047  1084  1097  1101  1102  1102  1103  1104  1105  1104  1092  1055        *
              960  965  *  971  1025  1076  1096  1101  1102  1103  1103  1104  1106  1106  1102  1083  1032  976  *  954  932

                      *        1043  1085  1101  1104  1105  1105  1105  1106  1108  1108  1106  1092  1050        *
           958  964  *  970  1015  1072  1098  1105  1106  1106  1106  1107  1108  1109  1109  1103  1079  1022  975  *  953  931
           927  946  *  966                                                                                    976  *  936  895
           923  945  *  966  1015  1074  1100  1108  1109  1109  1109  1109  1110  1111  1111  1105  1081  1025  982  *  950  917
                      *        1046  1090  1106  1110  1110  1110  1110  1111  1112  1112  1110  1095  1054        *

              926  949  *  970  1030  1085  1107  1112  1113  1113  1113  1113  1114  1114  1110  1090  1040  986  *  954  921
                         *        1056  1097  1111  1114  1114  1114  1114  1115  1116  1113  1101  1063        *

                 929  952  *  974  1036  1091  1111  1116  1117  1117  1117  1118  1117  1113  1094  1044  988  *  956  923
                         *        1061  1102  1115  1118  1118  1118  1119  1119  1117  1104  1066        *

                    932  955  *  978  1040  1095  1115  1120  1121  1121  1121  1121  1116  1097  1046  989  *  957  925
                           *        1065  1105  1118  1121  1122  1122  1122  1120  1107  1069        *

                       933  958  *  982  1044  1097  1116  1121  1122  1122  1122  1118  1099  1048  988  *  958  926
                                  *        1068  1106  1118  1120  1120  1121  1119  1108  1070        *

                          934  960  *  984  1045  1093  1108  1112  1112  1113  1110  1095  1047  987  *  957  926
                                     *        1063  1094  1102  1104  1104  1103  1096  1066        *

                             933  959  *  984  1033  1064  1072  1075  1076  1075  1068  1036  985  *  956  925
                                        *        1033  1047  1051  1053  1053  1052  1038        *

                                           *  979   981   985   988   991   993   993   991  985  *
                                              *   *   *   *   *   *   *   *   *   *   *   *   *
                                        945          956   959   962   963   965   965   962        945

                                     910             930   932   934   935   935   935   933            903
```


VOID

Table B11C.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 11C

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          874             896   897   896   895   893   891   889            877

                              911         923   924   922   920   917   915   913        907
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  946   949   949   947   944   941   938   936  936  *

                                  *         983   990   990   986   982   977   966        *
                           903  926  *  948   983  1004  1007  1005  1001   996   987   967  940  *  924  908

                                    *        1007  1028  1032  1030  1026  1020  1010   987        *
                        906  929  *  952   995  1030  1041  1040  1037  1032  1024  1009   976  941  *  926  911

                                    *        1016  1044  1053  1052  1048  1043  1036  1022   992        *
                     908  933  *  956  1001  1040  1055  1057  1054  1049  1044  1034  1015   978  941  *  927  912

                                  *        1020  1051  1061  1061  1058  1053  1048  1040  1024   993        *
                  910  936  *  960  1004  1044  1061  1063  1061  1057  1052  1046  1036  1016   977  941  *  927  913

                              *        1023  1054  1065  1065  1062  1058  1053  1048  1040  1024   991        *
                912  938  *  963  1006  1047  1064  1067  1064  1060  1056  1051  1046  1035  1015   976  940  *  927  913

                           *        1023  1056  1067  1068  1065  1060  1056  1052  1047  1039  1022   989        *
             913  939  *  965  1006  1047  1065  1069  1067  1063  1058  1054  1050  1044  1034  1012   973  939  *  926  912

                        *        1019  1054  1068  1070  1067  1063  1058  1054  1050  1045  1036  1018   984        *
      912  939  *  965   997  1042  1064  1071  1069  1065  1061  1056  1052  1048  1042  1030  1005   966  939  *  926  911
      899  931  *  962                                                                                   941  *  929  917
      930  947  *  963   997  1042  1064  1071  1069  1065  1061  1057  1053  1049  1042  1030  1006   968  945  *  943  941
                        *        1019  1054  1069  1070  1067  1063  1059  1055  1051  1046  1037  1019   986        *

             931  949  *  966  1006  1048  1066  1070  1068  1063  1059  1055  1051  1046  1035  1014   978  948  *  947  946
                           *        1025  1057  1068  1069  1066  1061  1057  1053  1048  1041  1024   994        *

                932  950  *  968  1009  1049  1065  1068  1066  1062  1058  1053  1048  1038  1018   982  949  *  949  948
                           *        1026  1056  1067  1067  1064  1060  1055  1051  1043  1027   996        *

                   932  951  *  970  1010  1048  1063  1066  1063  1059  1055  1049  1039  1019   983  950  *  950  951
                              *        1025  1054  1064  1064  1060  1056  1051  1044  1028   998        *

                      932  951  *  971  1009  1045  1058  1060  1057  1053  1048  1039  1020   984  950  *  951  952
                                 *        1023  1049  1056  1055  1052  1047  1040  1027   998        *

                         930  951  *  970  1006  1036  1045  1045  1042  1038  1030  1015   982  949  *  951  953
                                    *        1016  1034  1038  1036  1032  1027  1017   994        *

                            927  948  *  968   995  1012  1015  1014  1011  1006   997   976  949  *  950  952
                                       *         993   999   999   998   995   989   978        *

                                          *  964   962   962   962   961   960   958   954  950  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       929         935   935   935   934   932   930   927        931

                                    894            907   907   906   905   903   901   898            911
```


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Table B11C.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11C

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                            972             981   985   987   988   988   987   985            957

                                976         982   985   987   987   987   985   984        970
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  979   982   986   987   986   985   984   982  983  *

                                  *        1001  1013  1018  1019  1019  1016  1006        *
                           969  973  *  977   999  1023  1031  1034  1035  1035  1028  1008  986  *  968  948

                                 *        1021  1048  1058  1061  1063  1063  1056  1031        *
                           971  974  *  977  1009  1048  1064  1070  1072  1073  1071  1057  1021  990  *  970  950

                                 *        1029  1064  1079  1083  1086  1087  1085  1074  1041        *
                           972  976  *  979  1014  1057  1079  1086  1089  1091  1091  1087  1068  1026  991  *  971  950

                                *        1033  1071  1087  1092  1094  1096  1097  1094  1080  1044        *
                      973  977  *  981  1017  1062  1085  1093  1096  1097  1098  1098  1093  1072  1027  991  *  971  951

                                *        1036  1074  1091  1097  1098  1100  1101  1101  1098  1083  1045        *
                 973  978  *  983  1020  1065  1088  1096  1099  1100  1101  1102  1102  1096  1074  1028  991  *  971  950

                           *        1038  1077  1095  1100  1101  1102  1103  1104  1105  1101  1085  1045        *
            973  979  *  985  1019  1067  1092  1100  1102  1103  1104  1105  1106  1105  1098  1074  1026  990  *  970  950

                      *        1032  1077  1097  1103  1105  1105  1106  1107  1108  1108  1103  1083  1039        *
         971  977  *  983  1009  1061  1092  1103  1106  1106  1107  1107  1108  1109  1107  1098  1068  1016  989  *  970  949
         940  961  *  980                                                                                        991  *  952  910
         936  958  *  980  1008  1063  1094  1106  1108  1109  1109  1109  1110  1111  1109  1099  1070  1019  996  *  963  929
                      *        1034  1081  1102  1109  1110  1110  1110  1111  1112  1112  1106  1087  1043        *

            939  961  *  982  1022  1076  1102  1111  1113  1113  1113  1113  1114  1113  1105  1081  1033 1000  *  967  933
                           *        1045  1089  1108  1113  1114  1114  1114  1115  1115  1110  1094  1054        *

                  941  964  *  986  1029  1081  1107  1115  1117  1117  1117  1117  1116  1109  1086  1038 1002  *  969  935
                           *        1051  1094  1112  1117  1118  1118  1118  1118  1114  1097  1057        *

                     944  967  *  990  1033  1085  1110  1118  1120  1120  1120  1119  1112  1088  1040 1002  *  970  937
                           *        1055  1097  1114  1119  1120  1120  1120  1116  1100  1059        *

                        945  970  *  994  1036  1087  1110  1117  1119  1119  1118  1112  1089  1041 1001  *  970  937
                                     *        1056  1096  1111  1115  1116  1116  1113  1098  1059        *

                           946  972  *  996  1036  1081  1099  1104  1105  1105  1100  1083  1039 1000  *  969  937
                                        *        1051  1081  1091  1094  1095  1093  1084  1053        *

                              945  971  *  996  1025  1052  1061  1064  1065  1064  1056  1028  999  *  968  937
                                           *        1024  1038  1043  1045  1046  1044  1031        *

                                              *  992   993   996  1000  1003  1006  1006  1004 1000  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           958         968   971   974   976   977   978   976        959

                                        923            943   945   947   948   948   948   946            916
```


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Table B11C.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 11C

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                            885             906   906   906   905   903   902   900            888

                                922         933   933   932   930   928   926   925        920
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  957   959   959   957   954   952   950   948  949  *

                                  *         977   985   985   982   978   973   964        *
                          913  936  *  958   978   995   999   997   994   989   980   965  952  *  936  918

                                    *         997  1017  1023  1022  1018  1012  1001   980        *
                         916  939  *  962   989  1019  1031  1032  1029  1024  1016  1000   973  954  *  938  922

                                    *        1006  1034  1045  1046  1043  1038  1029  1014   986        *
                        919  943  *  966   995  1030  1047  1051  1049  1045  1039  1028  1008   976  954  *  939  923

                                  *        1011  1042  1055  1058  1055  1051  1045  1036  1018   987        *
                       921  945  *  969   999  1035  1054  1060  1059  1055  1050  1043  1031  1009   975  954  *  939  924

                                *        1014  1046  1060  1063  1061  1057  1052  1046  1036  1017   986        *
                      922  948  *  973  1001  1038  1058  1064  1063  1059  1055  1050  1043  1031  1008   974  953  *  939  925

                              *        1014  1047  1062  1066  1064  1060  1056  1051  1045  1035  1015   984        *
                    923  949  *  975  1000  1037  1059  1066  1066  1062  1058  1054  1049  1042  1029  1005   971  953  *  939  925

                           *        1009  1044  1063  1068  1066  1063  1058  1054  1050  1043  1032  1010   978        *
                923  949  *  975   992  1030  1057  1067  1068  1065  1061  1056  1052  1047  1039  1024   997   966  954  *  940  925
                911  943  *  973                                                                              957  *  944  931
                941  958  *  974   992  1030  1057  1067  1068  1065  1061  1057  1053  1048  1040  1024   998   968  959  *  958  956
                           *        1009  1044  1063  1068  1067  1063  1059  1055  1050  1044  1033  1012   981        *

                    943  960  *  976  1001  1039  1060  1067  1067  1063  1059  1055  1050  1043  1031  1008   977  962  *  961  960
                              *        1016  1048  1064  1067  1065  1061  1057  1053  1047  1037  1018   989        *

                       943  962  *  979  1005  1040  1060  1065  1065  1061  1057  1052  1046  1033  1012   981  963  *  963  963
                                 *        1018  1048  1062  1065  1063  1059  1054  1049  1039  1021   992        *

                          944  963  *  981  1006  1039  1057  1062  1061  1057  1053  1046  1035  1013   982  964  *  965  966
                                    *        1018  1046  1058  1060  1058  1054  1048  1039  1022   993        *

                             943  963  *  982  1006  1036  1051  1055  1053  1049  1043  1033  1013   983  964  *  965  967
                                       *        1016  1040  1049  1050  1047  1042  1034  1019   992        *

                                941  962  *  982  1002  1026  1037  1038  1035  1031  1023  1007   981  964  *  966  968
                                          *        1008  1024  1029  1028  1025  1020  1009   988        *

                                   939  960  *  980   992  1004  1008  1008  1005  1001   992   975  964  *  965  967
                                             *         990   996   997   996   993   988   977        *

                                               *  977   976   975   975   975   973   971   968  965  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                           942         948   947   947   946   945   943   940        946

                                         905             919   919   918   917   915   913   910            925
```


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Table B11C.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11C

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1005            1014  1017  1019  1020  1021  1021  1020           1002

                               1011        1016  1018  1019  1020  1020  1019  1019       1010
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1017  1018  1019  1020  1020  1019  1018  1018 1018  *

                                 *       1020  1025  1028  1029  1028  1026  1022        *
                         1003 1009  * 1015  1019  1026  1032  1034  1035  1033  1029  1023 1019  * 1008  995

                               *       1024  1035  1043  1047  1047  1045  1039  1030        *
                        1003 1009  * 1015  1022  1034  1045  1051  1054  1053  1049  1040  1028 1021  * 1008  995

                             *       1029  1044  1056  1064  1067  1066  1061  1050  1036        *
                      1003 1009  * 1015  1025  1041  1056  1066  1071  1072  1070  1062  1048  1032 1022  * 1008  995

                           *       1032  1051  1066  1076  1081  1082  1080  1072  1058  1039        *
                    1002 1009  * 1016  1026  1046  1064  1076  1083  1086  1086  1081  1070  1053  1033 1021  * 1008  994

                         *       1033  1054  1072  1084  1090  1093  1092  1088  1078  1061  1040        *
                  1001 1008  * 1016  1027  1048  1068  1082  1091  1095  1096  1094  1087  1074  1055  1033 1021  * 1007  993

                       *       1032  1055  1075  1088  1096  1099  1100  1098  1093  1081  1062  1039        *
                999 1007  * 1016  1025  1046  1068  1085  1095  1100  1102  1101  1098  1090  1075  1053  1031 1020  * 1006  992

                    *       1027  1050  1073  1089  1099  1103  1105  1104  1102  1094  1079  1057  1035        *
            997 1006  * 1014  1019  1039  1064  1084  1096  1103  1105  1106  1105  1100  1089  1070  1047  1027 1019  * 1005  991
            969  991  * 1012                                                                                  1019  *  983  945
            969  990  * 1011  1018  1040  1065  1086  1099  1105  1108  1108  1107  1102  1091  1072  1048  1028 1021  *  988  953
                    *       1027  1052  1077  1094  1103  1108  1109  1109  1106  1097  1082  1060  1037        *

               969  991  * 1011  1024  1050  1075  1094  1104  1109  1110  1110  1106  1097  1081  1058  1035 1023  *  990  956
                       *       1034  1061  1084  1099  1107  1110  1111  1108  1102  1089  1068  1044        *

                  970  991  * 1012  1028  1056  1081  1097  1106  1110  1110  1107  1100  1085  1063  1038 1024  *  992  958
                       *       1038  1066  1088  1101  1107  1110  1108  1103  1091  1072  1047        *

                     970  992  * 1014  1031  1059  1082  1096  1104  1106  1105  1098  1085  1065  1040 1024  *  992  959
                       *       1041  1067  1086  1098  1102  1103  1099  1089  1072  1048        *

                        970  993  * 1015  1032  1058  1077  1089  1094  1095  1091  1080  1062  1039 1023  *  992  960
                                *       1041  1063  1078  1086  1089  1088  1081  1067  1046        *

                           970  993  * 1016  1031  1051  1065  1072  1075  1074  1068  1055  1037 1022  *  992  961
                                   *       1036  1051  1061  1066  1067  1064  1056  1041        *

                              969  993  * 1015  1025  1036  1044  1048  1050  1048  1043  1031 1021  *  991  961
                                       *       1025  1032  1037  1040  1040  1038  1032        *

                                         * 1013  1014  1016  1018  1021  1023  1024  1023 1021  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                      981         991   992   994   995   996   997   996        982

                                   948            966   967   968   969   969   969   968            941
```


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Table B11C.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 11C

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                            908             924   925   927   927   928   928   929            912

                                942         950   951   952   952   952   953   953        946
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  974   976   976   977   976   976   976   977  978  *

                                  *         982   985   986   986   984   982   980        *
                          937  956  *  975   982   988   991   992   991   988   984   982  980  *  960  939

                                    *         989   998  1002  1003  1001   997   992   986        *
                         938  957  *  976   987   998  1006  1009  1008  1005   999   992   985  982  *  963  943

                                    *         995  1008  1016  1020  1019  1015  1008   999   990        *
                        939  959  *  978   991  1006  1018  1024  1025  1022  1016  1008   997   988  983  *  965  946

                                  *         999  1015  1027  1033  1034  1031  1024  1015  1003   992        *
                      940  961  *  980   994  1012  1026  1035  1038  1037  1032  1023  1012  1000   989  984  *  967  949

                                *        1001  1019  1033  1041  1044  1043  1038  1029  1018  1005   993        *
                    941  962  *  982   995  1014  1030  1041  1046  1047  1043  1036  1026  1014  1000   989  985  *  968  951

                              *        1001  1020  1035  1046  1050  1051  1047  1040  1030  1018  1004   992        *
                   942  963  *  984   995  1013  1030  1043  1050  1053  1051  1045  1037  1026  1012   999   989  986  *  970  953

                            *         999  1017  1034  1046  1053  1055  1052  1047  1039  1028  1014  1001   991        *
                942  963  *  984   992  1009  1027  1041  1051  1055  1055  1051  1044  1035  1022  1008   996   989  987  *  971  954
                935  960  *  983                                                                                 989  *  974  959
                960  972  *  985   992  1009  1027  1042  1051  1055  1055  1051  1045  1035  1023  1009   997   990  990  *  987  984
                           *       1000  1018  1035  1047  1054  1055  1053  1048  1040  1029  1016  1002   993        *

                   961  974  *  987   998  1016  1033  1045  1052  1054  1052  1047  1039  1028  1015  1002   993  992  *  989  987
                              *        1005  1024  1039  1048  1053  1052  1049  1042  1033  1021  1007   997        *

                      961  976  *  990  1001  1020  1035  1045  1049  1049  1046  1039  1030  1018  1005   995  992  *  991  990
                                 *        1009  1025  1038  1045  1048  1046  1041  1033  1022  1010   999        *

                         961  977  *  992  1004  1020  1033  1040  1043  1041  1036  1029  1018  1007   997  992  *  992  992
                                    *        1010  1024  1034  1039  1039  1036  1030  1021  1010  1000        *

                            961  977  *  994  1004  1018  1027  1032  1032  1030  1024  1015  1006   997  992  *  993  993
                                       *        1008  1019  1026  1029  1028  1023  1017  1008   999        *

                               960  978  *  995  1003  1012  1018  1020  1019  1016  1010  1003   996  992  *  993  994
                                          *        1005  1012  1015  1016  1014  1009  1004   997        *

                                  959  977  *  995  1000  1004  1006  1007  1005  1003   998   994  991  *  992  994
                                             *         999  1001  1002  1002  1001   998   994        *

                                               *  993   993   994   994   994   994   993   992  991  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                           962         968   968   968   968   967   966   964        972

                                        929            941   941   940   940   939   937   936            951
```


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Table E11C.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11C

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              945             954   958   960   962   962   961   959            929

                                  948         955   958   960   961   961   960   958        943
                                                *   *   *   *   *   *   *   *   *   *   *   *
                                     *  951   955   959   960   960   959   958   957  957  *

                                     *         991  1004  1008  1009  1010  1008   999        *
                           943  947  *  950   989  1017  1024  1027  1028  1029  1024  1001  961  *  942  921

                                        *        1015  1042  1050  1053  1055  1055  1051  1027        *
                              945  948  *  951  1000  1041  1056  1060  1062  1064  1063  1052  1014  964  *  944  923

                                        *        1022  1056  1067  1070  1073  1074  1074  1066  1035        *
                           947  950  *  953  1004  1049  1067  1072  1075  1077  1078  1076  1061  1017  966  *  945  924

                                     *        1026  1061  1073  1077  1078  1080  1082  1081  1071  1038        *
                        948  952  *  955  1007  1053  1071  1077  1079  1080  1082  1083  1080  1064  1019  966  *  945  924

                                  *        1029  1064  1076  1080  1081  1082  1084  1085  1084  1074  1040        *
                     949  953  *  957  1010  1057  1075  1080  1082  1083  1084  1085  1086  1083  1067  1020  965  *  945  923

                               *        1031  1067  1080  1083  1084  1084  1085  1087  1088  1087  1076  1040        *
                  949  954  *  959  1011  1059  1078  1083  1084  1085  1086  1087  1088  1089  1086  1068  1018  964  *  944  923

                            *        1028  1068  1083  1086  1087  1087  1087  1088  1090  1091  1089  1076  1036        *
               947  953  *  958  1001  1056  1080  1087  1088  1088  1088  1089  1090  1091  1092  1086  1063  1009  963  *  943  922
               917  936  *  954                                                 *                                   964  *  927  888
               913  934  *  955  1001  1057  1082  1089  1090  1090  1090  1091  1092  1093  1093  1088  1065  1011  970  *  940  908
                         *        1030  1073  1088  1091  1091  1091  1092  1092  1094  1094  1092  1079  1039        *

                  916  938  *  958  1015  1068  1088  1093  1094  1094  1094  1095  1096  1096  1092  1074  1025  974  *  943  912
                               *        1040  1079  1092  1095  1095  1095  1095  1096  1097  1095  1084  1047        *

                     919  941  *  962  1021  1073  1092  1097  1098  1098  1098  1099  1099  1095  1077  1029  975  *  945  914
                               *        1045  1083  1096  1099  1099  1099  1100  1100  1098  1086  1050        *

                        921  944  *  966  1025  1076  1095  1100  1101  1101  1102  1102  1097  1079  1031  975  *  946  915
                                  *        1048  1086  1099  1102  1102  1102  1103  1100  1089  1052        *

                           923  946  *  969  1028  1079  1097  1101  1102  1102  1102  1098  1081  1032  975  *  946  916
                                        *        1050  1087  1098  1100  1101  1101  1099  1089  1053        *

                              923  948  *  971  1028  1074  1089  1092  1093  1093  1091  1077  1031  974  *  945  916
                                           *        1046  1075  1083  1084  1085  1084  1078  1049        *

                                 922  947  *  970  1018  1047  1055  1057  1058  1057  1051  1020  972  *  944  915
                                              *        1017  1030  1034  1036  1037  1035  1022        *

                                                 *  966   967   971   974   977   979   979   977  972  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                934         944   947   949   951   952   952   950        934

                                              900            919   922   923   924   924   924   922           894
```


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Table E11C.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 11C

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                            870             892   893   892   891   889   887   885            876

                                906         918   918   917   915   913   910   908        904
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  940   943   943   941   938   935   933   931  931  *

                                  *         975   983   982   980   976   971   960        *
                          897  920  *  942   975   996   999   997   994   989   981   961  934  *  920  905

                                    *         998  1019  1023  1021  1018  1013  1003   981        *
                             900  923  *  945   986  1020  1031  1031  1028  1024  1017  1002   970  935  *  922  907

                                    *        1006  1034  1042  1042  1038  1034  1028  1014   985        *
                           902  926  *  949   991  1029  1044  1046  1044  1040  1035  1026  1008   971  935  *  922  908

                                  *        1009  1039  1049  1050  1047  1043  1039  1032  1016   985        *
                       904  928  *  952   994  1033  1049  1052  1050  1046  1042  1037  1028  1008   970  934  *  922  908

                              *        1011  1042  1052  1053  1051  1047  1043  1039  1031  1015   984        *
                     905  930  *  954   996  1035  1051  1054  1052  1049  1045  1041  1036  1027  1006   968  933  *  921  908

                           *        1012  1043  1054  1055  1052  1049  1045  1041  1037  1030  1013   981        *
                  905  931  *  956   995  1035  1052  1056  1054  1051  1047  1043  1040  1034  1024  1003   965  932  *  920  907

                        *        1007  1041  1055  1057  1054  1050  1047  1043  1040  1035  1027  1009   976        *
            905  930  *  955   986  1029  1051  1057  1056  1052  1048  1045  1041  1038  1032  1020   996   958  932  *  919  906
            891  922  *  952                                                                              934  *  923  912
            920  937  *  953   985  1029  1051  1057  1056  1052  1048  1045  1041  1038  1032  1020   997   959  937  *  936  935
                        *        1006  1041  1055  1057  1054  1050  1046  1043  1040  1035  1027  1009   978        *

               922  939  *  956   995  1035  1052  1056  1054  1050  1047  1043  1039  1034  1025  1005   969  939  *  939  939
                           *        1012  1043  1054  1055  1052  1048  1045  1041  1037  1030  1014   984        *

                  923  940  *  958   997  1035  1051  1054  1052  1049  1045  1041  1036  1027  1007   972  940  *  941  941
                              *        1013  1042  1052  1053  1050  1047  1043  1038  1031  1016   986        *

                     923  941  *  959   998  1034  1049  1052  1049  1046  1042  1037  1028  1009   973  941  *  942  943
                                 *        1012  1040  1049  1050  1047  1043  1039  1031  1017   987        *

                        922  941  *  960   997  1031  1044  1046  1043  1040  1035  1026  1008   973  940  *  942  944
                                    *        1010  1035  1042  1042  1039  1034  1028  1015   987        *

                           920  940  *  960   994  1023  1032  1032  1029  1025  1018  1003   972  940  *  942  945
                                       *        1003  1021  1024  1023  1020  1015  1005   983        *

                              918  938  *  957   983   999  1002  1001   999   995   986   965  939  *  941  944
                                          *         981   987   987   986   983   978   967        *

                                             *  953   952   952   951   951   950   947   944  940  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          920         926   926   925   925   923   921   918        923

                                       886            899   899   898   897   896   894   891            904
```


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VOID

Table E11C.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11C

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 50.500 in

```
                          962             970   974   976   977   978   977   975            948

                              965         970   974   976   976   976   975   973        960
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  967   970   974   975   975   974   972   971  972  *

                                  *         988  1000  1004  1005  1006  1003   994        *
                             958  961  *  965   986  1009  1017  1020  1021  1021  1015   996  975  *  957  939

                                    *        1007  1033  1043  1046  1048  1048  1041  1018        *
                           960  963  *  965   996  1032  1049  1054  1057  1058  1056  1043  1008  978  *  960  940

                                    *        1014  1048  1062  1067  1069  1070  1069  1058  1027        *
                         961  964  *  967  1000  1042  1062  1069  1072  1074  1075  1071  1053  1013  979  *  961  941

                                  *        1018  1054  1070  1075  1077  1079  1080  1078  1065  1030        *
                       962  965  *  969  1003  1046  1068  1075  1078  1080  1081  1081  1076  1057  1014  979  *  961  941

                             *        1021  1058  1074  1079  1081  1082  1083  1084  1081  1068  1031        *
                    962  966  *  971  1005  1049  1071  1079  1081  1082  1084  1085  1085  1079  1059  1014  979  *  960  940

                           *        1023  1061  1077  1082  1084  1084  1085  1087  1087  1084  1069  1031        *
                 962  967  *  972  1005  1051  1074  1082  1084  1085  1086  1087  1088  1088  1081  1059  1012  978  *  959  940

                        *        1018  1060  1079  1085  1087  1087  1088  1089  1090  1090  1086  1067  1025        *
           960  966  *  971   995  1045  1074  1085  1087  1088  1088  1089  1090  1091  1090  1081  1053  1003  977  *  958  939
           930  949  *  968                                                                                  979  *  941  902
           926  947  *  967   994  1047  1077  1087  1090  1090  1090  1091  1092  1093  1092  1082  1054  1005  983  *  952  920
                        *        1019  1064  1084  1090  1091  1091  1092  1093  1094  1094  1089  1071  1029        *

              928  949  *  970  1008  1058  1084  1092  1094  1094  1094  1095  1095  1095  1088  1065  1019  987  *  956  923
                           *        1029  1072  1089  1094  1095  1095  1096  1096  1096  1092  1077  1038        *

                    931  952  *  973  1014  1064  1088  1096  1097  1098  1098  1098  1097  1091  1069  1024  988  *  957  925
                           *        1035  1076  1093  1098  1099  1099  1099  1099  1095  1080  1041        *

                       933  955  *  977  1018  1068  1091  1098  1100  1101  1101  1100  1093  1071  1025  988  *  958  927
                              *        1038  1079  1095  1100  1101  1101  1101  1097  1082  1043        *

                          934  958  *  980  1021  1069  1091  1097  1099  1099  1099  1093  1072  1026  987  *  958  927
                                       *        1040  1078  1092  1096  1097  1096  1094  1080  1043        *

                             935  959  *  983  1021  1063  1080  1084  1086  1086  1082  1065  1023  986  *  957  927
                                          *        1034  1063  1073  1075  1076  1075  1066  1037        *

                                934  958  *  982  1010  1035  1044  1047  1048  1047  1039  1013  984  *  956  926
                                             *        1009  1022  1027  1029  1030  1027  1015        *

                                               *  978   979   982   986   989   991   992   990  985  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                           946         956   959   961   963   964   965   963        947

                                      913             932   934   936   937   937   937   935            907
```


ACT-QUO-ECI
VOID

Table E11C.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 11C

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          881             901   902   902   901   899   898   896             886

                              916         928   928   927   925   923   921   920         916
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  951   953   953   951   949   946   944   943  943  *

                                *         970   977   978   975   972   967   958         *
                      907  930  *  952   970   987   991   990   987   982   974   959  946  *  931  915

                            *         988  1008  1014  1013  1010  1004   994   974         *
                   910  933  *  955   981  1009  1021  1023  1021  1016  1009   993   967  947  *  933  918

                          *         997  1024  1035  1036  1033  1029  1021  1006   979         *
                912  935  *  958   986  1020  1036  1041  1039  1036  1030  1020  1000   969  947  *  934  919

                        *        1001  1031  1044  1047  1045  1041  1036  1027  1010   980         *
            914  938  *  961   989  1024  1043  1048  1048  1044  1040  1034  1023  1001   968  947  *  934  920

                      *        1003  1034  1048  1051  1049  1046  1042  1037  1027  1009   979         *
         915  940  *  964   991  1026  1045  1052  1051  1048  1045  1040  1034  1022  1000   967  946  *  933  920

                    *        1003  1035  1050  1053  1052  1049  1045  1041  1036  1026  1007   976         *
      915  941  *  966   990  1025  1046  1053  1053  1050  1047  1043  1039  1032  1020   996   964  945  *  933  920

                *         998  1031  1049  1055  1054  1050  1047  1043  1039  1033  1022  1002   970         *
   915  941  *  965   981  1018  1043  1054  1055  1052  1048  1045  1041  1037  1029  1014   989   957  946  *  933  919
   903  934  *  963                                                                                 948  *  938  926
   932  948  *  964   981  1018  1043  1054  1055  1052  1048  1045  1041  1037  1029  1015   989   959  951  *  950  950
              *         998  1031  1049  1055  1054  1050  1047  1043  1039  1033  1023  1002   973         *

      933  950  *  966   990  1026  1046  1053  1053  1050  1047  1043  1039  1032  1020   998   968  953  *  953  953
                  *        1004  1035  1050  1053  1052  1048  1045  1041  1035  1026  1008   980         *

         934  951  *  969   993  1027  1046  1052  1051  1048  1044  1040  1034  1022  1001   971  954  *  955  956
                    *        1006  1035  1048  1051  1049  1046  1042  1037  1027  1010   982         *

            934  952  *  970   994  1026  1043  1048  1047  1044  1040  1034  1023  1002   973  954  *  956  958
                      *        1006  1033  1044  1047  1044  1041  1036  1027  1010   983         *

               933  953  *  972   994  1023  1037  1041  1039  1036  1030  1021  1001   972  954  *  956  959
                           *        1003  1027  1036  1037  1034  1030  1022  1008   982         *

                  932  952  *  971   990  1013  1023  1025  1022  1018  1011   996   970  954  *  957  960
                             *         996  1012  1016  1016  1013  1008   997   977         *

                     929  950  *  969   981   992   996   996   993   989   981   965  953  *  956  959
                                *         979   984   985   984   981   976   967         *

                                  *  966   965   964   964   964   963   961   957  955  *
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                933         938   938   937   937   935   933   930         937

                              897             911   910   910   908   907   905   903             918
```


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Table E11C.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11C

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              994            1003  1005  1007  1008  1009  1009  1008            991

                                  999        1004  1006  1007  1008  1007  1007  1006        998
                                         *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1004  1005  1007  1007  1007  1006  1005  1005 1005  *

                                     *        1007  1012  1014  1015  1015  1013  1009        *
                            991  997  * 1003  1006  1012  1018  1020  1021  1019  1015  1010 1006  *  995  984

                                        *        1011  1021  1028  1032  1033  1031  1025  1016        *
                           991  997  * 1002  1008  1020  1030  1037  1039  1038  1034  1026  1015 1007  *  996  984

                                        *        1015  1029  1041  1048  1051  1050  1046  1036  1022        *
                          991  997  * 1002  1011  1027  1041  1050  1055  1056  1054  1047  1034  1018 1008  *  996  983

                                     *        1018  1036  1050  1060  1065  1066  1063  1056  1043  1025        *
                     990  997  * 1002  1012  1031  1048  1060  1067  1069  1069  1065  1055  1039  1019 1008  *  995  982

                                  *        1019  1039  1056  1067  1073  1076  1075  1072  1062  1046  1026        *
                989  996  * 1003  1013  1032  1052  1065  1073  1077  1078  1077  1071  1059  1040  1019 1007  *  994  981

                             *        1018  1039  1058  1071  1078  1081  1082  1081  1076  1064  1046  1024        *
           988  995  * 1002  1011  1031  1052  1068  1077  1082  1084  1084  1081  1073  1059  1038  1017 1006  *  993  980

                        *        1013  1035  1056  1072  1081  1085  1087  1087  1084  1077  1063  1042  1020        *
      986  993  * 1001  1006  1024  1048  1067  1079  1085  1087  1088  1087  1083  1072  1055  1032  1012 1005  *  992  979
      959  980  *  999                                                                                1005  *  971  936
      958  978  *  998  1005  1025  1049  1068  1081  1087  1089  1090  1089  1084  1074  1056  1033  1013 1007  *  976  943
                        *        1013  1036  1060  1076  1085  1089  1091  1090  1088  1080  1066  1044  1022        *

           958  978  *  998  1009  1034  1058  1076  1086  1090  1092  1091  1088  1080  1064  1042  1020 1008  *  978  946
                        *        1019  1045  1067  1081  1088  1092  1092  1090  1084  1072  1052  1029        *

              958  979  *  999  1013  1040  1063  1079  1087  1091  1092  1089  1082  1068  1047  1023 1009  *  979  948
                           *        1023  1049  1070  1082  1089  1091  1090  1085  1074  1055  1032        *

                 958  980  * 1000  1016  1042  1064  1078  1085  1087  1086  1080  1068  1048  1024 1009  *  979  949
                           *        1025  1050  1068  1079  1084  1084  1081  1071  1055  1032        *

                    958  980  * 1001  1017  1041  1060  1071  1076  1076  1073  1063  1046  1024 1008  *  979  950
                              *        1025  1046  1060  1068  1071  1070  1063  1050  1030        *

                       958  980  * 1002  1016  1034  1048  1055  1058  1057  1051  1039  1021 1007  *  979  950
                                 *        1020  1035  1044  1049  1050  1048  1040  1026        *

                          957  979  * 1001  1010  1021  1028  1032  1033  1032  1027  1016 1006  *  978  950
                                    *        1010  1017  1021  1024  1025  1023  1017        *

                                       *  999  1000  1001  1004  1006  1008  1009  1008 1006  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                   969         978   979   980   982   983   983   982        969

                                  937            955   955   956   957   957   957   956            931
```


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Table E11C.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 11C

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                            903             919   921   922   922   923   923   923            910

                                936         944   945   946   946   946   946   947        941
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  967   969   969   969   969   968   968   969  970  *

                                     *         974   978   979   978   977   975   973        *
                           930  949  *  968   974   980   984   984   983   980   977   974  972  *  954  936

                                        *         981   990   994   995   993   989   984   978        *
                              931  950  *  969   979   990   997  1000  1000   997   991   984   977  973  *  957  939

                                   *         986   999  1007  1011  1010  1006  1000   991   982        *
                         932  952  *  971   982   997  1008  1014  1016  1013  1008   999   989   979  974  *  958  942

                              *         990  1006  1017  1023  1024  1021  1015  1006   995   984        *
                    933  953  *  973   985  1002  1016  1024  1028  1027  1022  1014  1004   991   980  975  *  960  944

                           *         992  1009  1022  1031  1034  1032  1028  1020  1009   996   984        *
                  934  954  *  974   986  1004  1019  1030  1035  1036  1033  1027  1017  1005   991   980  976  *  961  946

                        *         992  1009  1024  1034  1039  1039  1036  1030  1021  1008   995   983        *
             934  955  *  975   986  1003  1019  1032  1039  1041  1039  1035  1027  1016  1003   989   980  977  *  962  947

                     *         989  1006  1022  1034  1041  1043  1041  1036  1029  1018  1005   991   981        *
           934  955  *  976   983   998  1015  1029  1039  1043  1043  1039  1033  1024  1012   999   986   979  978  *  963  948
           926  951  *  975                                                                                    979  *  967  954
           950  964  *  976   983   999  1016  1030  1039  1043  1043  1039  1033  1025  1013   999   987   980  980  *  978  977
                     *         990  1007  1023  1035  1041  1043  1041  1037  1029  1019  1006   993   983        *

             951  965  *  978   988  1005  1021  1033  1039  1041  1040  1035  1028  1017  1004   992   983  981  *  980  979
                        *         995  1012  1026  1035  1040  1040  1037  1031  1022  1010   997   986        *

                  952  966  *  980   991  1008  1022  1032  1036  1037  1034  1028  1019  1007   995   985  982  *  981  981
                           *         998  1013  1025  1033  1035  1034  1029  1022  1011   999   988        *

                        952  967  *  982   993  1008  1020  1027  1030  1029  1024  1017  1007   996   986  982  *  982  983
                                 *         998  1012  1021  1026  1027  1024  1018  1010   999   989        *

                           951  968  *  984   993  1006  1014  1019  1020  1017  1012  1004   995   986  981  *  983  984
                                      *         997  1007  1014  1016  1015  1011  1005   997   988        *

                              950  968  *  984   992  1000  1006  1008  1007  1004   998   992   985  981  *  983  985
                                         *         994  1000  1003  1004  1002   998   992   986        *

                                 949  967  *  984   989   993   995   995   994   991   987   983  980  *  982  985
                                            *         988   990   991   991   989   987   983        *

                                               *  983   983   983   983   983   983   982   981  980  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               952         958   958   958   958   957   956   955        962

                                            920             933   932   932   931   930   929   928            944
```


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Table B12A-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12A-1

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 44.000 in

```
                              974             986   990   992   993   993   992   989            954

                                  977         985   989   990   991   990   989   986        969
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  980   984   988   989   989   987   985   983  983  *

                                     *        1024  1038  1042  1043  1043  1041  1029        *
                            969  974  *  978  1022  1052  1061  1063  1064  1064  1058  1031  987  *  966  943

                                  *        1050  1080  1089  1092  1093  1093  1087  1060        *
                         971  975  *  979  1033  1079  1095  1100  1102  1103  1101  1088  1045  991  *  969  946

                               *        1057  1094  1106  1111  1113  1114  1113  1104  1069        *
                      972  977  *  981  1037  1086  1106  1112  1115  1117  1117  1114  1097  1049  992  *  970  948

                            *        1059  1098  1112  1116  1118  1120  1121  1120  1108  1071        *
                  973  978  *  982  1039  1089  1110  1116  1119  1120  1122  1122  1119  1100  1050  991  *  970  948

                         *        1061  1100  1114  1119  1120  1122  1123  1124  1123  1111  1072        *
               973  978  *  984  1040  1091  1112  1118  1120  1122  1123  1125  1125  1121  1102  1050  991  *  970  948

                      *        1062  1102  1116  1120  1122  1123  1124  1126  1127  1125  1112  1072        *
            972  978  *  985  1040  1092  1113  1120  1122  1123  1124  1126  1127  1127  1123  1103  1048  989  *  969  948

                  *        1057  1101  1118  1122  1124  1125  1126  1127  1128  1129  1126  1111  1067        *
      969  976  *  983  1028  1087  1113  1122  1124  1125  1126  1127  1128  1130  1129  1123  1097  1037  987  *  967  946
      936  957  *  978                                                                                  988  *  950  910
      932  955  *  978  1027  1088  1115  1124  1126  1127  1127  1128  1130  1131  1131  1124  1099  1039  994  *  962  929
                  *        1058  1104  1122  1126  1127  1128  1129  1130  1131  1132  1129  1114  1070        *

            934  958  *  981  1041  1098  1121  1128  1129  1130  1131  1132  1133  1133  1128  1108  1054  997  *  966  933
                        *        1068  1111  1126  1130  1130  1131  1132  1133  1134  1132  1119  1079        *

               937  961  *  984  1047  1103  1125  1131  1132  1133  1134  1135  1135  1130  1111  1058  998  *  967  934
                           *        1072  1115  1129  1133  1134  1134  1135  1136  1134  1121  1081        *

                  938  963  *  988  1051  1106  1128  1134  1135  1136  1137  1137  1132  1112  1059  998  *  967  935
                              *        1076  1117  1131  1135  1136  1137  1137  1135  1122  1082        *

                     940  966  *  991  1054  1108  1128  1134  1135  1136  1136  1132  1113  1060  997  *  967  935
                                 *        1078  1117  1130  1133  1134  1134  1132  1121  1082        *

                        940  967  *  993  1054  1103  1119  1123  1124  1125  1122  1107  1057  995  *  965  935
                                    *        1073  1104  1112  1115  1115  1115  1108  1076        *

                           938  965  *  991  1042  1073  1082  1084  1085  1085  1078  1045  993  *  963  933
                                       *        1041  1055  1059  1061  1062  1061  1047        *

                                          *  986   988   991   995   998  1000  1001   998  992  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       951         962   965   968   970   971   971   969        952

                                    914             935   938   939   940   941   940   938            910
```


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Table B12A-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                              869             890   890   889   888   886   884   882            871

                                  903         915   915   914   911   909   906   904        899
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  937   939   939   937   934   931   928   925  925  *

                                     *         971   979   978   975   971   965   955        *
                           895  917  *  938   972   992   995   993   989   984   975   955  929  *  914  900

                                        *         994  1015  1019  1017  1012  1007   997   975        *
                              898  920  *  942   983  1016  1027  1026  1023  1018  1011   996   964  930  *  916  902

                                     *        1002  1030  1038  1037  1033  1029  1022  1008   979        *
                           900  923  *  946   988  1025  1039  1041  1038  1034  1029  1020  1001   965  929  *  916  903

                                  *        1006  1035  1045  1045  1042  1038  1033  1025  1010   979        *
                        902  926  *  949   991  1029  1044  1047  1045  1041  1036  1031  1021  1001   964  928  *  916  903

                              *        1008  1038  1048  1048  1045  1041  1037  1032  1024  1009   977        *
                     903  928  *  951   992  1031  1046  1049  1047  1043  1039  1035  1030  1020   999   962  927  *  915  903

                           *        1008  1038  1049  1050  1047  1043  1039  1035  1030  1022  1006   975        *
                  903  929  *  953   991  1030  1047  1051  1049  1045  1041  1037  1033  1028  1017   996   959  926  *  914  902

                        *        1003  1036  1050  1052  1049  1045  1040  1037  1033  1028  1019  1002   969        *
               902  928  *  952   982  1024  1046  1052  1050  1046  1042  1038  1035  1031  1025  1013   989   951  926  *  914  901
               889  920  *  949                                                                              928  *  917  906
               917  934  *  950   982  1024  1045  1051  1050  1046  1042  1038  1034  1031  1025  1013   990   953  931  *  930  929
                        *        1002  1036  1049  1051  1048  1044  1040  1036  1033  1028  1019  1002   971        *

                  919  936  *  952   991  1030  1046  1050  1048  1044  1040  1036  1032  1027  1017   997   962  933  *  933  933
                           *        1008  1038  1048  1049  1046  1042  1038  1034  1030  1022  1007   977        *

                     919  937  *  954   993  1030  1045  1048  1045  1042  1038  1034  1029  1019  1000   966  934  *  935  935
                           *        1008  1036  1046  1046  1043  1040  1036  1031  1023  1008   979        *

                        919  937  *  955   993  1028  1042  1045  1042  1039  1035  1029  1020  1001   967  935  *  936  937
                              *        1007  1034  1043  1043  1040  1036  1031  1024  1009   980        *

                           918  937  *  956   992  1025  1037  1039  1036  1032  1027  1019  1001   967  934  *  936  938
                                    *        1004  1028  1035  1034  1031  1027  1020  1007   980        *

                              916  936  *  955   988  1016  1025  1024  1021  1017  1011   996   965  934  *  936  939
                                       *         997  1014  1017  1016  1012  1007   998   976        *

                                 913  933  *  952   978   993   996   994   992   987   979   959  933  *  935  937
                                           *         975   981   981   979   976   972   961        *

                                              *  949   947   947   946   945   944   942   938  935  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           916         921   921   921   919   918   916   912        917

                                        882            895   895   894   893   891   889   886            899
```


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Table B12A-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12A-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              992            1003  1007  1009  1011  1011  1010  1007            971

                                  995        1002  1006  1007  1007  1007  1005  1003        985
                                         *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  997  1001  1004  1005  1004  1003  1001   998  999  *

                                    *        1020  1034  1038  1039  1038  1035  1024        *
                               985  990  *  995  1018  1043  1052  1055  1056  1055  1048  1026 1002  *  980  957

                                       *        1041  1070  1080  1084  1085  1084  1076  1050        *
                              986  991  *  995  1028  1069  1087  1093  1095  1096  1093  1078  1039 1005  *  983  960

                                       *        1048  1086  1101  1106  1109  1110  1108  1095  1059        *
                             987  992  *  996  1032  1078  1101  1109  1112  1114  1114  1109  1088  1043 1006  *  984  961

                                      *        1051  1091  1108  1115  1117  1119  1119  1116  1101  1062        *
                        987  993  *  998  1034  1081  1105  1114  1118  1120  1121  1121  1114  1092  1044 1006  *  984  962

                               *        1053  1093  1111  1118  1120  1122  1123  1123  1120  1104  1063        *
                      987  993  *  999  1036  1083  1108  1117  1120  1122  1123  1124  1124  1117  1093  1044 1005  *  984  962

                             *        1053  1095  1113  1120  1122  1123  1124  1126  1126  1122  1105  1062        *
                 986  993  * 1000  1034  1083  1109  1119  1122  1123  1124  1126  1127  1126  1118  1093  1041 1003  *  983  961

                          *        1047  1092  1114  1121  1124  1125  1126  1127  1128  1128  1123  1102  1055        *
           983  991  *  998  1022  1076  1108  1120  1124  1125  1126  1127  1128  1129  1127  1117  1086  1031 1002  *  981  960
           950  972  *  994                                                                                 1003  *  964  923
           946  969  *  992  1021  1077  1109  1122  1126  1127  1128  1129  1130  1131  1129  1118  1087  1033 1008  *  975  942
                          *        1047  1095  1118  1125  1127  1128  1129  1130  1131  1131  1125  1105  1059        *

              947  971  *  994  1034  1089  1116  1126  1129  1130  1131  1132  1132  1131  1124  1098  1047 1012  *  979  945
                            *        1057  1103  1122  1129  1130  1131  1132  1133  1133  1128  1111  1068        *

                 949  974  *  997  1040  1094  1120  1129  1132  1133  1134  1134  1133  1126  1102  1052 1012  *  980  947
                            *        1062  1107  1126  1132  1133  1134  1135  1135  1130  1113  1071        *

                        951  976  * 1001  1044  1097  1123  1132  1134  1135  1136  1135  1127  1103  1053 1012  *  980  948
                                     *        1065  1109  1127  1133  1134  1135  1135  1131  1114  1072        *

                           952  978  * 1004  1046  1098  1122  1130  1132  1133  1132  1126  1103  1053 1010  *  980  948
                                        *        1066  1108  1123  1128  1129  1129  1126  1112  1071        *

                              952  979  * 1005  1046  1091  1109  1115  1116  1117  1113  1095  1049 1008  *  978  947
                                           *        1060  1091  1102  1105  1106  1105  1096  1064        *

                                 950  978  * 1004  1033  1060  1070  1073  1075  1074  1066  1037 1006  *  977  946
                                              *        1033  1047  1052  1054  1055  1053  1039        *

                                                 * 1000  1001  1004  1008  1011  1013  1014  1012 1007  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                964         975   978   981   983   984   984   982        966

                                              927            949   951   953   954   954   953   951            923
```


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Table B12A-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12A-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          879             899   900   899   898   896   894   893             882

                              914         924   925   923   921   919   917   915         910
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  947   949   948   946   944   941   938   937  938  *

                                  *         966   973   973   971   967   961   952         *
                        905  927  *  948   966   983   987   985   982   977   968   953  940  *  925  910

                                  *         984  1004  1010  1008  1004   999   988   968         *
                       907  930  *  951   977  1005  1017  1018  1015  1011  1003   987   961  941  *  927  912

                                  *         993  1020  1030  1031  1028  1023  1015  1000   973         *
                      910  933  *  955   982  1016  1032  1036  1034  1030  1024  1014   994   963  941  *  928  914

                                *         997  1027  1040  1042  1039  1035  1030  1021  1003   974         *
                    911  935  *  958   986  1020  1038  1044  1042  1039  1034  1028  1016   995   962  941  *  928  914

                              *        1000  1030  1043  1046  1044  1040  1036  1030  1021  1002   972         *
                  913  937  *  961   987  1022  1041  1047  1046  1043  1039  1034  1027  1015   993   960  940  *  927  914

                            *        1000  1030  1045  1048  1046  1043  1039  1034  1029  1019  1000   969         *
               913  938  *  963   986  1021  1042  1048  1048  1045  1041  1037  1032  1025  1013   989   957  939  *  927  914

                          *         994  1027  1044  1049  1048  1044  1041  1037  1032  1026  1015   994   964         *
          913  938  *  962   978  1014  1039  1048  1049  1046  1042  1038  1034  1030  1022  1007   982   951  940  *  927  913
          900  931  *  960                                                                                 942  *  931  920
          928  945  *  961   977  1014  1038  1048  1049  1046  1042  1038  1034  1030  1022  1007   982   953  944  *  944  943
                          *         994  1027  1044  1049  1048  1044  1040  1036  1032  1026  1015   995   966         *

               930  947  *  963   986  1021  1041  1047  1047  1044  1040  1036  1031  1025  1013   991   961  947  *  947  947
                            *        1000  1030  1044  1047  1045  1042  1038  1034  1028  1019  1001   973         *

                  930  948  *  965   989  1022  1040  1045  1044  1041  1037  1033  1026  1015   994   965  948  *  949  949
                               *        1001  1029  1042  1044  1042  1039  1035  1029  1020  1003   975         *

                      930  949  *  967   990  1020  1037  1042  1040  1037  1033  1027  1015   995   966  948  *  950  951
                                 *        1000  1027  1038  1040  1037  1033  1028  1020  1003   976         *

                         929  949  *  967   989  1017  1031  1034  1032  1028  1023  1013   994   966  948  *  950  953
                                      *         998  1020  1029  1029  1027  1022  1015  1000   975         *

                            927  947  *  967   985  1007  1017  1018  1015  1011  1003   989   964  947  *  950  953
                                           *         990  1005  1010  1009  1006  1000   990   971         *

                               924  945  *  965   975   986   990   989   987   982   974   958  947  *  950  952
                                            *         973   978   979   978   975   970   960         *

                                              *  962   960   959   959   958   957   955   951  949  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           928         934   933   932   931   930   928   925         931

                                        893             906   906   905   904   902   900   898             912
```


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Table B12A-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12A-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1026            1038  1040  1042  1043  1043  1042  1041           1005

                               1031        1037  1039  1040  1040  1039  1038  1036       1018
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1036  1037  1038  1038  1037  1035  1033  1032 1031  *

                                 *       1040  1044  1047  1048  1046  1043  1038        *
                          1020 1027  * 1035  1039  1046  1051  1054  1054  1051  1046  1038 1032  * 1011  989

                                 *       1044  1055  1063  1067  1068  1065  1057  1046        *
                        1019 1027  * 1034  1041  1054  1065  1072  1075  1074  1068  1058  1044 1033  * 1012  990

                                *       1048  1064  1077  1085  1088  1087  1081  1069  1052        *
                      1019 1027  * 1034  1044  1061  1077  1087  1093  1094  1090  1082  1066  1047 1034  * 1013  991

                               *       1051  1070  1087  1097  1102  1104  1101  1092  1076  1055        *
                    1018 1026  * 1034  1045  1065  1084  1097  1104  1107  1107  1102  1090  1071  1048 1033  * 1013  991

                             *       1051  1073  1092  1104  1111  1114  1113  1109  1098  1079  1056        *
                  1016 1025  * 1034  1044  1066  1087  1102  1111  1115  1117  1115  1108  1093  1072  1047 1032  * 1012  991

                           *       1049  1072  1093  1107  1115  1119  1121  1119  1113  1100  1079  1053        *
                1014 1024  * 1033  1042  1063  1086  1103  1114  1119  1122  1122  1119  1110  1093  1069  1044 1031  * 1011  991

                        *       1044  1066  1090  1107  1117  1122  1124  1124  1121  1113  1097  1074  1048        *
           1011 1022  * 1032  1036  1055  1080  1101  1114  1121  1124  1125  1124  1119  1107  1087  1062  1039 1030  * 1011  990
            981 1005  * 1029                                                                                 1030  *  992  952
            980 1004  * 1027  1034  1055  1081  1102  1116  1123  1126  1127  1126  1120  1109  1089  1063  1040 1032  * 1000  967
                        *       1042  1067  1092  1110  1120  1125  1127  1127  1124  1116  1099  1076  1050        *

               980 1004  * 1027  1038  1064  1090  1109  1120  1126  1128  1127  1124  1114  1097  1073  1047 1034  * 1002  969
                           *       1048  1075  1099  1115  1123  1127  1128  1126  1119  1105  1083  1057        *

                  979 1004  * 1027  1042  1069  1094  1112  1121  1126  1126  1124  1116  1100  1077  1051 1034  * 1003  971
                              *       1052  1079  1101  1115  1122  1125  1124  1119  1107  1086  1060        *

                     979 1004  * 1028  1044  1072  1095  1110  1118  1121  1119  1113  1100  1078  1051 1034  * 1003  972
                                 *       1054  1080  1099  1111  1116  1117  1113  1103  1085  1060        *

                        978 1004  * 1029  1045  1070  1089  1101  1107  1108  1104  1093  1075  1050 1032  * 1003  972
                                    *       1052  1074  1090  1099  1102  1100  1093  1079  1057        *

                           977 1003  * 1028  1043  1062  1076  1084  1087  1086  1080  1066  1047 1031  * 1002  972
                                       *       1047  1062  1072  1077  1079  1076  1067  1051        *

                              975 1002  * 1027  1036  1047  1054  1058  1060  1058  1052  1041 1029  * 1001  972
                                          *       1036  1042  1047  1050  1050  1048  1042        *

                                        * 1025  1025  1026  1028  1030  1032  1033  1032 1029  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     989       1000  1000  1002  1003  1004  1004  1003        990

                                  953            973   974   974   975   975   974   973            949
```


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Table B12A-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                              901             916   917   918   919   919   919   919             905

                                  932         940   941   941   941   941   941   941        935
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  962   963   964   963   963   962   962   962  964  *

                                        *         969   972   973   973   971   969   966        *
                           926  945  *  962   969   975   978   979   977   974   971   967  965  *  948  930

                                     *         976   985   989   990   988   984   978   972        *
                        928  946  *  964   974   985   992   995   995   991   985   978   971  967  *  950  933

                                  *         982   994  1002  1006  1005  1001   994   985   975        *
                     929  948  *  966   978   993  1004  1009  1010  1008  1002   993   983   973  968  *  952  935

                               *         985  1001  1012  1018  1019  1016  1009  1000   989   977        *
                  930  949  *  968   980   997  1011  1019  1022  1021  1016  1008   997   985   974  969  *  953  937

                           *         987  1004  1018  1025  1028  1027  1022  1014  1003   989   977        *
               931  951  *  970   982   999  1015  1025  1030  1030  1027  1020  1011   998   985   974  969  *  955  939

                        *         987  1005  1019  1029  1034  1034  1030  1024  1014  1002   988   976        *
            931  951  *  971   981   998  1015  1027  1033  1035  1033  1028  1021  1010   996   983   973  970  *  956  941

                     *         985  1002  1017  1029  1035  1037  1035  1030  1022  1011   998   985   975        *
      931  952  *  971   978   994  1011  1024  1033  1037  1037  1033  1027  1018  1005   992   980   973  971  *  957  942
      923  947  *  971                                                 *                                 973  *  960  947
      946  959  *  972   979   995  1011  1025  1033  1037  1037  1033  1027  1018  1006   992   980   974  974  *  972  970
                     *         986  1003  1018  1029  1035  1037  1035  1030  1022  1012   999   986   976        *

            947  961  *  974   984  1001  1016  1027  1034  1035  1033  1028  1021  1010   998   985   977  975  *  973  972
                        *         991  1007  1021  1030  1034  1033  1030  1024  1015  1003   990   980        *

               947  962  *  976   987  1003  1017  1026  1030  1030  1027  1021  1012  1000   988   979  975  *  975  974
                           *         993  1008  1020  1026  1029  1027  1022  1015  1004   993   982        *

                  947  963  *  978   988  1003  1014  1021  1024  1022  1017  1010  1000   989   980  976  *  976  976
                              *         994  1007  1015  1020  1020  1017  1011  1003   992   982        *

                     946  963  *  979   989  1000  1009  1013  1013  1011  1005   997   988   979  975  *  976  978
                                 *         992  1002  1008  1010  1009  1005   998   990   982        *

                        945  963  *  980   987   995  1000  1002  1001   998   992   985   978  975  *  977  978
                                    *         989   994   997   998   996   992   986   980        *

                           944  962  *  980   984   987   989   989   988   985   981   977  975  *  976  978
                                       *         983   985   986   985   983   981   977        *

                                          *  978   978   978   978   978   978   977   975  974  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                          948         954   953   953   953   952   951   949        956

                                       915             928   928   927   926   925   924   923            938
```


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Table E12A-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12A-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              965             976   979   982   983   983   982   979            946

                                  967         975   978   980   980   980   978   976        959
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  969   974   977   978   978   977   975   973  972  *

                                        *        1012  1025  1029  1030  1030  1028  1017        *
                                 960  964  *  968  1010  1039  1047  1050  1051  1050  1045  1019  977  *  956  934

                                           *        1037  1065  1074  1077  1078  1079  1073  1047        *
                              962  965  *  969  1021  1065  1080  1085  1087  1088  1086  1074  1032  980  *  959  937

                                           *        1044  1079  1091  1095  1097  1099  1098  1089  1055        *
                           963  966  *  970  1024  1072  1091  1097  1099  1101  1102  1099  1083  1036  981  *  960  939

                                     *        1046  1083  1097  1101  1103  1104  1106  1104  1093  1058        *
                        963  968  *  972  1026  1075  1094  1101  1103  1105  1106  1107  1103  1086  1037  981  *  960  939

                                  *        1048  1085  1099  1103  1105  1106  1108  1109  1107  1096  1059        *
                     963  968  *  973  1028  1077  1096  1103  1105  1106  1107  1109  1109  1105  1087  1037  980  *  960  940

                           *        1049  1087  1101  1105  1106  1107  1108  1110  1111  1109  1097  1059        *
                  962  968  *  974  1027  1078  1098  1105  1106  1107  1108  1110  1111  1112  1107  1088  1036  979  *  959  939

                        *        1044  1086  1102  1107  1108  1109  1110  1111  1112  1113  1111  1096  1053        *
               960  966  *  972  1016  1073  1098  1106  1108  1109  1110  1111  1112  1114  1114  1107  1083  1025  977  *  958  938
               928  948  *  968                                                                                    977  *  941  903
               924  946  *  968  1015  1074  1100  1108  1110  1111  1111  1112  1114  1115  1115  1109  1084  1027  983  *  953  921
                        *        1045  1090  1106  1110  1111  1112  1113  1114  1115  1116  1113  1099  1057        *

                  926  949  *  970  1029  1084  1106  1112  1113  1114  1114  1115  1117  1117  1113  1093  1041  986  *  956  924
                           *        1055  1096  1110  1114  1114  1115  1116  1117  1118  1116  1103  1065        *

                     928  951  *  974  1034  1088  1109  1115  1116  1117  1118  1119  1119  1115  1096  1045  987  *  957  926
                           *        1059  1099  1113  1117  1118  1118  1119  1120  1118  1105  1067        *

                        930  954  *  977  1038  1092  1112  1118  1119  1120  1121  1121  1116  1097  1046  987  *  958  927
                              *        1062  1102  1115  1119  1120  1120  1121  1119  1107  1068        *

                           931  956  *  980  1041  1093  1113  1118  1119  1120  1120  1116  1098  1046  986  *  957  927
                                     *        1064  1102  1114  1116  1117  1118  1116  1106  1068        *

                              931  957  *  982  1041  1088  1104  1107  1109  1109  1107  1092  1044  984  *  956  926
                                        *        1059  1089  1097  1099  1100  1100  1093  1063        *

                                 930  956  *  981  1029  1059  1067  1070  1071  1071  1064  1033  982  *  954  925
                                           *        1028  1042  1046  1048  1049  1047  1034        *

                                              *  976   977   981   984   987   989   989   987  981  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           942         953   956   958   960   961   961   959        943

                                        906            927   929   931   932   932   932   930           902
```


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Table E12A-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                            867             888   888   888   886   884   882   880            871

                                901         912   913   911   909   907   904   902        898
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  934   936   936   934   931   928   926   923  923  *

                                  *         967   975   975   972   968   963   952        *
                          892  914  *  935   968   988   991   989   986   981   973   953  926  *  913  899

                                    *         989  1010  1014  1012  1009  1004   994   972        *
                         894  917  *  938   978  1011  1021  1022  1019  1014  1008   993   961  927  *  914  901

                                    *         997  1024  1032  1032  1028  1024  1018  1005   976        *
                        896  919  *  942   983  1019  1034  1036  1033  1030  1025  1016   998   962  927  *  914  902

                                  *        1000  1029  1039  1039  1036  1033  1028  1021  1006   976        *
                      898  922  *  945   985  1023  1038  1041  1039  1035  1031  1026  1017   998   961  925  *  914  901

                                *        1002  1031  1041  1042  1039  1036  1032  1028  1020  1005   974        *
                    899  923  *  947   986  1024  1040  1043  1041  1037  1034  1030  1025  1015   996   958  924  *  912  901

                              *        1002  1031  1042  1043  1041  1037  1033  1030  1025  1018  1002   971        *
                  899  924  *  948   985  1023  1040  1044  1042  1038  1035  1031  1028  1023  1013   992   955  923  *  911  900

                            *         996  1029  1042  1044  1042  1038  1034  1031  1027  1023  1015   997   965        *
          898  923  *  947   976  1017  1038  1044  1043  1040  1036  1032  1029  1025  1020  1008   985   948  922  *  910  898
          885  915  *  944                                                                                 924  *  914  904
          912  929  *  945   976  1017  1038  1044  1043  1039  1035  1032  1029  1025  1019  1008   985   949  927  *  926  926
                            *         996  1028  1041  1044  1041  1037  1033  1030  1027  1022  1014   997   966        *

                  914  930  *  947   984  1022  1039  1042  1040  1037  1033  1030  1026  1021  1012   993   958  929  *  929  929
                              *        1001  1030  1041  1041  1039  1035  1031  1028  1024  1016  1001   973        *

                      914  931  *  948   986  1022  1037  1040  1038  1035  1031  1027  1022  1013   995   961  930  *  931  932
                                *        1001  1029  1038  1039  1036  1033  1029  1025  1018  1003   974        *

                          914  932  *  950   986  1021  1035  1037  1035  1032  1028  1023  1014   996   962  930  *  932  933
                                    *        1000  1026  1035  1035  1032  1029  1024  1017  1003   975        *

                              913  932  *  950   985  1017  1030  1031  1029  1025  1021  1012   995   961  929  *  932  934
                                        *         997  1021  1028  1027  1024  1020  1014  1001   974        *

                                  911  930  *  949   982  1009  1017  1017  1015  1011  1004   990   960  929  *  932  935
                                            *         990  1007  1010  1009  1005  1001   992   970        *

                                     908  928  *  946   971   986   989   988   985   981   973   953  928  *  931  933
                                               *         969   975   975   973   970   966   955        *

                                                  *  943   941   941   940   940   938   936   933  929  *
                                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                                911         916   916   915   915   913   911   908        913

                                                877             891   890   890   888   887   885   882            895
```


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Table E12A-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12A-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              982             993   996   999  1000  1000   999   996            962

                                  984         991   995   996   996   996   994   992        975
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  986   990   993   994   993   992   989   988  988  *

                                        *       1008  1021  1025  1026  1026  1023  1012        *
                                 975  979  *  984  1006  1030  1039  1042  1043  1042  1035  1014  991  *  970  948

                                           *       1028  1056  1066  1069  1071  1070  1063  1037        *
                              976  980  *  984  1016  1055  1072  1078  1080  1081  1078  1064  1027  994  *  973  950

                                           *       1035  1071  1086  1091  1093  1094  1092  1080  1046        *
                           977  981  *  985  1020  1064  1086  1094  1097  1098  1098  1094  1074  1031  995  *  974  952

                                        *       1038  1076  1093  1099  1102  1103  1104  1101  1086  1049        *
                        977  982  *  987  1022  1067  1090  1099  1102  1104  1105  1105  1099  1078  1032  995  *  974  952

                                     *       1040  1079  1096  1102  1104  1106  1107  1108  1104  1089  1050        *
                     977  983  *  988  1023  1069  1093  1101  1104  1106  1107  1108  1108  1101  1079  1032  994  *  974  953

                                  *       1040  1080  1098  1104  1106  1107  1109  1110  1110  1106  1090  1049        *
                  976  982  *  989  1022  1069  1094  1103  1106  1107  1109  1110  1111  1110  1103  1079  1029  992  *  973  952

                               *       1034  1078  1099  1106  1108  1109  1110  1111  1112  1112  1107  1087  1043        *
               974  980  *  987  1010  1062  1093  1105  1108  1109  1110  1111  1112  1113  1112  1102  1072  1019  991  *  971  951
               942  963  *  983                                                                                  992  *  955  916
               937  960  *  982  1009  1063  1094  1106  1110  1111  1112  1113  1114  1115  1113  1103  1073  1021  997  *  966  933
                            *       1034  1081  1102  1109  1111  1112  1113  1114  1115  1115  1110  1090  1046        *

                  939  962  *  984  1022  1074  1101  1110  1113  1114  1115  1116  1116  1116  1108  1084  1035 1000  *  969  936
                               *       1044  1088  1107  1113  1114  1115  1116  1117  1117  1113  1096  1055        *

                     940  964  *  986  1028  1080  1105  1113  1116  1117  1118  1118  1117  1110  1087  1039 1001  *  970  938
                               *       1049  1092  1110  1116  1117  1118  1119  1119  1115  1098  1058        *

                        942  966  *  990  1031  1083  1107  1116  1118  1119  1119  1119  1112  1089  1040 1000  *  970  939
                                  *       1052  1094  1112  1117  1118  1119  1119  1115  1099  1059        *

                           943  968  *  992  1034  1084  1106  1114  1116  1117  1116  1110  1088  1040  999  *  969  939
                                     *       1053  1092  1107  1112  1113  1113  1110  1096  1058        *

                              943  969  *  994  1033  1076  1094  1099  1101  1101  1097  1080  1036  997  *  968  938
                                        *       1047  1077  1087  1090  1091  1090  1081  1050        *

                                 941  968  *  993  1021  1047  1056  1059  1061  1060  1052  1025  995  *  966  937
                                           *       1020  1034  1039  1041  1042  1040  1027        *

                                              *  989   989   993   996   999  1001  1002  1000  996  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           955         965   968   970   972   974   974   972        956

                                        919            940   942   944   945   945   944   942            915
```


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Table E12A-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12A-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                            877             897   897   897   896   894   893   891            882

                                911         922   922   921   919   917   915   913        909
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  944   946   946   944   941   938   936   934  935  *

                                   *         962   970   970   967   964   959   950        *
                          902  924  *  945   963   979   983   982   978   974   965   950  937  *  923  909

                                  *         980   999  1005  1004  1001   995   985   965        *
                         904  926  *  948   973  1000  1012  1014  1011  1007   999   984   958  938  *  925  911

                                 *         988  1015  1025  1026  1023  1019  1012   997   970        *
                        906  929  *  951   978  1010  1026  1031  1029  1025  1020  1010   990   959  938  *  925  912

                               *         992  1021  1034  1036  1034  1030  1025  1017  1000   970        *
                       908  931  *  954   980  1014  1032  1037  1037  1034  1029  1023  1012   991   958  937  *  925  912

                              *         994  1023  1037  1040  1038  1035  1031  1026  1016   999   969        *
                      909  933  *  956   982  1015  1034  1040  1040  1037  1033  1029  1023  1011   989   957  936  *  924  912

                             *         993  1023  1038  1042  1040  1037  1033  1029  1024  1014   996   966        *
                    909  934  *  958   980  1014  1034  1041  1041  1038  1035  1031  1027  1020  1008   985   953  935  *  924  912

                            *         988  1020  1037  1042  1041  1038  1034  1031  1027  1021  1011   990   960        *
                  908  933  *  957   972  1007  1031  1041  1042  1040  1036  1032  1029  1024  1017  1003   978   947  936  *  923  911
                  896  926  *  955                                                                                  938  *  928  918
                  923  940  *  956   972  1007  1031  1041  1042  1039  1036  1032  1028  1024  1017  1003   978   949  940  *  940  940
                            *         987  1019  1036  1041  1040  1037  1034  1030  1026  1021  1010   991   962        *

                    924  941  *  957   980  1014  1033  1040  1040  1037  1033  1030  1025  1019  1008   986   957  942  *  943  943
                             *         993  1022  1036  1040  1038  1035  1031  1027  1022  1013   996   968        *

                       925  942  *  959   982  1015  1032  1038  1037  1034  1031  1026  1020  1009   989   960  943  *  944  946
                                *         994  1022  1034  1037  1035  1032  1028  1023  1014   997   970        *

                          924  943  *  961   983  1013  1029  1034  1033  1030  1026  1020  1009   990   961  943  *  945  947
                                   *         994  1019  1030  1032  1030  1027  1022  1013   997   971        *

                             923  943  *  961   982  1009  1023  1027  1025  1022  1016  1007   988   960  943  *  945  948
                                       *         991  1013  1021  1022  1020  1015  1008   994   970        *

                                922  942  *  961   978  1000  1009  1011  1008  1004   997   983   958  942  *  945  949
                                          *         983   998  1003  1002   999   994   984   965        *

                                   919  939  *  959   969   980   983   983   980   976   968   953  942  *  945  948
                                             *         967   972   973   971   969   964   955        *

                                               *  956   954   953   953   952   951   949   946  943  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               923         928   928   927   926   925   923   920        926

                                             888             902   901   900   899   898   896   893            909
```


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Table E12A-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12A-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1015            1026  1028  1030  1031  1031  1030  1029            995

                               1020        1026  1027  1028  1028  1027  1026  1024       1007
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1024  1025  1026  1026  1025  1023  1021  1020 1019  *

                                 *       1027  1032  1034  1035  1034  1030  1026        *
                          1009 1016  * 1022  1026  1033  1038  1041  1041  1038  1033  1026 1020  * 1000  979

                                 *       1031  1042  1050  1054  1054  1051  1044  1034        *
                           1009 1015  * 1022  1029  1041  1052  1058  1061  1060  1054  1045  1031 1021  * 1001  980

                                 *       1035  1051  1063  1070  1073  1072  1067  1056  1039        *
                           1008 1015  * 1022  1031  1048  1063  1073  1078  1079  1076  1067  1053  1034 1021  * 1001  981

                                 *       1038  1057  1072  1082  1087  1089  1086  1078  1063  1042        *
                           1007 1015  * 1022  1032  1051  1069  1082  1089  1092  1092  1087  1075  1057  1035 1021  * 1001  981

                                 *       1038  1059  1077  1089  1096  1098  1098  1094  1083  1066  1043        *
                           1006 1014  * 1022  1032  1052  1072  1087  1096  1100  1101  1099  1093  1079  1058  1034 1020  * 1001  981

                                 *       1037  1058  1078  1092  1100  1104  1105  1103  1098  1085  1065  1041        *
                           1004 1013  * 1021  1029  1050  1072  1088  1099  1104  1106  1106  1103  1095  1079  1056  1032 1019  * 1000  981

                                 *       1031  1053  1075  1092  1102  1106  1108  1109  1106  1098  1083  1060  1036        *
                          1001 1011  * 1020  1023  1042  1066  1086  1099  1105  1109  1110  1109  1104  1092  1073  1049  1027 1018  *  999  980
                           972  995  * 1017                                                                                    1018  *  982  944
                           970  993  * 1015  1022  1042  1067  1087  1100  1107  1110  1111  1110  1105  1094  1074  1050  1028 1020  *  990  958
                                 *       1030  1054  1077  1095  1105  1109  1111  1111  1108  1100  1085  1062  1037        *

                              970  993  * 1015  1026  1051  1075  1094  1105  1110  1112  1112  1108  1099  1082  1059  1034 1022  *  992  960
                                       *       1035  1061  1084  1099  1107  1111  1112  1110  1104  1090  1069  1044        *

                                 970  993  * 1015  1029  1056  1080  1096  1106  1110  1111  1108  1101  1086  1063  1038 1022  *  993  962
                                       *       1039  1065  1087  1100  1107  1109  1108  1103  1092  1072  1047        *

                                    969  993  * 1016  1032  1058  1080  1095  1102  1105  1104  1098  1085  1064  1039 1021  *  993  963
                                       *       1041  1066  1084  1096  1101  1102  1098  1088  1071  1047        *

                                       969  993  * 1017  1032  1056  1075  1086  1092  1093  1089  1079  1061  1037 1020  *  992  963
                                             *       1040  1061  1075  1084  1087  1086  1079  1065  1044        *

                                          967  992  * 1017  1030  1048  1062  1070  1073  1072  1066  1053  1034 1019  *  991  963
                                             *       1034  1049  1058  1063  1065  1062  1053  1039        *

                                             966  991  * 1015  1024  1034  1041  1045  1047  1045  1039  1028 1017  *  991  963
                                                *       1023  1030  1034  1037  1037  1035  1029        *

                                                   * 1013  1013  1014  1016  1018  1020  1020  1020 1017  *
                                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                                979         989   990   991   992   993   993   992        980

                                                944            964   964   965   965   965   965   963            940
```


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Table E12A-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12A-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                          898          914   915   916   916   917   917   917          904

                              929       937   938   938   938   938   938   938      933
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  959   960   960   960   959   959   958   959  960  *

                                *       965   969   970   969   967   965   963      *
                        923  941  *  959   965   972   974   975   973   971   967   963  961  *  945  929

                              *       972   981   985   986   984   980   974   968      *
                     924  942  *  960   970   981   988   991   990   987   981   974   967  963  *  947  932

                           *       977   990   998  1001  1000   996   990   981   971      *
                  925  944  *  962   974   988   999  1004  1006  1003   998   989   979   969  964  *  949  934

                         *       981   996  1007  1013  1014  1011  1005   996   984   973      *
               926  945  *  964   976   993  1006  1014  1017  1016  1012  1004   993   981   969  964  *  950  936

                       *       983   999  1012  1020  1023  1021  1017  1009   998   985   973      *
            926  946  *  966   977   994  1009  1019  1024  1025  1022  1015  1006   994   980   969  964  *  951  937

                    *       982   999  1013  1023  1027  1028  1025  1018  1009   997   983   972      *
         927  947  *  967   976   993  1009  1020  1027  1029  1028  1023  1015  1005   992   978   968  965  *  952  938

                 *       980   996  1011  1022  1029  1031  1029  1024  1017  1006   993   980   970      *
      927  947  *  967   974   989  1005  1018  1027  1030  1030  1027  1021  1012  1001   987   975   968  966  *  953  939
      918  943  *  966                                                                                    967  *  956  945
      941  955  *  967   974   989  1005  1018  1027  1030  1030  1027  1021  1012  1001   987   975   969  968  *  967  966
                 *       981   997  1011  1022  1029  1030  1028  1024  1017  1006   994   981   971      *

         942  956  *  969   978   995  1009  1020  1027  1028  1027  1022  1015  1005   992   980   971  969  *  969  968
                    *       985  1001  1014  1023  1027  1027  1024  1018  1009   998   985   975      *

            942  957  *  971   981   997  1010  1019  1023  1024  1021  1015  1006   995   983   973  970  *  970  970
                       *       987  1002  1013  1020  1022  1020  1016  1009   999   987   976      *

               942  958  *  973   983   997  1008  1014  1017  1015  1011  1004   994   983   974  970  *  971  972
                          *       988  1000  1009  1013  1014  1011  1005   997   987   977      *

                  941  958  *  974   983   994  1002  1006  1007  1004   999   991   982   974  970  *  971  973
                             *       986   995  1001  1003  1002   998   992   984   976      *

                     940  958  *  974   981   989   993   995   994   991   986   979   973  969  *  971  974
                                *       983   988   991   991   989   985   980   974      *

                        939  957  *  974   978   981   983   983   982   979   975   971  969  *  971  973
                                   *       977   979   980   979   977   975   971      *

                                      *  973   973   972   973   972   972   971   969  968  *
                                         *   *   *   *   *   *   *   *   *   *   *   *   *
                                   943       949   948   948   948   947   946   944      952

                               911          924   923   923   922   921   919   918          934
```


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Table B12A-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12A-2

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 44.000 in

```
                          970          981   985   987   988   989   988   985          950

                              972       980   984   985   986   985   984   981       964
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  974   979   982   983   983   982   980   977  977  *

                                *       1018  1032  1035  1036  1036  1034  1023       *
                           965  969  *  973  1016  1045  1054  1056  1057  1057  1051  1024  981  *  960  939

                                 *       1043  1072  1081  1084  1085  1085  1080  1053       *
                        966  970  *  974  1027  1072  1087  1092  1094  1095  1093  1081  1038  985  *  964  941

                                 *       1050  1086  1099  1103  1105  1106  1105  1096  1061       *
                      967  971  *  975  1030  1079  1098  1105  1107  1109  1109  1106  1090  1042  986  *  965  943

                                *       1053  1091  1104  1109  1111  1112  1113  1112  1100  1064       *
                 968  973  *  977  1033  1082  1102  1109  1111  1112  1114  1114  1111  1093  1043  986  *  965  944

                           *       1055  1093  1107  1111  1113  1114  1115  1116  1115  1103  1065       *
              968  973  *  979  1034  1084  1104  1111  1113  1114  1115  1117  1117  1113  1094  1043  985  *  965  944

                        *       1056  1095  1109  1113  1114  1115  1116  1118  1119  1117  1104  1065       *
           967  973  *  979  1033  1085  1106  1113  1114  1115  1116  1118  1119  1119  1115  1095  1042  984  *  964  943

                     *       1051  1094  1110  1115  1116  1117  1118  1119  1120  1121  1118  1103  1060       *
     965  971  *  978  1022  1080  1106  1115  1117  1117  1118  1119  1120  1122  1121  1115  1089  1031  982  *  962  942
     932  953  *  973                                                                                  983  *  946  908
     928  951  *  973  1021  1081  1108  1116  1119  1119  1120  1121  1122  1123  1123  1116  1091  1033  988  *  959  927
                     *       1052  1097  1114  1119  1120  1120  1121  1122  1123  1124  1121  1106  1063       *

           931  954  *  976  1035  1092  1114  1120  1122  1122  1123  1124  1125  1125  1120  1100  1048  992  *  962  931
                        *       1062  1104  1118  1122  1123  1124  1124  1125  1126  1124  1111  1072       *

              933  957  *  979  1041  1096  1117  1124  1125  1126  1126  1127  1127  1123  1103  1052  993  *  964  933
                        *       1066  1108  1122  1125  1126  1127  1128  1128  1126  1113  1074       *

                 935  959  *  983  1045  1100  1121  1126  1128  1129  1129  1129  1125  1105  1053  993  *  964  934
                           *       1069  1110  1124  1128  1129  1129  1130  1128  1115  1076       *

                    936  961  *  986  1048  1102  1121  1127  1128  1129  1129  1125  1106  1053  992  *  964  934
                              *       1071  1110  1123  1125  1126  1127  1125  1114  1076       *

                       936  963  *  988  1048  1097  1112  1116  1117  1118  1115  1100  1051  990  *  962  933
                                 *       1067  1097  1106  1108  1109  1108  1101  1070       *

                          935  961  *  987  1036  1067  1075  1078  1079  1079  1072  1040  988  *  961  932
                                    *       1036  1049  1054  1056  1057  1055  1042       *

                                      *  982   983   987   990   993   995   996   994  988  *
                                         *   *   *   *   *   *   *   *   *   *   *   *   *
                                     947          958   962   964   966   967   967   965       949

                                 912          933   935   937   938   938   938   936          909
```


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Table B12A-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12A-2

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                              866             886   886   885   884   882   879   877            867

                                  899         910   910   909   906   904   901   899        894
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  931   934   933   931   928   925   922   920  919  *

                                        *         965   973   972   968   964   959   948        *
                                 891  913  *  933   966   986   989   986   982   977   969   949  922  *  909  894

                                           *         988  1008  1012  1009  1005  1000   990   967        *
                                    894  916  *  937   977  1010  1020  1019  1015  1011  1003   989   957  924  *  910  897

                                           *         996  1023  1031  1030  1026  1021  1014  1000   972        *
                                 896  919  *  940   982  1019  1033  1034  1031  1027  1021  1012   994   958  923  *  911  898

                                        *        1000  1029  1038  1038  1034  1030  1025  1017  1002   972        *
                              898  921  *  944   985  1022  1037  1040  1037  1033  1029  1023  1013   994   957  922  *  910  898

                                     *        1002  1031  1041  1041  1038  1034  1029  1024  1016  1001   970        *
                           899  923  *  946   987  1024  1040  1042  1040  1036  1032  1027  1022  1012   992   955  921  *  909  897

                                  *        1002  1032  1043  1043  1040  1036  1031  1027  1022  1014   998   968        *
                       900  925  *  948   986  1024  1041  1044  1042  1038  1033  1029  1025  1020  1009   989   952  920  *  909  896

                                 *         998  1030  1043  1045  1042  1037  1033  1029  1025  1020  1011   994   962        *
          899  924  *  947   977  1019  1039  1045  1043  1039  1035  1031  1027  1023  1017  1005   982   945  920  *  908  895
          887  916  *  945                                                 *                                    922  *  912  901
          914  930  *  946   977  1018  1039  1045  1043  1039  1035  1031  1027  1023  1017  1005   982   946  925  *  924  923
                    *         997  1030  1043  1044  1041  1037  1033  1029  1025  1020  1011   994   964        *

             915  932  *  948   985  1024  1040  1043  1041  1037  1033  1029  1025  1019  1009   990   956  928  *  927  927
                       *        1002  1031  1042  1042  1039  1035  1031  1027  1022  1014   999   970        *

                916  933  *  950   988  1024  1039  1041  1038  1035  1030  1026  1021  1011   993   959  929  *  929  930
                          *        1003  1030  1040  1040  1036  1032  1028  1023  1016  1001   973        *

                   915  933  *  951   988  1022  1036  1038  1035  1031  1027  1022  1012   994   960  929  *  930  932
                             *        1002  1028  1036  1036  1032  1028  1024  1016  1002   973        *

                      914  933  *  951   987  1019  1031  1032  1029  1025  1020  1011   994   960  929  *  931  933
                                *         999  1022  1029  1028  1024  1020  1013  1000   973        *

                         913  932  *  951   983  1010  1018  1018  1015  1010  1004   989   959  929  *  931  934
                                   *         992  1008  1011  1009  1006  1001   991   969        *

                            910  929  *  948   973   988   990   988   986   981   973   953  928  *  930  933
                                      *         970   976   976   974   971   966   955        *

                                         *  944   942   942   942   941   939   937   933  930  *
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                      912         918   917   916   915   914   911   908        913

                                  879             892   891   890   889   887   885   882            895
```


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Table B12A-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12A-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              988             998  1002  1004  1006  1006  1005  1002            967

                                  990         997  1000  1002  1002  1001  1000   997        980
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  992   995   998   999   998   997   995   993  993  *

                                        *        1014  1027  1031  1032  1032  1028  1018        *
                                 980  985  *  989  1012  1037  1046  1048  1049  1048  1041  1019  996  *  975  952

                                           *        1034  1063  1073  1076  1078  1077  1069  1043        *
                                    981  985  *  990  1022  1062  1079  1085  1088  1088  1085  1070  1032  999  *  978  955

                                           *        1042  1078  1094  1099  1101  1102  1100  1087  1052        *
                                 982  986  *  991  1026  1071  1093  1101  1104  1106  1106  1101  1081  1037 1000  *  979  956

                                     *        1045  1084  1101  1107  1109  1111  1111  1108  1093  1055        *
                              982  987  *  992  1028  1074  1098  1107  1110  1112  1113  1112  1106  1084  1038 1000  *  979  957

                                  *        1047  1086  1104  1110  1112  1114  1115  1115  1112  1096  1056        *
                           982  988  *  994  1029  1076  1100  1109  1112  1114  1115  1116  1116  1109  1086  1038  999  *  979  957

                                *        1047  1088  1106  1112  1114  1115  1116  1118  1118  1114  1097  1055        *
                        981  988  *  994  1028  1076  1102  1111  1114  1115  1117  1118  1119  1118  1110  1086  1035  998  *  978  957

                             *        1040  1085  1107  1114  1116  1117  1118  1119  1120  1120  1115  1094  1049        *
      978  985  *  992  1016  1069  1100  1113  1116  1117  1118  1119  1120  1121  1120  1109  1078  1025  997  *  977  956
      946  968  *  988                                                 *                                 998  *  960  921
      942  965  *  987  1015  1070  1102  1114  1118  1119  1120  1121  1122  1123  1121  1110  1080  1027 1003  *  972  940
                *        1041  1088  1110  1118  1120  1120  1121  1122  1123  1123  1117  1097  1052        *

         944  967  *  989  1028  1082  1109  1119  1121  1122  1123  1124  1125  1124  1116  1091  1041 1006  *  975  943
                   *        1051  1096  1115  1121  1123  1124  1124  1125  1125  1121  1103  1062        *

            946  969  *  992  1034  1087  1113  1122  1125  1125  1126  1127  1126  1118  1095  1046 1007  *  977  945
                      *        1056  1100  1118  1124  1126  1127  1127  1127  1123  1106  1065        *

               947  972  *  995  1038  1091  1116  1124  1127  1128  1128  1127  1120  1096  1047 1007  *  977  946
                         *        1059  1103  1120  1126  1127  1128  1128  1124  1107  1066        *

                  948  974  *  998  1041  1092  1115  1123  1125  1125  1125  1118  1096  1047 1006  *  976  946
                            *        1060  1101  1116  1121  1122  1122  1119  1105  1065        *

                     948  975  * 1000  1040  1084  1103  1108  1110  1110  1106  1088  1044 1003  *  975  946
                               *        1054  1085  1095  1098  1099  1098  1089  1058        *

                        947  973  *  999  1028  1055  1064  1067  1069  1068  1060  1032 1002  *  974  944
                                  *        1027  1041  1046  1049  1050  1047  1034        *

                                     *  995   996   999  1003  1006  1008  1009  1007 1002  *
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                  961         972   974   977   979   980   981   978        963

                                 925             946   948   950   951   951   951   949            922
```


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Table B12A-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12A-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          876          895   895   895   893   892   890   888          877

                              909         919   919   918   916   914   911   910        905
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  941   943   943   940   938   935   932   931  931  *

                                *         960   967   967   964   960   955   946        *
                        901  922  *  942   961   976   980   979   975   970   961   946  934  *  919  904

                              *         978   998  1003  1001   997   991   981   961        *
                     904  925  *  946   971   999  1010  1011  1008  1003   995   980   954  935  *  921  907

                           *         987  1014  1023  1024  1021  1016  1008   993   966        *
                   906  928  *  949   977  1009  1025  1029  1027  1022  1016  1006   986   956  935  *  922  908

                         *         991  1020  1033  1034  1032  1028  1022  1013   996   967        *
               908  931  *  953   980  1014  1032  1036  1035  1031  1027  1020  1008   987   955  934  *  922  909

                     *         994  1023  1037  1039  1037  1033  1028  1022  1013   995   965        *
           909  933  *  956   982  1016  1034  1040  1039  1035  1031  1026  1019  1007   985   953  934  *  921  909

                  *         994  1024  1038  1041  1039  1035  1031  1027  1021  1011   992   962        *
      910  934  *  957   981  1015  1035  1042  1041  1037  1033  1029  1024  1017  1005   982   950  933  *  921  908

               *         989  1021  1038  1043  1041  1037  1033  1029  1025  1018  1007   987   957        *
  909  934  *  957   973  1008  1032  1042  1042  1039  1035  1031  1027  1022  1014   999   974   945  934  *  921  908
  898  927  *  955                                                   *                              936  *  926  915
  925  941  *  956   972  1008  1032  1042  1042  1039  1035  1031  1027  1022  1014  1000   975   946  938  *  938  937
               *         988  1021  1038  1042  1041  1037  1033  1029  1024  1018  1007   988   959        *

      926  942  *  958   981  1015  1035  1041  1040  1037  1033  1028  1024  1017  1005   984   955  941  *  941  941
                  *         994  1024  1038  1040  1038  1034  1030  1026  1020  1011   993   966        *

         926  944  *  960   984  1016  1033  1039  1037  1034  1030  1025  1019  1007   987   958  942  *  943  944
                     *         996  1023  1035  1038  1035  1032  1027  1022  1012   995   968        *

            926  944  *  962   984  1015  1031  1035  1033  1030  1025  1019  1008   988   959  942  *  944  946
                        *         995  1020  1031  1033  1030  1026  1021  1012   996   969        *

               925  944  *  963   983  1011  1024  1027  1025  1021  1016  1006   987   959  942  *  945  947
                           *         992  1014  1022  1023  1020  1015  1008   993   969        *

                  924  943  *  962   980  1001  1010  1011  1009  1004   997   982   958  942  *  945  948
                              *         985   999  1004  1003   999   994   984   964        *

                     921  941  *  960   970   981   984   983   981   976   968   953  942  *  945  947
                                 *         968   973   974   972   969   964   955        *

                                   *  957   955   954   954   953   952   950   946  944  *
                                      *   *   *   *   *   *   *   *   *   *   *   *   *
                                  924         930   929   928   927   926   923   920        926

                                890          903   902   901   900   898   896   894          908
```


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Table B12A-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12A-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1021            1033  1035  1036  1037  1038  1037  1035           1001

                               1026        1032  1033  1034  1034  1033  1032  1030       1013
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1030  1031  1032  1032  1031  1029  1027  1026 1025  *

                                 *       1033  1038  1041  1041  1040  1036  1032        *
                          1014 1021  * 1028  1032  1039  1045  1047  1047  1044  1039  1032 1026  * 1005  984

                                 *       1038  1048  1056  1060  1061  1058  1050  1040        *
                        1014 1021  * 1028  1035  1048  1059  1065  1068  1066  1061  1051  1037 1027  * 1006  985

                               *       1042  1057  1070  1077  1080  1079  1074  1062  1046        *
                      1013 1021  * 1028  1037  1054  1070  1080  1085  1086  1083  1074  1059  1041 1028  * 1007  986

                             *       1044  1063  1079  1090  1095  1096  1093  1085  1069  1049        *
                    1012 1020  * 1028  1038  1058  1076  1089  1097  1100  1099  1094  1082  1064  1042 1028  * 1007  986

                           *       1045  1066  1084  1097  1103  1106  1106  1101  1090  1072  1049        *
                  1010 1019  * 1028  1038  1059  1079  1095  1103  1108  1109  1107  1100  1086  1065  1041 1027  * 1007  986

                         *       1043  1065  1086  1100  1108  1112  1113  1111  1105  1092  1072  1047        *
                1008 1018  * 1027  1035  1056  1079  1096  1106  1112  1114  1114  1111  1102  1086  1063  1038 1026  * 1006  986

                       *       1037  1060  1083  1100  1110  1114  1117  1117  1114  1105  1090  1067  1043        *
           1006 1016  * 1026  1030  1049  1073  1093  1107  1114  1117  1118  1117  1112  1100  1080  1056  1034 1025  * 1006  986
            976 1000  * 1023                                                                                 1025  *  988  950
            976  999  * 1021  1028  1049  1074  1095  1108  1115  1118  1119  1118  1113  1101  1082  1057  1035 1027  *  997  965
                       *       1036  1061  1085  1103  1113  1118  1120  1120  1116  1108  1092  1069  1044        *

               975  999  * 1021  1032  1057  1083  1102  1113  1118  1120  1120  1116  1107  1090  1066  1041 1029  *  999  968
                         *       1042  1069  1092  1107  1116  1119  1120  1118  1112  1098  1077  1051        *

                  975  999  * 1021  1036  1063  1088  1105  1114  1118  1119  1116  1109  1093  1071  1045 1029  * 1000  969
                            *       1046  1073  1095  1108  1115  1118  1117  1111  1099  1080  1054        *

                     975  999  * 1022  1038  1065  1088  1103  1111  1113  1112  1106  1093  1072  1046 1029  * 1000  970
                               *       1048  1073  1092  1104  1109  1110  1106  1096  1079  1054        *

                        974  999  * 1023  1039  1063  1083  1094  1100  1101  1097  1087  1069  1045 1027  * 1000  971
                                  *       1046  1068  1083  1092  1095  1094  1087  1073  1052        *

                           973  999  * 1023  1037  1056  1069  1077  1081  1080  1073  1061  1041 1026  *  999  971
                                     *       1041  1056  1066  1071  1072  1069  1061  1046        *

                              972  997  * 1022  1031  1041  1048  1053  1054  1053  1047  1036 1025  *  998  970
                                        *       1030  1037  1041  1044  1045  1043  1036        *

                                          * 1019  1019  1021  1023  1025  1027  1028  1027 1024  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       986         996   997   998   999  1000  1000  1000        987

                                    950            971   971   972   973   973   972   971           948
```


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Table B12A-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12A-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                          897          912   913   914   914   914   914   914          900

                              927       935   936   936   936   936   935   936       929
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  956   957   957   957   956   956   956   956  957  *

                                *       963   966   967   966   964   962   960       *
                        922  940  *  956   963   969   972   972   970   968   964   961  959  *  942  924

                              *       970   978   982   983   981   977   971   965       *
                     923  941  *  958   968   979   986   989   988   984   978   971   964  960  *  944  927

                            *       975   988   996   999   998   994   987   978   969       *
                   925  943  *  960   972   986   997  1002  1003  1001   995   986   976   966  962  *  946  929

                          *       979   995  1005  1011  1012  1008  1002   993   982   970       *
               926  944  *  962   974   991  1004  1012  1015  1014  1009  1001   990   978   967  962  *  947  932

                      *       981   998  1011  1019  1021  1019  1014  1006   995   982   970       *
            927  946  *  964   976   993  1008  1018  1023  1023  1019  1013  1003   991   978   967  963  *  949  933

                   *       981   999  1013  1022  1027  1026  1023  1016  1007   994   981   970       *
         927  947  *  965   975   992  1008  1020  1027  1028  1026  1021  1013  1002   989   976   967  964  *  950  935

                *       979   996  1011  1022  1028  1030  1028  1022  1015  1004   991   978   968       *
      927  947  *  966   973   988  1005  1018  1027  1030  1029  1026  1019  1010   998   985   973   966  965  *  951  936
      920  943  *  965                                                                                    967  *  954  941
      942  954  *  966   973   989  1005  1018  1027  1030  1029  1026  1019  1010   998   985   974   967  968  *  966  964
                *       980   997  1012  1023  1029  1030  1027  1022  1015  1004   992   979   970       *

         943  956  *  968   978   995  1010  1021  1027  1028  1026  1021  1013  1003   991   979   970  969  *  967  966
                   *       985  1001  1015  1023  1027  1026  1023  1017  1007   996   984   973       *

            943  957  *  970   981   998  1011  1020  1024  1023  1020  1014  1005   993   982   972  970  *  969  968
                      *       987  1002  1014  1020  1022  1020  1015  1008   997   986   976       *

               943  958  *  972   983   997  1008  1015  1017  1015  1011  1003   993   983   974  970  *  970  970
                         *       988  1001  1009  1013  1014  1011  1005   996   986   976       *

                  942  958  *  974   983   995  1003  1007  1007  1004   999   991   982   974  970  *  971  972
                            *       987   996  1002  1004  1002   998   992   984   976       *

                     941  958  *  975   982   990   994   996   995   991   986   979   973  969  *  971  973
                               *       983   989   991   992   990   986   980   974       *

                        940  958  *  974   979   982   984   984   982   979   975   971  969  *  971  972
                                  *       978   980   980   980   978   975   972       *

                                    *  973   973   973   973   973   972   971   970  969  *
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                    943       949   949   949   948   947   946   945       952

                                 912          924   924   923   922   921   920   918          933
```


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Table E12A-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12A-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              960             971   974   977   978   978   977   974            941

                                  962         969   973   974   975   974   973   970        954
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  964   968   971   972   972   971   969   967  966  *

                                        *        1006  1019  1022  1023  1023  1021  1010        *
                                 955  958  *  962  1004  1032  1040  1042  1043  1043  1037  1012  971  *  951  930

                                           *        1030  1058  1066  1069  1070  1071  1065  1040        *
                                 957  960  *  963  1014  1057  1072  1077  1079  1080  1078  1066  1025  974  *  954  932

                                           *        1037  1071  1083  1087  1089  1090  1090  1080  1048        *
                                 958  961  *  965  1018  1065  1083  1089  1091  1093  1094  1091  1075  1029  975  *  955  934

                                           *        1039  1076  1089  1093  1095  1096  1097  1096  1085  1050        *
                                 958  962  *  966  1020  1067  1087  1093  1095  1096  1098  1098  1095  1078  1030  975  *  955  935

                                           *        1041  1078  1091  1095  1097  1098  1099  1100  1099  1087  1051        *
                                 958  963  *  968  1021  1069  1089  1095  1097  1098  1099  1100  1101  1097  1079  1030  974  *  955  935

                                           *        1042  1080  1093  1097  1098  1099  1100  1102  1103  1101  1089  1051        *
                                 958  963  *  969  1021  1070  1091  1097  1098  1099  1100  1102  1103  1103  1099  1080  1029  973  *  954  934

                                           *        1037  1079  1095  1099  1100  1101  1102  1103  1104  1105  1102  1088  1046        *
                                 955  961  *  967  1010  1066  1091  1099  1101  1101  1102  1103  1104  1105  1105  1099  1075  1018  971  *  953  933
                                 924  944  *  963                                                                                   972  *  937  901
                                 920  942  *  962  1009  1067  1093  1101  1102  1103  1104  1104  1106  1107  1107  1100  1076  1021  977  *  949  919
                                           *        1039  1082  1098  1103  1104  1104  1105  1106  1107  1108  1105  1091  1049        *

                                 922  944  *  965  1023  1077  1098  1104  1105  1106  1107  1108  1109  1109  1104  1085  1035  981  *  952  922
                                           *        1048  1088  1102  1106  1107  1107  1108  1109  1110  1108  1095  1058        *

                                    924  947  *  969  1028  1081  1102  1107  1109  1109  1110  1111  1111  1107  1088  1038  982  *  954  924
                                           *        1052  1092  1106  1109  1110  1110  1111  1112  1110  1098  1060        *

                                       926  949  *  972  1032  1084  1104  1110  1111  1112  1113  1113  1108  1090  1040  982  *  954  925
                                              *        1055  1095  1108  1111  1112  1113  1113  1111  1099  1061        *

                                          927  952  *  975  1035  1086  1105  1110  1111  1112  1112  1108  1090  1040  981  *  954  925
                                                 *        1057  1095  1106  1109  1110  1110  1109  1098  1061        *

                                             928  953  *  977  1035  1081  1097  1100  1101  1102  1099  1085  1038  979  *  952  925
                                                    *        1053  1082  1090  1092  1093  1092  1086  1056        *

                                                926  951  *  976  1023  1053  1061  1063  1064  1064  1058  1027  977  *  951  923
                                                       *        1023  1036  1040  1042  1043  1041  1028        *

                                                          *  971   972   976   979   982   984   984   982  977  *
                                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                                       938         949   952   954   956   957   957   955        940

                                                    904            924   927   928   929   929   929   927           901
```


ACT-QUO-ECI
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Table E12A-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12A-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          863          884   884   883   882   880   878   876          867

                              896      908   908   906   904   902   899   897      893
                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  928   931   931   928   925   922   920   917  917  *

                                   *      961   969   968   965   961   956   946      *
                        888  909  *  930   962   981   984   982   979   974   966   946  920  *  907  894

                                 *      983  1003  1007  1005  1001   996   987   965      *
                           891  912  *  933   972  1004  1014  1014  1011  1007  1000   985   954  921  *  909  896

                                 *      991  1017  1025  1024  1021  1017  1010   997   969      *
                        893  915  *  936   977  1013  1026  1028  1026  1022  1017  1008   990   955  920  *  909  896

                               *      994  1022  1032  1032  1029  1025  1020  1013   998   968      *
                     894  917  *  939   979  1016  1031  1033  1031  1028  1024  1018  1009   990   954  919  *  908  896

                           *      996  1024  1034  1035  1032  1028  1024  1020  1012   997   967      *
                  895  919  *  942   981  1017  1033  1036  1033  1030  1026  1022  1017  1007   988   952  918  *  907  895

                        *      996  1025  1035  1036  1033  1029  1026  1022  1017  1010   994   964      *
               896  920  *  943   980  1017  1033  1037  1035  1031  1027  1023  1020  1015  1005   985   948  917  *  906  894

                     *      991  1023  1035  1037  1035  1031  1027  1023  1020  1015  1007   990   958      *
            895  919  *  942   971  1011  1032  1037  1036  1032  1028  1025  1021  1017  1012  1000   977   941  916  *  905  893
            882  911  *  939                                                                                 918  *  909  899
            909  925  *  940   970  1011  1031  1037  1036  1032  1028  1024  1021  1017  1011  1000   978   942  921  *  921  920
                     *      990  1022  1035  1037  1034  1030  1026  1022  1019  1014  1006   990   959      *

               910  926  *  942   979  1016  1032  1036  1033  1030  1026  1022  1018  1013  1004   985   951  923  *  924  924
                        *      995  1024  1034  1034  1031  1028  1024  1020  1016  1009   994   966      *

                  910  927  *  944   981  1016  1031  1033  1031  1027  1024  1020  1015  1006   987   954  924  *  925  926
                           *      995  1022  1032  1032  1029  1025  1021  1017  1010   995   967      *

                     910  928  *  945   981  1014  1028  1030  1028  1024  1020  1015  1006   988   955  924  *  926  928
                              *      994  1020  1028  1028  1025  1021  1017  1010   996   968      *

                        909  927  *  945   980  1011  1023  1024  1022  1018  1013  1005   988   955  924  *  926  929
                                 *      992  1015  1021  1020  1017  1013  1007   994   968      *

                           907  926  *  944   976  1003  1011  1011  1008  1004   997   983   953  923  *  926  929
                                    *      984  1001  1004  1002   999   994   985   964      *

                              904  923  *  942   966   981   983   982   979   975   967   947  923  *  926  928
                                       *      964   969   969   967   964   960   949      *

                                          *  938   936   936   936   935   933   931   927  924  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       907      912   912   911   910   909   907   903      908

                                    875          887   887   886   885   883   881   878          891
```


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VOID

Table E12A-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12A-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              977             988   991   993   994   995   993   991            957

                                  979         986   989   990   991   990   988   986        970
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  980   984   987   987   987   985   983   981  982  *

                                     *        1002  1014  1018  1019  1019  1016  1005        *
                           970  974  *  978  1000  1024  1032  1035  1036  1034  1028  1007  985  *  964  943

                                        *        1021  1049  1059  1062  1063  1062  1055  1030        *
                              971  975  *  978  1010  1048  1065  1070  1072  1073  1070  1056  1020  988  *  967  945

                                        *        1029  1064  1078  1083  1085  1086  1084  1072  1039        *
                           972  976  *  980  1013  1057  1078  1086  1089  1090  1090  1085  1066  1024  989  *  968  947

                                     *        1031  1069  1085  1091  1093  1095  1095  1092  1078  1042        *
                        972  977  *  981  1016  1060  1083  1091  1094  1096  1097  1097  1091  1070  1025  989  *  969  947

                                  *        1033  1071  1088  1094  1096  1098  1099  1099  1096  1081  1042        *
                     972  977  *  982  1017  1062  1085  1093  1096  1098  1099  1100  1100  1093  1071  1025  988  *  968  948

                               *        1034  1073  1090  1096  1098  1099  1100  1102  1102  1098  1082  1042        *
                  971  977  *  983  1015  1062  1086  1095  1098  1099  1100  1102  1103  1102  1095  1071  1022  986  *  967  947

                            *        1027  1071  1091  1098  1100  1101  1102  1103  1104  1104  1099  1080  1036        *
               969  975  *  981  1004  1055  1085  1097  1100  1101  1102  1103  1104  1105  1103  1093  1064  1012  985  *  966  946
               937  958  *  977                                                                                  987  *  951  913
               933  955  *  976  1003  1056  1087  1099  1102  1103  1104  1105  1106  1106  1105  1095  1066  1015  991  *  962  931
                            *        1028  1074  1095  1102  1103  1104  1105  1106  1107  1107  1102  1082  1039        *

                  935  957  *  978  1016  1067  1094  1103  1105  1106  1107  1108  1108  1107  1100  1076  1028  995  *  965  934
                               *        1038  1081  1099  1105  1107  1107  1108  1109  1109  1105  1088  1048        *

                     937  959  *  981  1022  1073  1097  1106  1108  1109  1110  1110  1109  1102  1080  1032  996  *  966  936
                               *        1042  1085  1102  1108  1109  1110  1111  1111  1107  1091  1051        *

                        938  962  *  984  1025  1076  1100  1108  1110  1111  1112  1111  1104  1081  1034  995  *  967  937
                                  *        1046  1087  1104  1109  1111  1111  1111  1107  1092  1052        *

                           939  964  *  987  1028  1077  1099  1106  1108  1109  1108  1102  1081  1033  994  *  966  937
                                     *        1047  1085  1100  1104  1106  1106  1103  1089  1051        *

                              939  964  *  989  1027  1070  1087  1092  1094  1094  1090  1073  1030  992  *  965  936
                                        *        1041  1070  1080  1083  1084  1083  1074  1044        *

                                 938  963  *  988  1015  1041  1050  1053  1054  1054  1046  1019  990  *  963  935
                                           *        1015  1028  1033  1035  1036  1034  1021        *

                                              *  984   984   988   991   994   996   997   995  991  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           951         961   964   966   968   970   970   968        953

                                        917            937   939   941   942   942   942   940            914
```


AT-OUO-EOI
VOID

Table E12A-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12A-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          873            893   893   893   891   890   888   886            877

                              906        917   917   916   914   911   909   908        903
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  938   940   940   938   935   932   930   928  929  *

                                *        956   963   963   961   957   952   943        *
                      898  919  *  939   957   972   976   975   972   967   959   944  931  *  917  903

                                   *        974   993   998   997   993   988   978   958        *
                         900  921  *  942   967   994  1005  1007  1004   999   992   977   951  932  *  919  905

                                  *        982  1008  1018  1019  1016  1011  1004   989   963        *
                       902  924  *  945   972  1004  1019  1023  1022  1018  1012  1002   983   953  932  *  919  907

                                 *        986  1014  1026  1029  1026  1023  1017  1009   992   963        *
                  904  927  *  948   975  1008  1025  1030  1029  1026  1022  1015  1004   983   952  931  *  919  907

                               *        988  1017  1030  1033  1031  1027  1023  1018  1008   991   962        *
                905  928  *  951   976  1009  1027  1033  1032  1029  1025  1021  1015  1003   982   950  930  *  918  907

                             *        988  1017  1031  1034  1033  1029  1025  1021  1016  1006   988   959        *
           905  929  *  953   975  1008  1028  1034  1034  1031  1027  1023  1019  1013  1000   978   947  929  *  918  906

                        *        982  1014  1030  1035  1034  1031  1027  1023  1019  1013  1003   983   953        *
      905  929  *  952   967  1001  1025  1034  1035  1032  1028  1025  1021  1016  1009   995   970   941  930  *  918  905
      893  922  *  950                                                 *                                        932  *  922  913
      919  935  *  951   966  1001  1024  1034  1035  1032  1028  1024  1021  1016  1009   995   971   942  934  *  934  934
                        *        982  1013  1030  1035  1033  1030  1026  1022  1018  1013  1002   983   955        *

           920  937  *  952   974  1008  1027  1033  1033  1029  1026  1022  1018  1011  1000   979   950  936  *  937  937
                       *        987  1016  1030  1033  1031  1027  1024  1020  1014  1005   988   961        *

                  921  938  *  954   977  1008  1026  1031  1030  1027  1023  1019  1013  1002   982   953  937  *  938  940
                              *        989  1015  1028  1030  1028  1024  1020  1015  1006   990   963        *

                     920  938  *  956   978  1007  1023  1027  1026  1023  1019  1013  1002   983   954  937  *  939  942
                                 *        988  1013  1024  1025  1023  1019  1014  1006   990   964        *

                        920  938  *  956   977  1003  1017  1020  1018  1014  1009  1000   981   954  937  *  940  943
                                    *        985  1007  1015  1015  1013  1008  1001   987   963        *

                           918  937  *  956   973   994  1003  1004  1002   998   990   976   952  937  *  940  943
                                       *        978   992   996   996   992   987   977   959        *

                              915  935  *  954   964   974   977   977   974   970   962   947  937  *  939  942
                                          *        962   966   967   966   963   958   949        *

                                             *  951   949   948   948   947   946   944   940  938  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          919        924   923   923   922   920   918   915        922

                                       885            898   898   897   895   894   892   889            904
```


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VOID

Table E12A-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12A-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                            1010            1021  1023  1024  1025  1025  1025  1023            990

                               1014        1019  1021  1022  1022  1021  1020  1018       1002
                                       *   *   *   *   *   *   *   *   *   *   *   *   *
                                   * 1017  1018  1019  1019  1018  1017  1015  1013 1013  *

                                 *       1020  1025  1028  1028  1027  1024  1019        *
                          1003 1010  * 1016  1019  1026  1031  1034  1034  1031  1026  1019 1013  *  994  973

                                 *       1025  1035  1043  1046  1047  1044  1037  1027        *
                        1003 1009  * 1015  1022  1034  1045  1051  1053  1052  1047  1037  1024 1015  *  995  974

                               *       1029  1044  1056  1063  1066  1065  1059  1048  1032        *
                      1002 1009  * 1015  1024  1041  1055  1065  1070  1071  1068  1060  1046  1028 1015  *  996  975

                             *       1031  1049  1065  1075  1080  1081  1078  1070  1055  1035        *
                    1001 1009  * 1016  1026  1044  1062  1074  1081  1084  1084  1079  1068  1050  1029 1015  *  996  976

                           *       1032  1052  1070  1081  1088  1090  1090  1086  1075  1058  1036        *
                 1000 1008  * 1016  1025  1045  1065  1079  1088  1092  1093  1091  1085  1071  1051  1028 1014  *  996  976

                         *       1030  1051  1071  1084  1092  1096  1097  1095  1090  1077  1058  1034        *
            998 1007  * 1015  1023  1043  1064  1081  1091  1096  1098  1098  1095  1087  1071  1049  1025 1013  *  995  976

                      *       1025  1046  1068  1084  1094  1098  1100  1100  1098  1090  1075  1053  1030        *
          996 1005  * 1013  1017  1036  1059  1078  1091  1098  1101  1102  1101  1096  1085  1066  1042  1021 1013  *  994  975
          967  990  * 1011                                                                                 1013  *  978  941
          966  988  * 1009  1016  1035  1060  1080  1093  1099  1102  1103  1102  1097  1086  1067  1043  1022 1015  *  986  956
                      *       1023  1047  1070  1087  1097  1102  1103  1103  1100  1092  1077  1055  1031        *

             965  987  * 1009  1020  1044  1068  1086  1097  1102  1104  1104  1100  1091  1075  1052  1028 1017  *  988  958
                         *       1029  1055  1077  1092  1100  1103  1104  1102  1096  1083  1062  1038        *

                965  988  * 1009  1023  1049  1073  1089  1098  1102  1103  1100  1093  1078  1057  1032 1017  *  989  960
                         *       1033  1059  1079  1093  1099  1102  1101  1096  1084  1065  1041        *

                   965  988  * 1010  1025  1051  1073  1087  1095  1097  1096  1090  1078  1057  1033 1016  *  989  961
                            *       1034  1059  1077  1088  1093  1094  1091  1081  1064  1041        *

                      964  988  * 1011  1026  1049  1068  1079  1085  1086  1082  1072  1054  1031 1015  *  988  961
                               *       1033  1054  1069  1077  1080  1079  1072  1059  1038        *

                         963  987  * 1011  1024  1042  1055  1063  1066  1065  1059  1047  1028 1013  *  988  961
                                  *       1028  1042  1052  1057  1058  1055  1047  1033        *

                            962  986  * 1009  1018  1028  1035  1039  1041  1039  1034  1023 1012  *  987  961
                                     *       1018  1024  1028  1031  1032  1029  1023        *

                                       * 1007  1007  1009  1011  1013  1014  1015  1014 1012  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                    975         985   986   987   988   989   989   988        977

                                  942            961   962   962   963   963   962   961            940
```


A T-QUO FCI
VOID

Table E12A-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12A-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                              894             909   910   911   912   912   912   912             900

                                  924         932   933   933   933   932   932   932         927
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  952   953   954   954   953   952   952   952  953  *

                                   *         959   962   963   962   961   958   956         *
                          918  936  *  953   959   965   968   968   967   964   960   957  955  *  939  923

                                *         966   974   978   979   977   973   967   961         *
                          920  937  *  954   964   975   981   984   983   980   974   967   960  956  *  941  926

                             *         971   983   991   994   993   989   983   974   965         *
                       921  939  *  956   967   982   992   998   999   996   990   982   972   962  957  *  943  928

                          *         975   989  1000  1006  1006  1004   998   989   977   966         *
                    922  940  *  958   970   986   999  1007  1010  1009  1004   996   986   974   963  958  *  944  930

                       *         977   993  1005  1013  1015  1014  1009  1002   991   978   966         *
                 922  941  *  960   971   988  1002  1012  1017  1017  1014  1008   999   986   973   963  958  *  945  931

                    *         976   993  1007  1016  1020  1020  1017  1011  1002   990   976   965         *
           923  942  *  961   971   987  1002  1014  1020  1022  1020  1015  1008   997   984   971   962  959  *  946  932

                  *         974   990  1005  1016  1022  1023  1021  1017  1009   999   986   973   963         *
     923  942  *  961   968   983   998  1011  1020  1023  1023  1020  1014  1005   993   980   968   961  960  *  947  933
     915  938  *  961                                                                                 961  *  950  939
     937  950  *  962   968   983   999  1012  1020  1023  1023  1019  1013  1005   993   980   969   962  962  *  961  960
                  *         975   991  1005  1016  1022  1023  1021  1016  1009   999   987   974   965         *

           937  951  *  963   973   989  1003  1014  1020  1021  1019  1015  1007   997   985   973   965  963  *  963  962
                       *         979   995  1008  1016  1020  1020  1016  1010  1002   990   978   968         *

                 938  952  *  965   975   991  1004  1013  1016  1016  1013  1007   999   988   976   967  964  *  964  964
                          *         981   996  1007  1013  1015  1013  1009  1001   992   980   970         *

                    937  953  *  967   977   991  1001  1008  1010  1009  1004   997   987   977   968  964  *  965  966
                             *         982   994  1002  1006  1007  1004   998   990   980   971         *

                       937  953  *  968   977   988   996  1000  1000   998   992   985   976   968  964  *  966  967
                                    *         980   989   995   997   996   992   986   978   970         *

                          936  953  *  969   976   983   987   989   988   985   980   973   967  963  *  966  968
                                       *         977   982   985   985   983   979   974   968         *

                             935  952  *  969   972   976   977   977   976   973   969   965  963  *  965  968
                                          *         972   973   974   973   972   969   966         *

                                        *  967   967   967   967   967   966   965   964  963  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     938         944   943   943   943   942   941   939         946

                                908             919   919   918   918   916   915   914             929
```


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Table B12B-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              919             915   918   919   920   921   920   920            900

                                  939         940   943   944   945   945   944   943        934
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  958   963   967   968   968   968   967   966  967  *

                                        *        1004  1017  1021  1023  1023  1021  1011        *
                                953  956  *  959  1002  1032  1040  1043  1044  1044  1039  1014  973  *  951  929

                                           *        1030  1059  1068  1071  1072  1073  1067  1042        *
                              955  958  *  961  1014  1058  1074  1079  1081  1082  1081  1069  1028  976  *  955  933

                                           *        1037  1073  1085  1089  1091  1093  1092  1083  1051        *
                           957  960  *  963  1018  1066  1085  1091  1094  1096  1097  1094  1078  1032  978  *  957  935

                                     *        1040  1077  1091  1095  1097  1099  1100  1099  1088  1053        *
                        957  962  *  966  1020  1069  1088  1095  1098  1099  1101  1102  1098  1081  1033  978  *  958  936

                                  *        1042  1079  1093  1097  1099  1101  1102  1104  1102  1091  1055        *
                     958  963  *  968  1022  1070  1090  1097  1099  1101  1102  1104  1104  1101  1083  1034  977  *  958  937

                           *        1043  1081  1095  1099  1101  1102  1103  1105  1106  1104  1093  1055        *
                  957  963  *  969  1021  1071  1092  1099  1101  1102  1103  1105  1106  1107  1103  1084  1032  976  *  957  937

                        *        1038  1080  1096  1101  1103  1104  1105  1106  1108  1109  1106  1092  1050        *
955  961  *  967  1010  1066  1092  1100  1103  1104  1105  1106  1108  1109  1109  1103  1079  1022  975  *  956  936
923  943  *  963                                                 *                                 976  *  945  913
920  942  *  963  1010  1068  1094  1102  1105  1106  1107  1108  1109  1111  1111  1104  1080  1024  981  *  957  931
                        *        1039  1083  1100  1105  1106  1107  1108  1109  1111  1112  1109  1095  1053        *

                  922  944  *  966  1023  1078  1100  1106  1108  1109  1110  1111  1112  1113  1108  1089  1038  985  *  960  934
                           *        1049  1090  1104  1108  1110  1110  1111  1113  1114  1112  1099  1062        *

                     924  947  *  969  1029  1083  1104  1110  1111  1112  1113  1114  1115  1111  1092  1042  986  *  962  936
                           *        1053  1094  1108  1112  1113  1114  1115  1116  1114  1102  1064        *

                        926  950  *  972  1033  1086  1107  1113  1115  1115  1116  1117  1112  1094  1043  986  *  962  937
                              *        1057  1097  1111  1114  1115  1116  1117  1115  1103  1065        *

                           928  952  *  976  1036  1088  1108  1113  1115  1116  1116  1112  1094  1044  985  *  961  937
                                     *        1059  1097  1109  1112  1113  1114  1113  1102  1065        *

                              928  953  *  978  1036  1084  1099  1103  1105  1105  1103  1089  1042  983  *  960  937
                                        *        1054  1085  1093  1095  1096  1096  1089  1060        *

                                 927  952  *  977  1025  1055  1064  1066  1068  1068  1061  1030  980  *  958  935
                                           *        1025  1038  1043  1045  1046  1044  1032        *

                                              *  972   974   977   981   984   986   987   985  980  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           939         950   954   956   958   960   960   958        948

                                        905             926   929   931   932   932   932   931            915
```


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Table B12B-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                            872             890   891   890   888   886   884   882            872

                                905         915   915   914   911   909   906   904        899
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  936   939   939   936   933   930   927   925  925  *

                                  *         970   978   977   974   970   965   954        *
                          899  919  *  938   971   991   994   992   988   983   975   955  928  *  914  900

                                    *         993  1014  1018  1016  1012  1006   996   974        *
                             901  922  *  941   982  1015  1025  1025  1022  1017  1010   995   963  929  *  916  902

                                    *        1001  1029  1037  1036  1032  1028  1021  1007   978        *
                           904  925  *  945   987  1024  1038  1040  1037  1033  1028  1019  1001   964  928  *  916  903

                                *        1005  1034  1044  1044  1041  1037  1032  1024  1009   978        *
                       905  927  *  948   990  1028  1043  1046  1043  1040  1035  1030  1020  1000   963  927  *  915  903

                             *        1007  1036  1047  1047  1044  1040  1036  1031  1024  1008   976        *
                    907  929  *  951   991  1029  1045  1048  1046  1042  1038  1034  1029  1019   999   961  925  *  914  902

                          *        1007  1037  1048  1049  1046  1042  1038  1034  1030  1022  1006   974        *
                 907  930  *  952   990  1029  1046  1050  1048  1044  1040  1036  1032  1027  1017   996   957  924  *  913  901

                       *        1002  1035  1048  1050  1047  1043  1039  1036  1032  1027  1019  1001   968        *
           906  929  *  952   981  1023  1044  1050  1049  1045  1041  1037  1034  1030  1024  1012   988   949  923  *  912  899
           892  921  *  949                                                                              924  *  903  881
           917  934  *  949   981  1023  1044  1050  1049  1045  1041  1037  1034  1030  1024  1012   989   951  928  *  911  893
                       *        1001  1034  1048  1050  1047  1043  1039  1035  1032  1027  1019  1001   969        *

              918  935  *  951   989  1028  1045  1049  1046  1043  1039  1035  1031  1026  1017   996   961  931  *  914  896
                          *        1006  1036  1047  1047  1045  1041  1037  1033  1029  1021  1006   976        *

                 919  936  *  953   992  1028  1043  1046  1044  1040  1037  1033  1028  1018   999   964  932  *  916  899
                          *        1007  1035  1045  1045  1042  1038  1035  1030  1023  1008   978        *

                       919  937  *  954   992  1027  1041  1043  1041  1037  1033  1028  1019  1000   965  933  *  917  900
                                 *        1006  1032  1041  1041  1038  1035  1030  1023  1008   979        *

                          918  937  *  955   990  1023  1036  1037  1035  1031  1026  1018  1000   966  934  *  918  902
                                       *        1003  1027  1034  1033  1030  1026  1020  1007   979        *

                             917  936  *  954   987  1015  1023  1023  1021  1017  1010   996   965  934  *  919  903
                                          *         996  1013  1017  1015  1012  1007   998   976        *

                                915  934  *  952   977   993   996   995   992   988   980   960  936  *  920  904
                                           *         975   981   982   981   978   973   963        *

                                             *  949   948   949   949   949   948   946   942  939  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          938         951   952   952   951   949   947   943        927

                                       927            955   956   955   953   951   947   943            914
```


ANL-OUO-FCI
VOID

Table B12B-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12B-1

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 50.500 in

```
                          933          928   930   932   933   933   933   932          913

                              954      953   956   957   958   958   957   957      948
                                   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  974   977   981   982   982   981   980   980  982  *

                                *      999  1012  1016  1018  1018  1015  1006      *
                           967  970  *  973   998  1022  1032  1034  1035  1035  1029  1009  987  *  965  942

                                  *      1020  1049  1059  1063  1064  1064  1057  1032      *
                             969  972  *  975  1009  1048  1066  1072  1074  1075  1073  1058  1022  991  *  969  945

                                 *      1029  1065  1080  1085  1088  1089  1087  1075  1042      *
                        970  974  *  977  1013  1058  1080  1088  1091  1093  1093  1088  1069  1027  992  *  970  948

                           *      1032  1070  1087  1093  1096  1098  1098  1096  1081  1045      *
                      971  975  *  980  1016  1061  1084  1093  1097  1099  1100  1100  1094  1073  1028  992  *  971  949

                          *      1034  1073  1090  1096  1099  1101  1102  1103  1099  1084  1046      *
                 971  976  *  982  1017  1063  1086  1095  1099  1101  1102  1103  1103  1097  1075  1028  991  *  971  950

                        *      1034  1074  1092  1098  1101  1102  1104  1105  1105  1102  1085  1045      *
            970  976  *  983  1016  1063  1088  1097  1101  1102  1103  1105  1106  1106  1098  1075  1026  990  *  970  950

                     *      1028  1072  1093  1100  1102  1104  1105  1106  1108  1108  1103  1083  1039      *
        968  974  *  981  1004  1056  1087  1099  1102  1104  1105  1106  1108  1109  1107  1097  1068  1016  989  *  970  949
        937  957  *  977                                          *                                        991  *  960  927
        933  955  *  976  1003  1057  1088  1100  1104  1106  1107  1108  1109  1110  1109  1099  1069  1018  996  *  971  945
                     *      1028  1075  1096  1104  1106  1107  1108  1109  1111  1111  1105  1086  1043      *

            935  957  *  978  1016  1069  1095  1105  1108  1109  1110  1111  1112  1111  1104  1080  1032  999  *  974  948
                        *      1039  1082  1101  1107  1109  1110  1111  1113  1113  1109  1092  1052      *

                 937  959  *  981  1022  1074  1099  1108  1111  1112  1113  1114  1113  1106  1084  1036 1000  *  975  950
                           *      1043  1086  1105  1111  1112  1114  1114  1115  1111  1095  1055      *

                      938  962  *  985  1026  1077  1102  1111  1113  1115  1115  1115  1108  1085  1038  999  *  975  950
                                 *      1047  1089  1107  1112  1114  1115  1115  1111  1096  1056      *

                         939  964  *  988  1029  1079  1102  1109  1112  1113  1112  1106  1085  1037  998  *  975  951
                                    *      1048  1088  1103  1108  1109  1109  1107  1093  1055      *

                            940  965  *  990  1028  1072  1090  1095  1097  1098  1094  1077  1034  996  *  973  950
                                       *      1042  1073  1083  1086  1087  1086  1078  1048      *

                               938  964  *  989  1017  1043  1053  1056  1057  1057  1049  1023  993  *  972  949
                                          *      1016  1030  1035  1038  1039  1037  1024      *

                                             *  985   986   989   993   996   999  1000   998  994  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          952          963   966   969   971   973   973   971        962

                                       918          939   942   944   945   946   945   944          929
```


ACT-OUO-ECI
VOID

Table B12B-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    50.500 in
                            883             900   900   900   898   897   895   893            883

                                915         924   925   923   921   919   917   915        910
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  946   948   948   946   943   940   938   936  937  *

                                  *         965   972   973   970   966   961   952        *
                          909  929  *  947   966   982   986   984   981   976   967   952  939  *  925  910

                                    *         984  1003  1009  1007  1004   998   987   967        *
                         911  931  *  951   976  1004  1016  1017  1015  1010  1002   986   960  940  *  926  912

                                   *         992  1019  1029  1030  1027  1022  1015   999   972        *
                        914  934  *  954   982  1015  1031  1035  1033  1029  1023  1013   993   961  940  *  927  913

                                  *         996  1026  1038  1041  1038  1034  1029  1020  1002   973        *
                      915  937  *  958   985  1019  1037  1042  1041  1038  1033  1027  1015   994   961  939  *  926  914

                                 *         999  1028  1042  1045  1043  1039  1035  1030  1020  1002   971        *
                    917  939  *  960   986  1021  1040  1046  1045  1042  1038  1033  1027  1015   992   959  937  *  926  913

                               *         998  1029  1044  1047  1045  1042  1038  1034  1028  1018   999   968        *
                  917  940  *  962   985  1020  1040  1047  1047  1044  1040  1036  1031  1025  1012   988   955  936  *  925  913

                             *         993  1025  1043  1048  1047  1043  1040  1036  1032  1026  1014   994   962        *
                917  940  *  962   977  1013  1037  1047  1048  1045  1041  1037  1034  1029  1021  1006   980   949  936  *  924  912
                904  932  *  960                                                                                  938  *  916  893
                928  945  *  960   977  1012  1037  1047  1048  1045  1041  1037  1033  1029  1021  1007   981   950  941  *  923  905
                             *         992  1025  1042  1047  1046  1043  1039  1035  1031  1025  1014   994   964        *

                  929  946  *  962   985  1019  1039  1046  1046  1043  1039  1035  1031  1024  1012   990   959  944  *  926  908
                               *         998  1028  1042  1046  1044  1041  1037  1033  1027  1018  1000   971        *

                    930  947  *  964   988  1020  1038  1044  1043  1040  1036  1032  1026  1014   993   963  945  *  928  910
                                 *        1000  1028  1040  1043  1041  1038  1034  1028  1019  1002   974        *

                        930  948  *  966   988  1019  1035  1040  1039  1036  1032  1026  1015   994   965  947  *  930  912
                                   *         999  1025  1036  1038  1036  1032  1027  1019  1002   975        *

                           930  948  *  966   987  1015  1029  1033  1031  1028  1022  1012   994   965  948  *  931  914
                                      *         996  1019  1028  1028  1026  1021  1014  1000   975        *

                              929  948  *  966   984  1006  1016  1017  1015  1011  1003   989   964  949  *  932  915
                                         *         989  1004  1009  1009  1006  1001   991   971        *

                                 927  946  *  964   975   986   990   990   988   984   976   961  951  *  934  916
                                            *         974   979   981   980   977   973   963        *

                                               *  962   961   962   963   963   962   960   957  954  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                               952         965   966   966   965   964   961   957        942

                                            941            970   971   970   968   966   962   958            929
```


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Table B12B-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              962             957   958   960   961   962   963   963            942

                                  984         982   984   985   986   987   987   988        978
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     * 1005  1006  1009  1010  1011  1011  1011  1012 1013  *

                                   *        1012  1018  1022  1023  1023  1022  1019        *
                              996 1001  * 1005  1011  1020  1026  1030  1031  1029  1026  1021 1016  *  993  969

                                 *        1019  1031  1040  1045  1046  1044  1038  1029        *
                            997 1001  * 1006  1016  1031  1043  1050  1053  1052  1048  1039  1027 1018  *  995  972

                                 *        1025  1042  1055  1063  1066  1066  1061  1050  1035        *
                           997 1002  * 1007  1020  1039  1055  1066  1071  1073  1070  1062  1048  1031 1019  *  997  974

                               *        1028  1049  1065  1076  1081  1083  1080  1072  1058  1039        *
                      997 1003  * 1009  1022  1043  1062  1076  1083  1087  1086  1082  1071  1053  1033 1019  *  998  975

                           *        1029  1052  1071  1083  1090  1093  1093  1089  1079  1062  1040        *
                    996 1003  * 1010  1022  1045  1066  1081  1090  1094  1096  1094  1088  1075  1055  1032 1019  *  998  977

                         *        1028  1051  1072  1086  1094  1098  1100  1099  1093  1081  1061  1038        *
                 995 1003  * 1011  1020  1042  1065  1082  1093  1098  1101  1101  1098  1090  1075  1053  1030 1018  *  998  977

                      *        1023  1046  1069  1086  1096  1101  1103  1104  1101  1094  1079  1057  1034        *
          992 1001  * 1010  1015  1035  1060  1080  1093  1100  1104  1105  1104  1099  1088  1070  1047  1026 1018  *  998  977
          965  987  * 1008                                                                              1018  *  986  953
          964  986  * 1007  1014  1035  1061  1081  1095  1102  1105  1106  1105  1101  1090  1071  1048  1027 1020  *  995  968
                      *        1023  1048  1072  1089  1099  1104  1107  1107  1104  1096  1081  1059  1036        *

             964  986  * 1007  1019  1045  1070  1088  1099  1105  1107  1107  1104  1095  1079  1056  1033 1022  *  996  970
                         *        1029  1056  1079  1094  1102  1106  1107  1106  1100  1087  1066  1042        *

                965  987  * 1008  1023  1050  1075  1091  1101  1105  1106  1104  1097  1082  1061  1036 1022  *  997  971
                         *        1033  1060  1082  1095  1102  1105  1104  1099  1088  1069  1045        *

                   965  987  * 1009  1026  1053  1075  1090  1098  1101  1100  1094  1081  1061  1037 1021  *  997  971
                            *        1035  1061  1080  1091  1097  1098  1094  1085  1068  1045        *

                      964  988  * 1010  1027  1051  1070  1082  1088  1089  1085  1075  1058  1035 1019  *  996  972
                               *        1034  1056  1071  1080  1083  1082  1076  1062  1042        *

                         964  988  * 1011  1025  1044  1058  1065  1069  1068  1062  1050  1032 1017  *  995  971
                                  *        1029  1044  1054  1059  1061  1058  1050  1036        *

                            962  987  * 1010  1019  1030  1037  1041  1043  1042  1037  1026 1016  *  994  971
                                     *        1019  1026  1030  1033  1034  1032  1027        *

                                        * 1008  1008  1010  1012  1015  1017  1018  1017 1015  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     977         987   988   990   991   993   993   992        984

                                  944            964   965   966   967   968   968   967            953
```


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Table B12B-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12B-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

```
                          905          917   918   919   919   919   919   919          905

                              933      940   941   941   941   940   940   940      934
                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                                 *  961   962   963   962   961   961   960   960  961  *

                                *      968   971   972   972   970   967   965      *
                      930  946  *  962   968   975   977   978   976   973   969   965  963  *  946  929

                             *      976   984   988   989   987   982   977   970      *
                    932  948  *  963   973   985   992   994   994   990   984   977   969  964  *  948  932

                           *      981   994  1002  1005  1004  1000   993   983   973      *
                  933  950  *  965   977   992  1003  1008  1009  1007  1001   992   981   971  965  *  950  934

                         *      985  1000  1011  1017  1018  1015  1008   999   987   975      *
              934  951  *  968   980   997  1010  1018  1021  1020  1015  1007   996   983   972  966  *  952  937

                       *      987  1004  1017  1024  1027  1026  1021  1013  1001   988   975      *
          935  953  *  970   981   999  1014  1024  1029  1029  1026  1019  1010   997   983   971  967  *  953  938

                    *      987  1004  1018  1028  1032  1033  1029  1023  1013  1000   986   974      *
     936  954  *  971   981   998  1014  1026  1032  1034  1032  1028  1020  1008   995   981   971  967  *  954  940

                *      984  1001  1016  1028  1034  1036  1034  1029  1021  1010   997   983   972      *
936  954  *  971   978   993  1010  1023  1032  1036  1036  1032  1026  1017  1004   990   977   970  968  *  955  941
928  950  *  971                                                 *                                970  *  945  919
948  960  *  972   979   994  1010  1024  1032  1036  1035  1032  1026  1017  1005   991   978   971  972  *  952  932
                *      985  1002  1017  1028  1034  1036  1034  1029  1021  1011   998   984   974      *

     949  962  *  974   983  1000  1015  1026  1032  1034  1032  1028  1020  1009   997   984   975  974  *  954  934
                    *      990  1006  1020  1029  1033  1032  1029  1023  1014  1002   989   979      *

          950  963  *  976   986  1003  1016  1025  1029  1029  1026  1020  1011  1000   988   978  976  *  957  937
                       *      993  1007  1019  1026  1028  1026  1022  1014  1004   992   982      *

               951  965  *  978   988  1003  1014  1020  1023  1022  1017  1010  1000   990   981  978  *  959  939
                          *      993  1006  1015  1019  1020  1017  1012  1003   993   984      *

                    951  965  *  979   988  1000  1008  1013  1014  1011  1006   998   990   982  979  *  960  941
                               *      992  1002  1008  1010  1010  1006  1000   992   984      *

                         951  966  *  980   987   995  1001  1003  1003  1000   995   988   983  981  *  962  943
                                    *      989   995   999  1000   998   995   990   984      *

                              951  966  *  980   985   989   992   993   993   990   987   983  982  *  964  945
                                         *      985   988   990   990   989   987   984      *

                                           *  980   981   983   984   985   986   986   985  984  *
                                              *   *   *   *   *   *   *   *   *   *   *   *   *
                                         974      986   988   988   988   987   986   985      970

                                    967           991   992   992   991   989   987   984          955
```


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Table E12B-1.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12B-1

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 44.000 in

```
                              912             908   911   912   913   913   913   912            894

                                  931         931   935   936   936   936   936   935        927
                                            *   *   *   *   *   *   *   *   *   *   *   *
                                     *  950   954   958   959   959   958   958   957  958  *

                                   *         994  1007  1010  1012  1012  1011  1001        *
                           944  947  *  950   992  1021  1029  1031  1032  1032  1027  1003  963  *  943  922

                                    *        1019  1047  1055  1058  1060  1060  1055  1031        *
                           947  950  *  952  1003  1046  1061  1066  1068  1069  1068  1056  1017  967  *  947  925

                                    *        1026  1060  1072  1076  1078  1080  1079  1071  1039        *
                         948  952  *  955  1007  1054  1072  1078  1080  1082  1083  1080  1065  1021  968  *  948  928

                                   *        1029  1064  1077  1082  1084  1086  1087  1086  1075  1041        *
                       949  953  *  957  1009  1056  1075  1082  1084  1086  1087  1088  1085  1068  1022  969  *  949  929

                                 *        1030  1066  1080  1084  1086  1087  1089  1090  1089  1078  1043        *
                     950  954  *  959  1011  1058  1077  1083  1086  1087  1089  1090  1091  1087  1070  1023  968  *  949  929

                               *        1031  1068  1081  1086  1087  1088  1090  1091  1092  1091  1080  1043        *
                   949  955  *  960  1011  1059  1079  1085  1087  1088  1090  1091  1093  1093  1089  1071  1021  967  *  949  929

                             *        1027  1067  1083  1087  1089  1090  1091  1092  1094  1095  1093  1079  1038        *
                 947  953  *  958  1000  1054  1079  1087  1089  1090  1091  1092  1094  1095  1095  1090  1066  1011  966  *  947  928
                 916  936  *  954                                                                                  967  *  937  907
                 913  934  *  954   999  1055  1081  1089  1091  1092  1093  1094  1095  1097  1097  1091  1068  1014  972  *  949  924
                           *        1028  1071  1087  1091  1092  1093  1094  1095  1097  1098  1095  1082  1042        *

                   915  936  *  957  1013  1065  1086  1093  1094  1095  1096  1097  1098  1099  1095  1076  1027  975  *  952  927
                             *        1037  1077  1091  1095  1096  1096  1097  1099  1100  1098  1086  1050        *

                     917  939  *  960  1018  1070  1090  1096  1098  1098  1099  1100  1101  1097  1079  1031  976  *  953  929
                               *        1042  1081  1094  1098  1099  1100  1101  1101  1100  1088  1052        *

                       919  942  *  963  1022  1073  1093  1099  1100  1101  1102  1102  1098  1080  1032  976  *  953  930
                                 *        1045  1084  1097  1100  1101  1102  1103  1101  1090  1053        *

                         920  944  *  966  1025  1075  1094  1099  1101  1102  1102  1098  1081  1032  975  *  953  930
                                   *        1047  1084  1095  1098  1099  1100  1099  1088  1053        *

                           921  945  *  968  1025  1071  1086  1090  1091  1091  1089  1076  1030  973  *  952  929
                                     *        1042  1072  1080  1082  1083  1083  1076  1047        *

                             919  944  *  967  1014  1043  1051  1054  1055  1055  1049  1019  971  *  950  928
                                       *        1013  1027  1031  1033  1034  1033  1020        *

                                         *  963   964   968   971   974   976   977   975  970  *
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                        931         942   945   948   950   951   951   949        940

                                      899             919   921   923   924   925   925   923            908
```


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Table E12B-1.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12B-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

| | | |

Table E12B-1.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              926             920   923   924   925   925   925   925            906

                                  945         944   947   949   949   949   949   948        940
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  964   968   971   972   972   972   971   971  973  *

                                        *         989  1002  1006  1007  1007  1005   996        *
                                 958  961  *  964   987  1011  1020  1023  1024  1023  1018   998  977  *  956  934

                                           *        1010  1037  1047  1051  1052  1052  1045  1021        *
                              960  963  *  966   998  1037  1054  1059  1062  1062  1060  1046  1012  981  *  960  937

                                           *        1018  1053  1067  1072  1075  1076  1074  1063  1030        *
                           962  965  *  968  1003  1046  1067  1075  1078  1079  1080  1075  1057  1016  982  *  961  940

                                     *        1021  1058  1074  1080  1083  1084  1085  1082  1069  1033        *
                        962  966  *  970  1005  1049  1071  1080  1083  1085  1086  1086  1081  1060  1017  982  *  962  941

                                  *        1023  1060  1077  1083  1085  1087  1088  1089  1086  1071  1034        *
                     963  967  *  972  1007  1051  1074  1082  1085  1087  1089  1090  1089  1083  1062  1017  982  *  962  942

                           *        1023  1061  1079  1085  1087  1088  1090  1091  1092  1088  1073  1034        *
                  962  968  *  973  1005  1051  1075  1084  1087  1088  1090  1091  1092  1092  1085  1062  1015  981  *  962  942

                        *        1017  1059  1079  1087  1089  1090  1091  1093  1094  1094  1089  1071  1028        *
               960  966  *  972   994  1044  1074  1085  1089  1090  1091  1093  1094  1095  1094  1084  1056  1006  980  *  961  941
               930  949  *  968                                                                                    981  *  952  920
               925  947  *  967   993  1045  1075  1087  1091  1092  1093  1094  1095  1096  1095  1085  1057  1008  986  *  962  938
                        *        1017  1062  1083  1090  1092  1093  1094  1096  1097  1097  1092  1073  1031        *

                  927  949  *  969  1006  1056  1082  1091  1094  1095  1096  1097  1098  1097  1090  1067  1021  989  *  965  940
                           *        1027  1070  1088  1094  1095  1096  1097  1099  1099  1095  1079  1040        *

                     929  951  *  972  1012  1061  1086  1095  1097  1098  1099  1100  1099  1093  1071  1025  990  *  966  942
                           *        1032  1074  1091  1097  1098  1099  1100  1100  1097  1081  1043        *

                        931  953  *  975  1015  1065  1089  1097  1099  1100  1101  1100  1094  1072  1026  989  *  966  943
                                 *        1035  1076  1093  1098  1100  1101  1101  1097  1082  1044        *

                           932  955  *  978  1018  1066  1088  1095  1098  1099  1098  1092  1072  1026  988  *  966  943
                                    *        1037  1075  1089  1094  1095  1095  1093  1080  1043        *

                              932  956  *  980  1017  1059  1077  1082  1084  1084  1080  1064  1023  985  *  964  942
                                       *        1031  1060  1070  1073  1074  1073  1065  1036        *

                                 931  955  *  979  1006  1031  1040  1044  1045  1045  1037  1012  983  *  963  941
                                          *        1006  1019  1024  1026  1027  1025  1013        *

                                             *  975   976   979   983   986   988   989   987  984  *
                                                *   *   *   *   *   *   *   *   *   *   *   *   *
                                          944         954   957   960   962   963   964   962        953

                                       911            932   934   936   937   938   937   936           922
```


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Table E12B-1.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12B-1

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          880          897   897   897   896   894   892   891          882

                              912      921   921   920   918   916   914   912      908
                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                   *  942   944   944   942   940   937   935   933  933  *

                                 *      961   968   968   966   962   957   948      *
                        905  925  *  944   961   977   981   980   977   972   964   949  935  *  922  908

                             *      978   998  1003  1002   999   993   983   963      *
                    908  927  *  946   971   999  1010  1012  1009  1005   998   982   956  937  *  924  910

                           *      987  1013  1023  1024  1022  1017  1010   995   968      *
                910  930  *  950   976  1008  1025  1029  1027  1024  1018  1008   989   958  936  *  924  911

                         *      990  1019  1032  1034  1032  1028  1024  1015   998   968      *
            911  932  *  953   979  1012  1030  1036  1035  1032  1028  1022  1011   989   956  935  *  923  911

                       *      992  1021  1035  1038  1036  1033  1029  1024  1015   997   967      *
          912  934  *  955   980  1014  1032  1038  1038  1035  1031  1027  1021  1009   987   954  933  *  922  911

                     *      992  1022  1036  1040  1038  1035  1031  1028  1022  1013   994   964      *
     912  935  *  957   979  1013  1033  1040  1039  1037  1033  1030  1025  1019  1007   984   951  932  *  921  910

                  *      986  1018  1035  1040  1039  1036  1033  1029  1025  1020  1009   989   957      *
912  934  *  956   971  1005  1029  1039  1040  1038  1034  1031  1027  1023  1016  1001   976   944  932  *  920  909
899  927  *  954                                                 *                              933  *  912  890
923  939  *  955   970  1005  1029  1039  1040  1037  1034  1030  1027  1023  1015  1001   976   945  936  *  919  901
                  *      986  1017  1035  1040  1039  1035  1032  1028  1025  1019  1009   989   959      *

     924  940  *  956   978  1012  1031  1038  1038  1035  1032  1028  1024  1018  1006   984   954  939  *  922  904
                     *      991  1021  1034  1038  1036  1033  1030  1026  1021  1012   994   966      *

          924  942  *  958   981  1013  1030  1036  1035  1032  1029  1025  1019  1008   987   958  940  *  923  906
                        *      993  1020  1032  1035  1033  1030  1026  1021  1013   996   968      *

               925  942  *  959   981  1011  1027  1032  1031  1028  1024  1019  1008   988   959  941  *  925  908
                           *      992  1017  1028  1030  1028  1025  1020  1012   996   969      *

                  924  942  *  960   980  1008  1022  1025  1024  1020  1015  1006   987   959  942  *  926  910
                              *      989  1011  1020  1021  1018  1014  1007   993   969      *

                     923  942  *  960   977   999  1008  1010  1008  1004   997   982   958  943  *  927  911
                                 *      982   997  1002  1001   999   994   984   965      *

                        922  940  *  958   968   979   983   983   981   977   969   955  945  *  929  912
                                    *      967   973   974   973   971   966   957      *

                                       *  956   955   956   956   956   956   954   951  948  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                    946          959   960   960   959   958   955   952      936

                                 936            963   964   964   962   960   956   952          924
```


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Table E12B-1.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12B-1

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              954             948   950   952   953   954   954   955            935

                                  975         973   975   976   977   978   978   979        970
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  995   996   998  1000  1000  1000  1001  1001 1003  *

                                   *        1001  1007  1011  1012  1012  1011  1008        *
                           987  991  *  995  1001  1009  1015  1019  1019  1018  1015  1010 1005  *  983  961

                                  *        1008  1020  1028  1033  1034  1032  1026  1018        *
                        988  992  *  996  1005  1020  1031  1038  1041  1040  1036  1028  1016 1008  *  986  963

                                 *        1014  1030  1043  1051  1054  1054  1049  1039  1024        *
                     988  993  *  997  1009  1027  1043  1053  1059  1060  1058  1050  1037  1020 1009  *  987  965

                                *        1017  1037  1053  1063  1068  1070  1067  1060  1046  1028        *
                  988  993  *  999  1011  1032  1050  1063  1070  1073  1073  1069  1058  1042  1021 1009  *  988  967

                             *        1018  1040  1058  1070  1077  1080  1080  1076  1066  1050  1028        *
               987  994  * 1000  1012  1033  1053  1068  1077  1081  1082  1081  1075  1062  1043  1021 1008  *  988  968

                          *        1017  1040  1060  1073  1081  1085  1086  1085  1080  1068  1049  1027        *
            986  993  * 1000  1010  1031  1053  1070  1080  1085  1087  1088  1085  1077  1062  1041  1019 1008  *  988  968

                       *        1013  1035  1057  1073  1083  1088  1090  1090  1088  1080  1066  1045  1023        *
      984  992  * 1000  1005  1024  1048  1067  1080  1087  1090  1091  1090  1086  1075  1057  1035  1015 1007  *  988  969
      957  978  *  998                                                                                1007  *  977  946
      956  977  *  997  1004  1024  1049  1069  1081  1088  1091  1093  1092  1087  1076  1058  1036  1016 1009  *  985  960
                 *        1012  1036  1059  1076  1086  1091  1093  1093  1090  1083  1068  1047  1025        *

            956  977  *  997  1009  1033  1057  1075  1086  1091  1093  1093  1090  1082  1066  1045  1022 1011  *  987  962
                        *        1018  1044  1066  1081  1089  1093  1094  1092  1086  1074  1054  1031        *

               956  977  *  998  1012  1039  1062  1078  1087  1091  1092  1090  1083  1069  1049  1025 1011  *  987  963
                           *        1022  1048  1069  1082  1089  1091  1091  1086  1075  1057  1033        *

                  956  978  *  999  1015  1041  1062  1077  1084  1087  1086  1081  1069  1049  1026 1010  *  987  963
                              *        1024  1048  1067  1078  1083  1084  1081  1072  1055  1033        *

                     956  979  * 1000  1016  1039  1058  1069  1074  1076  1072  1063  1046  1024 1008  *  986  963
                                 *        1023  1044  1059  1067  1070  1069  1063  1050  1031        *

                        955  978  * 1001  1014  1032  1045  1053  1056  1056  1050  1038  1021 1007  *  985  963
                                    *        1018  1033  1042  1047  1049  1046  1039  1025        *

                           954  977  * 1000  1009  1019  1026  1030  1032  1030  1025  1015 1005  *  984  963
                                       *        1008  1015  1019  1022  1023  1021  1016        *

                                          *  998   998  1000  1002  1004  1006  1007  1006 1005  *
                                             *   *   *   *   *   *   *   *   *   *   *   *   *
                                       968         977   979   980   982   983   983   983        975

                                    936            956   957   958   958   959   959   958            945
```


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Table E12B-1.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12B-1

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    92.000 in
                            901             914   915   916   916   916   916   916            904

                                930         936   937   937   937   937   936   936        931
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  957   958   958   958   957   956   956   956  957  *

                                  *         964   967   968   967   965   963   960        *
                          926  942  *  958   964   970   973   973   972   969   965   961  958  *  943  927

                                    *         971   979   983   984   982   978   972   965        *
                         928  944  *  959   969   980   987   989   989   985   980   972   964  960  *  945  930

                                  *         976   988   996   999   999   995   988   979   969        *
                        929  945  *  961   972   987   997  1003  1004  1001   996   987   977   966  960  *  947  932

                                *         980   995  1005  1011  1012  1009  1003   994   982   970        *
                    930  947  *  963   975   991  1004  1012  1015  1014  1010  1002   991   978   967  961  *  948  934

                              *         982   998  1010  1018  1021  1020  1015  1007   996   983   970        *
                 930  948  *  965   976   993  1007  1017  1022  1023  1020  1014  1004   992   978   966  961  *  949  935

                            *         981   998  1012  1021  1026  1026  1023  1017  1008   995   981   969        *
            931  949  *  966   976   992  1007  1019  1025  1028  1026  1021  1014  1003   989   976   965  962  *  949  936

                        *         979   995  1010  1021  1027  1029  1027  1023  1015  1005   991   977   967        *
        931  949  *  966   973   987  1003  1016  1025  1029  1029  1026  1020  1011   999   985   972   964  963  *  950  937
        922  945  *  966                                                 *                                 964  *  941  917
        943  955  *  967   973   988  1003  1016  1025  1029  1028  1025  1019  1011   999   985   973   966  966  *  947  927
                    *         980   995  1010  1021  1027  1029  1027  1022  1015  1005   992   979   969        *

            944  956  *  969   978   993  1008  1019  1025  1027  1025  1021  1013  1003   991   978   969  968  *  949  930
                        *         984   999  1013  1021  1025  1025  1022  1016  1008   996   984   973        *

                945  958  *  970   980   996  1009  1018  1022  1022  1019  1013  1005   994   982   972  970  *  951  932
                            *         986  1001  1012  1018  1020  1019  1015  1008   998   986   976        *

                    945  959  *  972   982   996  1006  1013  1016  1015  1010  1003   994   983   974  971  *  953  934
                                *         987   999  1008  1012  1013  1010  1005   997   987   977        *

                        945  960  *  973   982   993  1001  1006  1007  1004   999   992   983   976  973  *  955  936
                                    *         985   995  1001  1003  1003   999   993   986   978        *

                            946  960  *  974   981   989   994   996   996   993   988   982   976  974  *  956  938
                                        *         983   989   992   993   992   988   983   978        *

                                945  960  *  974   978   983   985   986   986   984   980   977  976  *  958  940
                                            *         979   982   983   984   983   981   978        *

                                                *  974   975   977   978   979   979   979   978  977  *
                                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                                968         980   981   982   982   981   980   978        964

                                            961             985   986   986   985   983   981   978            950
```


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Table B12B-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              914             909   912   914   914   915   915   914            895

                                  933         933   936   938   938   938   937   937        928
                                        *   *   *   *   *   *   *   *   *   *   *   *
                                     *  951   956   959   961   961   960   959   958  960  *

                                  *         996  1009  1013  1014  1014  1013  1003        *
                           946  949  *  951   994  1023  1031  1033  1035  1035  1030  1005  965  *  945  923

                                     *        1021  1049  1058  1061  1062  1063  1057  1033        *
                        949  951  *  954  1006  1049  1064  1068  1071  1072  1071  1059  1019  969  *  949  927

                                  *        1028  1063  1075  1079  1081  1082  1082  1073  1041        *
                     950  953  *  956  1010  1056  1075  1081  1083  1085  1086  1083  1068  1023  970  *  950  929

                               *        1031  1067  1080  1085  1087  1089  1090  1089  1078  1044        *
                  951  955  *  959  1012  1059  1078  1085  1087  1089  1090  1091  1088  1071  1024  971  *  951  931

                            *        1033  1069  1083  1087  1089  1090  1092  1093  1092  1081  1045        *
               951  956  *  961  1014  1061  1080  1087  1089  1090  1092  1093  1094  1090  1073  1025  970  *  951  931

                         *        1034  1071  1085  1089  1090  1092  1093  1095  1096  1094  1083  1046        *
            951  956  *  962  1013  1062  1082  1089  1091  1092  1093  1094  1096  1096  1092  1074  1024  969  *  951  931

                      *        1030  1070  1086  1091  1092  1093  1094  1096  1097  1098  1096  1082  1041        *
      949  955  *  960  1003  1057  1082  1090  1093  1094  1095  1096  1097  1099  1099  1093  1069  1014  968  *  950  930
      918  937  *  956                                                                                  969  *  940  909
      915  936  *  956  1002  1059  1084  1092  1095  1096  1096  1098  1099  1100  1100  1094  1071  1016  974  *  951  927
                      *        1031  1074  1090  1095  1096  1097  1098  1099  1100  1101  1099  1085  1044        *

            917  939  *  959  1015  1069  1090  1096  1098  1099  1100  1101  1102  1102  1098  1079  1030  978  *  954  930
                         *        1040  1080  1094  1098  1099  1100  1101  1102  1103  1101  1089  1053        *

               920  941  *  962  1021  1074  1094  1100  1101  1102  1103  1104  1104  1100  1082  1034  979  *  956  931
                         *        1045  1084  1098  1102  1103  1104  1105  1105  1103  1092  1055        *

                  921  944  *  966  1025  1077  1097  1103  1104  1105  1106  1106  1102  1084  1035  979  *  956  932
                            *        1048  1087  1101  1104  1105  1106  1107  1105  1093  1056        *

                     923  946  *  969  1028  1079  1098  1103  1105  1106  1106  1102  1085  1035  978  *  956  932
                               *        1050  1088  1099  1102  1103  1104  1103  1092  1056        *

                        923  948  *  971  1028  1075  1090  1094  1095  1096  1093  1079  1033  976  *  954  932
                                  *        1046  1076  1084  1086  1087  1087  1080  1051        *

                           922  947  *  970  1017  1047  1055  1058  1059  1059  1053  1022  973  *  952  931
                                     *        1017  1030  1035  1037  1038  1036  1024        *

                                        *  966   967   971   974   977   979   980   978  973  *
                                           *   *   *   *   *   *   *   *   *   *   *   *   *
                                     934         945   948   951   953   954   954   952        942

                                  901             922   924   926   927   927   927   926            911
```


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Table B12B-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for BOC 12B-2

```
1  temperature map for bundle  29     ASSEMBLY  NO. 2404    MFF-3
   axial height    44.000 in
                            874             893   894   893   891   889   887   884            873

                                902         913   913   912   909   907   904   901        896
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                    *  930   932   932   930   926   923   920   918  917  *

                                  *         963   970   969   966   962   957   946        *
                         893  913  *  931   963   983   986   983   980   975   966   946  920  *  907  894

                                    *         985  1005  1008  1006  1002   997   987   965        *
                        896  916  *  935   974  1006  1016  1015  1012  1008  1001   986   954  921  *  909  896

                                  *         992  1019  1026  1026  1022  1018  1011   998   969        *
                       898  918  *  938   978  1014  1028  1030  1027  1023  1018  1009   991   955  920  *  909  897

                                *         995  1024  1033  1033  1030  1026  1021  1014   999   969        *
                     900  921  *  941   981  1018  1032  1035  1033  1029  1025  1019  1010   991   954  919  *  908  896

                              *         997  1026  1036  1036  1033  1029  1025  1021  1013   998   967        *
                   901  922  *  943   982  1019  1034  1037  1035  1031  1027  1023  1018  1009   989   952  917  *  907  895

                            *         997  1026  1037  1038  1035  1031  1027  1023  1019  1011   995   964        *
                 901  923  *  945   981  1019  1035  1039  1036  1033  1029  1025  1021  1016  1006   985   948  916  *  905  894

                          *         992  1024  1037  1039  1036  1032  1028  1025  1021  1016  1008   990   958        *
               900  922  *  944   973  1013  1033  1039  1038  1034  1030  1026  1023  1019  1013  1001   978   940  915  *  904  893
               886  914  *  941                                                                                    916  *  896  874
               910  926  *  942   972  1012  1033  1039  1037  1034  1030  1026  1022  1019  1013  1001   978   942  919  *  903  886
                          *         991  1023  1036  1038  1035  1031  1028  1024  1020  1016  1008   991   960        *

                 911  928  *  943   980  1017  1034  1037  1035  1031  1027  1024  1020  1015  1005   986   951  922  *  906  889
                            *         996  1025  1035  1036  1033  1029  1025  1022  1017  1010   995   966        *

                    912  929  *  945   982  1017  1032  1035  1032  1029  1025  1021  1016  1007   988   954  923  *  908  891
                            *         996  1024  1033  1033  1030  1027  1023  1018  1011   997   968        *

                       911  929  *  946   982  1016  1029  1031  1029  1026  1022  1017  1008   989   956  924  *  909  893
                              *         995  1021  1029  1029  1026  1023  1018  1011   997   969        *

                          911  929  *  946   981  1012  1024  1026  1023  1019  1015  1007   989   956  925  *  910  894
                                      *         993  1016  1022  1021  1018  1014  1008   995   969        *

                             909  928  *  945   977  1004  1012  1012  1009  1005   999   985   955  926  *  911  896
                                          *         985  1002  1005  1004  1001   996   987   966        *

                                908  926  *  943   967   982   985   984   982   978   970   950  927  *  912  896
                                            *         965   972   972   970   968   963   953        *

                                              *  940   940   940   940   940   939   937   934  930  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                          930         943   943   943   942   940   938   934        919

                                       919            946   947   946   944   942   939   934            907
```


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Table B12B-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    50.500 in
                              927             921   924   926   927   927   927   927            908

                                  947         946   949   950   951   951   950   950        942
                                                *   *   *   *   *   *   *   *   *   *   *   *
                                     *  966   969   973   974   974   974   973   973  975  *

                                        *         991  1004  1008  1009  1009  1007   998        *
                                 960  963  *  965   989  1014  1022  1025  1026  1026  1020  1000  979  *  958  936

                                           *        1012  1040  1050  1053  1055  1054  1047  1023        *
                              962  965  *  967  1000  1039  1056  1062  1064  1065  1063  1049  1014  983  *  962  939

                                        *        1020  1055  1070  1075  1077  1078  1077  1065  1033        *
                           963  967  *  970  1005  1048  1070  1078  1081  1082  1083  1078  1059  1018  985  *  964  942

                                     *        1023  1061  1077  1083  1086  1087  1088  1085  1071  1036        *
                        964  968  *  972  1007  1052  1074  1083  1086  1088  1089  1089  1084  1063  1020  985  *  964  943

                                  *        1025  1063  1080  1086  1089  1090  1092  1092  1089  1074  1037        *
                     964  969  *  974  1009  1054  1077  1085  1089  1090  1092  1093  1093  1086  1065  1020  984  *  964  944

                           *        1026  1064  1082  1088  1090  1092  1093  1094  1095  1091  1076  1037        *
                  964  969  *  975  1008  1054  1078  1087  1090  1092  1093  1095  1096  1095  1088  1065  1018  983  *  964  944

                        *        1020  1062  1083  1090  1092  1093  1095  1096  1097  1097  1092  1074  1031        *
               961  968  *  974   997  1047  1077  1089  1092  1094  1095  1096  1097  1098  1097  1087  1059  1008  982  *  963  943
               931  951  *  970                                                                              984  *  954  923
               927  949  *  969   996  1048  1079  1091  1094  1096  1097  1098  1099  1100  1098  1089  1060  1011  988  *  965  940
                        *        1020  1066  1087  1094  1096  1097  1098  1099  1100  1100  1095  1076  1034        *

                  929  951  *  971  1009  1060  1086  1095  1098  1099  1100  1101  1102  1101  1094  1071  1024  992  *  968  943
                           *        1030  1073  1091  1097  1099  1100  1101  1102  1102  1098  1082  1043        *

                     931  953  *  974  1015  1065  1090  1098  1101  1102  1103  1104  1103  1096  1074  1028  993  *  969  945
                           *        1035  1077  1095  1101  1102  1103  1104  1104  1100  1085  1046        *

                        933  956  *  978  1018  1068  1093  1101  1103  1104  1105  1104  1098  1076  1029  992  *  969  945
                           *        1039  1080  1097  1102  1104  1105  1105  1101  1086  1047        *

                           934  958  *  981  1021  1070  1092  1100  1102  1103  1102  1096  1075  1029  991  *  969  946
                                     *        1040  1079  1093  1098  1099  1100  1097  1083  1046        *

                              935  959  *  983  1021  1063  1081  1086  1088  1088  1084  1068  1026  988  *  967  945
                                        *        1034  1064  1074  1077  1078  1077  1068  1039        *

                                 933  958  *  982  1010  1035  1044  1047  1049  1048  1041  1015  986  *  966  944
                                           *        1009  1022  1027  1030  1031  1029  1016        *

                                              *  978   979   982   986   989   992   993   991  987  *
                                                 *   *   *   *   *   *   *   *   *   *   *   *   *
                                           947         957   960   963   965   966   967   965        956

                                        914            934   937   939   940   940   940   939            925
```


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Table B12B-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for BOC 12B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          884          903   903   902   901   899   897   895          884

                              913      922   923   921   919   917   914   912      907
                                     *   *   *   *   *   *   *   *   *   *   *   *
                                   *  940   941   941   939   936   933   931   929  929  *

                                 *      958   965   965   962   958   953   944      *
                        903  922  *  941   958   974   978   976   972   968   959   944  931  *  918  904

                             *      975   994   999   998   994   989   978   958      *
                    906  925  *  944   968   995  1007  1008  1005  1000   993   977   951  932  *  919  906

                           *      984  1009  1019  1020  1017  1012  1005   990   963      *
                 908  928  *  947   973  1005  1021  1025  1023  1019  1013  1003   984   953  931  *  919  907

                         *      988  1016  1028  1030  1028  1024  1018  1010   993   963      *
              909  930  *  950   976  1009  1027  1032  1031  1027  1023  1017  1005   984   952  930  *  919  907

                       *      989  1018  1031  1034  1032  1029  1024  1019  1010   992   962      *
           911  932  *  953   978  1011  1029  1035  1034  1031  1027  1022  1016  1004   982   950  929  *  918  907

                     *      989  1019  1033  1036  1034  1031  1027  1023  1017  1008   989   959      *
        911  933  *  954   976  1010  1029  1036  1036  1032  1029  1025  1020  1014  1001   979   946  928  *  917  906

                  *      984  1015  1032  1037  1036  1032  1028  1025  1021  1015  1004   983   953      *
     910  932  *  954   968  1003  1026  1036  1037  1034  1030  1026  1023  1018  1010   996   971   940  928  *  916  905
     897  925  *  952                                                                                    929  *  908  886
     921  937  *  952   968  1002  1026  1035  1036  1033  1030  1026  1022  1018  1010   996   971   941  932  *  915  897
                  *      983  1015  1031  1036  1035  1031  1028  1024  1020  1014  1004   984   954      *

        922  938  *  954   976  1009  1028  1035  1034  1031  1027  1024  1019  1013  1001   979   950  935  *  918  900
                     *      989  1017  1031  1034  1032  1029  1025  1021  1016  1007   989   961      *

           922  939  *  956   978  1010  1027  1032  1031  1028  1025  1020  1014  1003   983   953  936  *  920  903
                        *      990  1017  1029  1031  1029  1026  1022  1017  1008   991   964      *

              922  940  *  957   979  1008  1024  1028  1027  1024  1020  1014  1003   984   955  938  *  921  904
                           *      989  1014  1025  1027  1024  1021  1016  1007   991   965      *

                 922  940  *  958   978  1004  1018  1021  1019  1016  1011  1001   983   955  939  *  923  906
                              *      986  1008  1016  1017  1014  1010  1003   989   965      *

                    921  939  *  957   974   995  1005  1006  1004  1000   992   978   955  940  *  924  908
                                 *      979   994   998   998   995   990   980   961      *

                       919  938  *  955   965   976   980   980   978   974   966   951  942  *  925  909
                                    *      964   969   971   970   967   963   954      *

                                      *  953   953   953   953   953   953   951   948  945  *
                                         *   *   *   *   *   *   *   *   *   *   *   *   *
                                   943          956   957   957   956   954   952   948      933

                              933            960   961   961   959   956   953   949          921
```


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Table B12B-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              956             950   952   953   955   956   956   957            936

                                  977         975   977   978   979   980   980   981        972
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  997   998  1000  1002  1003  1003  1003  1004 1005  *

                                   *        1004  1009  1013  1015  1015  1013  1011        *
                           989  993  *  997  1003  1012  1018  1021  1022  1021  1017  1012 1008  *  986  963

                                    *        1011  1022  1031  1035  1036  1034  1029  1020        *
                           990  994  *  998  1008  1022  1034  1040  1043  1043  1039  1030  1019 1010  *  988  965

                                    *        1016  1033  1046  1053  1057  1056  1051  1041  1027        *
                           990  995  *  999  1011  1030  1046  1056  1061  1063  1060  1053  1039  1023 1011  *  990  967

                                 *        1019  1040  1056  1066  1071  1073  1070  1063  1049  1030        *
                      990  995  * 1001  1013  1034  1053  1066  1073  1076  1076  1072  1061  1044  1024 1012  *  991  969

                                 *        1021  1043  1061  1073  1080  1083  1083  1079  1069  1052  1031        *
                989  996  * 1002  1014  1036  1056  1071  1080  1084  1086  1084  1078  1065  1046  1024 1011  *  991  970

                              *        1020  1042  1063  1076  1084  1088  1090  1088  1083  1071  1052  1030        *
           987  995  * 1002  1012  1034  1056  1073  1083  1088  1091  1091  1088  1080  1065  1044  1022 1011  *  991  971

                         *        1015  1038  1060  1076  1086  1091  1093  1093  1091  1084  1069  1048  1026        *
      986  994  * 1002  1007  1027  1051  1070  1083  1090  1093  1095  1094  1089  1079  1061  1038  1018 1010  *  991  971
      959  980  * 1000                                                  *                                 1011  *  980  949
      958  979  *  999  1006  1027  1052  1072  1085  1092  1095  1096  1095  1091  1080  1062  1039  1019 1013  *  989  964
                         *        1015  1039  1062  1080  1089  1094  1096  1097  1094  1086  1071  1050  1028        *

           958  979  *  999  1011  1036  1061  1079  1090  1095  1097  1097  1094  1085  1070  1048  1025 1014  *  990  965
                        *        1021  1047  1069  1084  1093  1096  1097  1096  1090  1077  1057  1034        *

                959  980  * 1000  1015  1042  1065  1082  1091  1095  1096  1094  1087  1073  1052  1028 1014  *  991  966
                        *        1025  1051  1072  1085  1092  1095  1094  1089  1078  1060  1037        *

                     959  981  * 1002  1018  1044  1066  1080  1088  1091  1090  1084  1072  1053  1029 1013  *  990  967
                               *        1027  1052  1071  1082  1087  1088  1085  1075  1059  1037        *

                          959  981  * 1003  1019  1043  1061  1073  1078  1079  1076  1066  1050  1028 1012  *  990  967
                                     *        1026  1047  1062  1070  1074  1073  1066  1053  1034        *

                               958  981  * 1003  1017  1036  1049  1057  1060  1059  1054  1042  1024 1010  *  989  966
                                          *        1022  1036  1046  1051  1052  1050  1042  1028        *

                                    957  980  * 1002  1012  1022  1029  1033  1035  1034  1029  1018 1008  *  988  966
                                               *        1011  1018  1023  1025  1026  1024  1019        *

                                                  * 1001  1001  1003  1005  1007  1009  1010  1010 1008  *
                                                     *   *   *   *   *   *   *   *   *   *   *   *   *
                                                971         980   981   983   985   986   987   986        979

                                              939             959   960   961   961   962   962   961            948
```


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Table B12B-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for BOC 12B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

| | | |

Table E12B-2.16. MFF-5 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    44.000 in
                              907             903   905   907   908   908   908   907            890

                                  925         926   929   930   930   930   930   929        921
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  943   947   951   952   952   952   951   950  951  *

                                   *         986   999  1002  1004  1004  1003   993        *
                           938  941  *  943   985  1012  1020  1023  1024  1024  1019   996  957  *  937  917

                                    *        1011  1038  1046  1049  1051  1051  1046  1022        *
                        941  943  *  946   996  1037  1052  1057  1059  1060  1059  1047  1009  961  *  941  920

                                  *        1018  1051  1063  1067  1069  1070  1070  1061  1030        *
                      942  945  *  948  1000  1045  1063  1069  1071  1073  1074  1071  1056  1013  962  *  942  922

                                *        1020  1055  1068  1072  1074  1076  1077  1076  1066  1033        *
                    943  947  *  950  1002  1048  1066  1072  1075  1076  1078  1079  1075  1059  1014  962  *  943  924

                           *        1022  1058  1070  1075  1076  1078  1079  1080  1079  1069  1034        *
                 944  948  *  952  1004  1050  1068  1074  1076  1078  1079  1081  1081  1078  1061  1015  962  *  943  924

                        *        1024  1059  1072  1076  1078  1079  1080  1082  1083  1081  1070  1035        *
            943  948  *  953  1003  1051  1070  1076  1078  1079  1080  1082  1083  1084  1080  1062  1013  961  *  943  924

                     *        1019  1059  1074  1078  1080  1081  1082  1083  1084  1085  1083  1070  1030        *
      941  947  *  952   993  1046  1070  1078  1080  1081  1082  1083  1084  1086  1086  1080  1057  1004  960  *  942  923
      912  930  *  948                                                                                 960  *  932  903
      908  928  *  948   992  1047  1072  1080  1082  1083  1083  1085  1086  1087  1087  1082  1059  1006  966  *  943  920
                     *        1020  1062  1078  1082  1083  1084  1085  1086  1087  1088  1086  1073  1033        *

            911  931  *  951  1005  1057  1078  1084  1085  1086  1087  1088  1089  1089  1085  1067  1019  969  *  946  923
                        *        1029  1068  1082  1085  1086  1087  1088  1089  1090  1088  1077  1041        *

                  913  934  *  954  1011  1062  1081  1087  1088  1089  1090  1091  1091  1087  1070  1023  970  *  948  924
                              *        1034  1072  1085  1089  1090  1090  1091  1092  1090  1079  1044        *

                        915  936  *  957  1014  1065  1084  1090  1091  1092  1093  1093  1089  1072  1024  970  *  948  925
                                    *        1037  1075  1088  1091  1092  1093  1093  1092  1080  1045        *

                           916  939  *  960  1017  1067  1085  1090  1092  1092  1093  1089  1072  1024  969  *  947  925
                                       *        1039  1075  1086  1089  1090  1091  1089  1079  1045        *

                              916  940  *  962  1018  1063  1077  1081  1082  1083  1080  1067  1022  967  *  946  925
                                          *        1035  1063  1071  1073  1074  1074  1067  1039        *

                                 915  939  *  961  1007  1036  1043  1046  1047  1047  1041  1011  964  *  944  923
                                             *        1007  1019  1024  1025  1026  1025  1013        *

                                                *  957   958   962   965   968   970   971   969  964  *
                                                   *   *   *   *   *   *   *   *   *   *   *   *   *
                                               927         937   940   943   944   946   946   944        935

                                           895             915   917   919   920   920   920   919            904
```


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Table E12B-2.13. MFF-3 Sodium Subchannel Temperatures at Top of Fuel Elevation for EOC 12B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 44.000 in

```
                          871             891   891   890   889   887   885   882             872

                              899         910   910   909   907   904   902   899         894
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  926   929   929   927   924   921   918   915  915  *

                                    *         959   966   965   962   959   954   943         *
                          890  909  *  928   959   978   981   979   976   971   963   944  917  *  905  893

                                       *         980   999  1003  1002   998   993   984   962         *
                             893  912  *  931   969  1001  1010  1011  1008  1003   997   983   951  918  *  907  894

                                       *         987  1013  1021  1020  1017  1013  1007   994   966         *
                          894  915  *  934   973  1009  1022  1024  1022  1018  1013  1005   987   952  917  *  906  895

                                    *         990  1018  1027  1027  1025  1021  1017  1010   995   965         *
                       896  917  *  937   976  1011  1026  1029  1027  1024  1020  1015  1006   987   950  916  *  905  894

                                 *         991  1019  1029  1030  1027  1024  1020  1016  1009   994   963         *
                    897  918  *  939   977  1013  1028  1031  1029  1025  1022  1018  1013  1004   985   948  914  *  904  893

                              *         991  1020  1030  1031  1029  1025  1021  1018  1014  1006   991   960         *
                 897  919  *  940   975  1012  1028  1032  1030  1026  1023  1019  1016  1011  1001   981   945  912  *  902  892

                         *         986  1017  1030  1032  1030  1026  1022  1019  1016  1011  1003   986   954         *
           896  918  *  939   967  1006  1026  1032  1031  1027  1024  1020  1017  1014  1008   997   974   937  911  *  901  890
           882  910  *  936                                                                                 912  *  893  872
           905  921  *  936   966  1005  1026  1031  1030  1027  1023  1020  1017  1013  1008   997   974   938  915  *  900  884
                         *         985  1016  1029  1031  1029  1025  1021  1018  1015  1010  1003   986   955         *

              906  923  *  938   974  1010  1026  1030  1028  1024  1021  1018  1014  1009  1000   981   947  918  *  902  886
                           *         990  1018  1028  1029  1026  1023  1019  1016  1012  1005   990   961         *

                 907  923  *  940   976  1010  1025  1027  1025  1022  1019  1015  1010  1002   983   950  919  *  904  888
                           *         990  1016  1026  1026  1023  1020  1017  1012  1005   991   963         *

                       907  924  *  940   975  1008  1022  1024  1022  1019  1015  1011  1002   984   951  920  *  905  890
                                 *         989  1014  1022  1022  1020  1016  1012  1005   992   964         *

                          906  924  *  941   974  1005  1017  1018  1016  1013  1008  1000   984   951  920  *  906  891
                                       *         986  1009  1015  1015  1012  1008  1002   990   964         *

                             905  923  *  940   971   997  1005  1005  1003   999   993   979   950  921  *  907  892
                                           *         979   995   999   997   994   990   981   960         *

                                903  920  *  937   961   976   979   978   976   972   964   945  922  *  908  893
                                             *         959   965   966   965   962   958   948         *

                                               *  935   934   935   935   935   934   932   928  925  *
                                                  *   *   *   *   *   *   *   *   *   *   *   *   *
                                             925         937   938   938   937   935   933   929         914

                                          914             941   942   941   940   937   934   930             903
```


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Table E12B-2.17. MFF-5 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12B-2

1 temperature map for bundle 11 ASSEMBLY NO. 1304 MFF-5
axial height 50.500 in

| | | |

Table E12B-2.14. MFF-3 Sodium Subchannel Temperatures at Top of Core Upper Axial Reflector Elevation for EOC 12B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 50.500 in

```
                          882          900   901   900   899   897   895   893          883

                              910         919   920   918   916   914   912   910        905
                                    *   *   *   *   *   *   *   *   *   *   *   *   *
                                  *  936   938   938   936   933   930   928   926  926  *

                                *         954   961   961   958   955   950   941        *
                      900  919  *  937   954   969   973   972   969   964   956   941  928  *  915  902

                             *         971   989   995   994   990   985   975   955        *
                   902  922  *  940   964   990  1002  1003  1001   996   989   974   948  929  *  917  904

                           *         979  1004  1014  1015  1012  1008  1001   986   960        *
                 904  924  *  943   968  1000  1015  1019  1018  1014  1009   999   980   949  928  *  917  905

                         *         982  1010  1022  1024  1022  1019  1014  1005   989   960        *
               906  926  *  946   971  1003  1021  1026  1025  1022  1018  1012  1001   980   948  927  *  916  905

                       *         984  1012  1025  1028  1026  1023  1019  1014  1005   988   958        *
           906  928  *  948   972  1004  1022  1028  1028  1025  1021  1017  1011  1000   978   946  925  *  915  904

                     *         983  1012  1026  1029  1028  1025  1021  1017  1012  1003   985   955        *
      907  929  *  950   971  1003  1023  1029  1029  1026  1023  1019  1015  1009   997   974   942  924  *  914  903

                 *         978  1008  1025  1030  1029  1026  1022  1019  1015  1010   999   979   949        *
   906  928  *  949   963   996  1019  1029  1030  1027  1024  1020  1017  1013  1005   991   966   936  924  *  913  902
   893  921  *  947                                                                                  925  *  905  884
   916  932  *  947   962   996  1019  1028  1029  1027  1023  1020  1016  1012  1005   991   967   937  928  *  911  894
                 *         977  1008  1024  1029  1028  1025  1021  1018  1014  1009   999   979   950        *

      917  933  *  949   970  1002  1021  1027  1027  1024  1021  1017  1013  1007   996   975   945  930  *  914  897
                     *         982  1010  1024  1027  1026  1022  1019  1015  1010  1001   984   957        *

         917  934  *  950   972  1003  1020  1025  1024  1022  1018  1014  1008   998   978   949  932  *  916  899
                        *         983  1010  1022  1024  1023  1019  1016  1011  1002   986   959        *

            917  935  *  951   973  1001  1017  1021  1020  1018  1014  1008   998   978   950  933  *  917  901
                           *         983  1007  1018  1020  1018  1014  1009  1001   986   960        *

               917  935  *  952   971   998  1011  1014  1013  1009  1004   995   977   950  934  *  918  902
                              *         980  1001  1009  1010  1008  1004   997   983   959        *

                  916  934  *  951   968   989   998   999   997   993   986   972   949  935  *  919  904
                                 *         973   987   992   991   989   984   974   956        *

                     914  932  *  949   959   970   974   974   972   968   960   946  936  *  921  905
                                    *         958   963   965   964   962   957   948        *

                                       *  948   947   947   948   948   947   945   942  940  *
                                          *   *   *   *   *   *   *   *   *   *   *   *   *
                                    938         951   952   951   951   949   947   943        928

                                 928            955   956   955   954   951   948   944            917
```


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Table E12B-2.18. MFF-5 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12B-2

```
1  temperature map for bundle  11     ASSEMBLY  NO. 1304    MFF-5
   axial height    92.000 in
                              948             942   944   946   947   948   948   949            930

                                  968         966   968   969   970   971   971   972        963
                                        *   *   *   *   *   *   *   *   *   *   *   *   *
                                     *  987   989   991   992   993   993   993   994  996  *

                                   *         994  1000  1003  1005  1005  1003  1001        *
                           981  984  *  987   993  1002  1008  1011  1012  1010  1007  1002  998  *  977  955

                                    *        1001  1012  1020  1025  1026  1024  1018  1010        *
                           981  985  *  988   998  1012  1023  1030  1032  1032  1028  1020  1009 1000  *  979  957

                                    *        1006  1022  1035  1042  1045  1045  1040  1030  1016        *
                           982  986  *  990  1001  1019  1034  1045  1050  1051  1049  1041  1029  1012 1001  *  981  959

                                   *        1009  1029  1044  1054  1059  1061  1058  1051  1038  1020        *
                      981  986  *  991  1003  1024  1042  1054  1061  1064  1064  1060  1050  1033  1014 1002  *  982  961

                                  *        1011  1032  1049  1061  1068  1070  1070  1067  1057  1041  1021        *
                 981  987  *  993  1004  1025  1045  1059  1068  1072  1073  1072  1066  1053  1035  1014 1001  *  982  962

                             *        1010  1031  1051  1064  1072  1076  1077  1076  1071  1059  1041  1019        *
            980  986  *  993  1002  1023  1045  1061  1071  1076  1078  1078  1076  1068  1053  1033  1012 1001  *  982  963

                        *        1005  1027  1048  1064  1074  1078  1080  1081  1078  1071  1057  1037  1015        *
       978  985  *  992   997  1016  1039  1059  1071  1077  1081  1082  1081  1077  1066  1049  1027  1008 1000  *  982  963
       952  972  *  991                                                                                 1001  *  972  942
       950  970  *  990   997  1017  1040  1060  1072  1079  1082  1083  1082  1078  1068  1050  1028  1009 1003  *  980  956
                        *        1005  1028  1051  1067  1077  1082  1084  1084  1081  1074  1059  1039  1017        *

            951  971  *  990  1001  1025  1049  1067  1077  1082  1084  1084  1081  1073  1058  1037  1015 1004  *  981  958
                          *        1011  1036  1057  1072  1080  1083  1084  1083  1077  1065  1046  1023        *

               951  971  *  991  1005  1031  1054  1069  1078  1082  1083  1081  1074  1061  1041  1018 1004  *  982  959
                          *        1015  1040  1060  1073  1080  1082  1081  1077  1066  1048  1026        *

                  951  972  *  992  1008  1033  1054  1068  1075  1078  1077  1072  1060  1041  1018 1003  *  982  959
                             *        1017  1041  1058  1069  1074  1075  1072  1063  1047  1026        *

                     951  973  *  993  1009  1032  1050  1061  1066  1067  1064  1054  1038  1017 1002  *  981  959
                                *        1016  1036  1050  1058  1062  1061  1054  1042  1023        *

                        950  972  *  994  1007  1025  1038  1045  1048  1048  1042  1031  1014 1000  *  980  959
                                   *        1011  1025  1035  1039  1041  1038  1031  1018        *

                           949  971  *  993  1002  1012  1018  1023  1024  1023  1018  1008  998  *  979  958
                                      *        1001  1008  1012  1015  1016  1014  1009        *

                                         *  991   991   993   995   997   999  1000  1000  998  *
                                            *   *   *   *   *   *   *   *   *   *   *   *   *
                                        962         971   973   974   976   977   978   977        970

                                     932            951   952   953   954   954   954   953            941
```


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Table E12B-2.15. MFF-3 Sodium Subchannel Temperatures at Top of Pin Bundle Elevation for EOC 12B-2

1 temperature map for bundle 29 ASSEMBLY NO. 2404 MFF-3
axial height 92.000 in

| | | |

7.0 Detailed Pin Calculations

7.1 Methods

Details of the pin burnup calculation methods can be found in Appendix C. Data for specific pins in MFF-3 and MFF-5 during their residence in the FFTF core and for decay times following discharge were generated based on three dimensional calculations of detailed irradiation conditions for these pins to help analysts and designers in evaluating these fuel tests. This information will allow a more detailed interpretation of test results and development of performance correlations and/or models for metal fuel assemblies.

Obtaining radionuclide inventories involved:

1. Compiling pin information
    a. Pins selected in each test assembly for detailed burnup calculations
    b. Irradiation history (irradiation and decay times) of each assembly
    c. Initial as-built compositions of the selected fuel pins
    d. Decay times selected following end of irradiation
2. Generate total flux and effective one-group reaction cross sections for each irradiation cycle for each axial layer of each pin in each assembly.
3. Use the as-built pin compositions along with pin-segment-specific fluxes and cross sections by cycle to generate radionuclide inventories for each fuel pin axial segment at the beginning and end of each irradiation cycle and selected decay times following discharge, accounting for isotope buildup, depletion and radioactive decay.

The length of the fuel column in the three dimensional flux calculations was 92.28 cm, with eighteen axial layers in the fuel region, corresponding to layers 12 through 29 in the 3DBF flux model. Individual calculations of pin segments were made using the average flux and cross sections over each of the axial layers, providing eighteen fuel pin segments per pin. Thus, each detailed pin burnup calculation corresponds to a 5.127 cm long segment of a fuel pin.

Data provided for MFF-3 and MFF-5 for the beginning and end of each operating cycle include:

- neutron flux, cross sections, and burnup dependent compositions for eighteen axial pin segments for selected fuel pins

7.2 Selected Pins For Detailed Calculations

Nine pins from MFF-3 and ten pins from MFF-5 were selected by INL for detailed burnup calculations. The locations of the selected pins in MFF-3 and MFF-5 are shown in Tables 14 and 15, respectively. The as-built isotopic masses for each of the selected test pins were tabulated from the Test Design Description for each assembly, and are shown in Table 16.

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Table 14. MFF-3 Pin Numbers

Strip layer

1 193001 193072 193073 193002 193074 193075 193003 193004

2 193065 193066 193067 193068 193069 193070 193071 193005 193006

3 193057 193058 193007 193059 193060 193061 193008 (1) 193062 193063 193064

4 193049 193050 193051 193052 193009 193010 193053 193054 193055 193056 193011

5 193012 193043 193013 193044 (9) 193014 193015 193016 (2) 193045 193018 193046 193047 193048

6 193122 193123 193124 193125 193126 (7) 193127 (5) 193019 193020 193128 193129 193130 193021 193131

7 193109 193110 193111 193112 193022 (8) 193113 (6) 193114 (3) 193115 193116 193117 193118 193119 193120 193121

8 193023 193099 193100 193024 193101 193102 193103 (4) 193025 193104 193105 193026 193106 193107 193108 193027 X
0° Index Notch

9 193086 193087 193088 193089 193090 193091 193092 193093 193094 193095 193096 193097 193028 193098

10 193076 193029 193077 193078 193079 193030 193080 193081 193082 193083 193031 193084 193085

11 193163 193164 193165 193032 193166 193167 193168 193169 193033 193170 193171 193035

12 193036 193154 193155 193156 193157 193037 193158 193159 193160 193161 193162

13 193145 193146 193147 193148 193149 193150 193151 193152 193038 193153

14 193137 193138 193039 193139 193140 193141 193142 193143 193144

15 193040 193132 193133 193134 193041 193135 193136 193042

(x) = pin number for pin composition calculations

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Table 15. MFF-5 Pin Numbers

Strip layer

1 195007 195043 195044 195008 195045 195046 195047 195009

2 195035 195036 195005 195037 195038 195039 195006 195041 195042

3 195024 195025 195026 195027 195028 195030 195031 195032 195033 195034

4 195017 195018 195001 195019 195020 195002 195021 195022 195003 195023 195004

5 195069 195106 195107 195108 195109 195110 195111 195112 195113 195114 195115 195116

(7)
6 195096 195097 195098 195099 195066 195100 195101 195102 195067 195103 195104 195068 195105

(8) (4) (1)
7 195093 195016 195094 195095 195058 195059 195060 195061 195062 195063 195064 195065 195091 195092

(10) (9) (5) (2)
8 195010 195048 195049 195050 195011 195051 195052 195012 195053 195054 195013 195055 195056 195057 195015 X
0° Index Notch

(6) (3)
9 195142 195143 195144 195145 195146 195147 195148 195149 195150 195151 195152 195153 195082 195154

10 195132 195079 195133 195134 195135 195080 195081 195136 195137 195138 195139 195140 195141

11 195126 195127 195073 195128 195074 195075 195076 195129 195077 195130 195131 195078

12 195070 195117 195118 195119 195071 195072 195121 195122 195123 195124 195125

13 195185 195186 195187 195188 195189 195190 195191 195090 195192 195193

14 195087 195088 195159 195089 195160 195181 195182 195183 195184

15 195083 195084 195155 195156 195085 195157 195158 195086

(x) = pin number for pin composition calculations

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Table 16. As-Built Initial Fuel Pin Compositions for Selected Pins in MFF-3 and MFF-5

pin#	Serial#	Strip#/ pin#	Pin mass (g)				Segment[1] mass (g)		
			UZr	U	^{235}U	^{238}U[2]	U	^{235}U	^{238}U[2]
MFF-3									
1	193062	3/8	284.64	256.00	82.89	173.11	14.222	4.605	9.617
2	193045	5/8	282.75	254.36	82.16	172.20	14.131	4.564	9.567
3	193115	7/8	284.67	256.00	82.94	173.06	14.222	4.608	9.614
4	193025	8/8	283.04	254.62	82.85	171.77	14.146	4.603	9.543
5	193019	6/7	283.05	254.63	82.86	171.77	14.146	4.603	9.543
6	193114	7/7	283.39	254.85	82.57	172.28	14.158	4.587	9.571
7	193127	6/6	284.54	255.89	82.91	172.98	14.216	4.606	9.610
8	193113	7/6	284.52	255.87	82.90	172.97	14.215	4.606	9.609
9	193014	5/5	279.67	251.58	81.73	169.85	13.977	4.541	9.436
MFF-5									
1	195061	7/8	283.84	255.34	78.88	176.47	14.186	4.382	9.804
2	195012	8/8	283.65	255.17	79.10	176.07	14.176	4.395	9.782
3	195148	9/7	282.74	254.32	79.32	175.00	14.129	4.407	9.722
4	195060	7/7	283.65	255.17	78.82	176.35	14.176	4.379	9.797
5	195052	8/7	282.82	254.43	78.59	175.83	14.135	4.366	9.769
6	195147	9/6	282.88	254.47	78.86	175.61	14.137	4.381	9.756
7	195100	6/6	284.71	256.10	79.88	176.22	14.228	4.438	9.790
8	195059	7/6	284.07	255.55	78.94	176.61	14.197	4.386	9.812
9	195051	8/6	284.85	256.25	79.16	177.10	14.236	4.398	9.839
10	195011	8/5	283.69	255.21	79.11	176.09	14.178	4.395	9.783

[1]Pin segment masses were generated by dividing the pin mass by 18 (the number of axial layers in the flux file)

[2]UZr, U, and ^{235}U are given as as-built, ^{238}U was generated as the difference between U and ^{235}U

7.3 Selected Pins Total Flux

The effective one-group neutron flux for each cycle and each axial layer of each pin is shown in Table 17 for MFF-3 and Table 18 for MFF-5. These were calculated by running HEDPIN on each axial layer of the fuel region (layers 12 through 29) of the 3DBF flux file for each cycle. These fluxes were generated from the same 3DBF flux files with the mid-cycle control rod elevations that were used in the assembly cycle burn calculations that created the NADBs for each cycle.

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Table 17. Total Flux in Each Pin Segment by Cycle for MFF-3

Layer	Cycle	1	2	3	4	5	6	7	8	9
12	10c1	2.8054E+15	2.7676E+15	2.7300E+15	2.7114E+15	2.7454E+15	2.7266E+15	2.7420E+15	2.7230E+15	2.7576E+15
	10c2	2.7486E+15	2.7113E+15	2.6742E+15	2.6559E+15	2.6885E+15	2.6699E+15	2.6842E+15	2.6655E+15	2.6987E+15
	10c3	2.7376E+15	2.7003E+15	2.6631E+15	2.6448E+15	2.6775E+15	2.6589E+15	2.6733E+15	2.6546E+15	2.6879E+15
	11a1	2.8030E+15	2.7609E+15	2.7196E+15	2.6993E+15	2.7299E+15	2.7096E+15	2.7198E+15	2.6998E+15	2.7302E+15
	11a2	2.7495E+15	2.7097E+15	2.6707E+15	2.6516E+15	2.6794E+15	2.6603E+15	2.6690E+15	2.6501E+15	2.6779E+15
	11a3	2.7173E+15	2.6767E+15	2.6369E+15	2.6175E+15	2.6462E+15	2.6267E+15	2.6361E+15	2.6167E+15	2.6456E+15
	11b1	2.7589E+15	2.7181E+15	2.6776E+15	2.6576E+15	2.6887E+15	2.6687E+15	2.6801E+15	2.6603E+15	2.6917E+15
	11b2	2.6770E+15	2.6259E+15	2.5765E+15	2.5525E+15	2.5890E+15	2.5649E+15	2.5776E+15	2.5537E+15	2.5907E+15
	11c	2.7152E+15	2.6615E+15	2.6105E+15	2.5861E+15	2.6217E+15	2.5969E+15	2.6082E+15	2.5837E+15	2.6199E+15
	12a1	2.6459E+15	2.5935E+15	2.5435E+15	2.5196E+15	2.5512E+15	2.5270E+15	2.5348E+15	2.5109E+15	2.5430E+15
	12a2	2.6545E+15	2.5986E+15	2.5454E+15	2.5200E+15	2.5543E+15	2.5285E+15	2.5375E+15	2.5120E+15	2.5469E+15
	12b1	2.7739E+15	2.7191E+15	2.6671E+15	2.6423E+15	2.6750E+15	2.6499E+15	2.6577E+15	2.6331E+15	2.6660E+15
	12b2	2.7480E+15	2.6927E+15	2.6402E+15	2.6151E+15	2.6470E+15	2.6216E+15	2.6286E+15	2.6037E+15	2.6360E+15
13	10c1	3.2508E+15	3.2084E+15	3.1664E+15	3.1458E+15	3.1856E+15	3.1647E+15	3.1838E+15	3.1628E+15	3.2030E+15
	10c2	3.1853E+15	3.1434E+15	3.1020E+15	3.0817E+15	3.1197E+15	3.0991E+15	3.1168E+15	3.0961E+15	3.1347E+15
	10c3	3.1727E+15	3.1307E+15	3.0892E+15	3.0688E+15	3.1070E+15	3.0864E+15	3.1042E+15	3.0835E+15	3.1222E+15
	11a1	3.2404E+15	3.1934E+15	3.1474E+15	3.1251E+15	3.1600E+15	3.1376E+15	3.1500E+15	3.1279E+15	3.1625E+15
	11a2	3.1822E+15	3.1378E+15	3.0944E+15	3.0734E+15	3.1052E+15	3.0840E+15	3.0947E+15	3.0738E+15	3.1054E+15
	11a3	3.1434E+15	3.0981E+15	3.0538E+15	3.0324E+15	3.0652E+15	3.0436E+15	3.0550E+15	3.0336E+15	3.0664E+15
	11b1	3.1859E+15	3.1408E+15	3.0962E+15	3.0742E+15	3.1099E+15	3.0880E+15	3.1019E+15	3.0802E+15	3.1160E+15
	11b2	3.0920E+15	3.0340E+15	2.9781E+15	2.9511E+15	2.9936E+15	2.9664E+15	2.9820E+15	2.9552E+15	2.9980E+15
	11c	3.1371E+15	3.0754E+15	3.0172E+15	2.9896E+15	3.0310E+15	3.0029E+15	3.0167E+15	2.9889E+15	3.0309E+15
	12a1	3.0524E+15	2.9921E+15	2.9352E+15	2.9082E+15	2.9449E+15	2.9174E+15	2.9271E+15	2.9000E+15	2.9372E+15
	12a2	3.0618E+15	2.9972E+15	2.9362E+15	2.9073E+15	2.9474E+15	2.9179E+15	2.9291E+15	2.9000E+15	2.9407E+15
	12b1	3.2016E+15	3.1383E+15	3.0788E+15	3.0507E+15	3.0888E+15	3.0602E+15	3.0701E+15	3.0422E+15	3.0802E+15
	12b2	3.1691E+15	3.1053E+15	3.0453E+15	3.0168E+15	3.0539E+15	3.0251E+15	3.0337E+15	3.0055E+15	3.0428E+15
14	10c1	3.6656E+15	3.6196E+15	3.5740E+15	3.5515E+15	3.5964E+15	3.5736E+15	3.5959E+15	3.5730E+15	3.6181E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
	10c2	3.5947E+15	3.5492E+15	3.5042E+15	3.4820E+15	3.5249E+15	3.5024E+15	3.5230E+15	3.5005E+15	3.5437E+15
	10c3	3.5807E+15	3.5350E+15	3.4899E+15	3.4677E+15	3.5107E+15	3.4882E+15	3.5089E+15	3.4864E+15	3.5298E+15
	11a1	3.6454E+15	3.5943E+15	3.5444E+15	3.5200E+15	3.5589E+15	3.5345E+15	3.5488E+15	3.5247E+15	3.5630E+15
	11a2	3.5865E+15	3.5384E+15	3.4914E+15	3.4685E+15	3.5038E+15	3.4808E+15	3.4931E+15	3.4704E+15	3.5053E+15
	11a3	3.5416E+15	3.4924E+15	3.4444E+15	3.4210E+15	3.4575E+15	3.4340E+15	3.4470E+15	3.4239E+15	3.4600E+15
	11b1	3.5842E+15	3.5356E+15	3.4874E+15	3.4636E+15	3.5032E+15	3.4795E+15	3.4955E+15	3.4720E+15	3.5116E+15
	11b2	3.4846E+15	3.4199E+15	3.3576E+15	3.3275E+15	3.3758E+15	3.3455E+15	3.3637E+15	3.3338E+15	3.3823E+15
	11c	3.5362E+15	3.4669E+15	3.4017E+15	3.3709E+15	3.4180E+15	3.3865E+15	3.4026E+15	3.3715E+15	3.4191E+15
	12a1	3.4364E+15	3.3689E+15	3.3052E+15	3.2750E+15	3.3167E+15	3.2859E+15	3.2973E+15	3.2671E+15	3.3092E+15
	12a2	3.4468E+15	3.3741E+15	3.3055E+15	3.2730E+15	3.3188E+15	3.2857E+15	3.2988E+15	3.2662E+15	3.3124E+15
	12b1	3.6046E+15	3.5336E+15	3.4671E+15	3.4357E+15	3.4787E+15	3.4469E+15	3.4584E+15	3.4273E+15	3.4701E+15
	12b2	3.5655E+15	3.4941E+15	3.4269E+15	3.3952E+15	3.4371E+15	3.4049E+15	3.4150E+15	3.3835E+15	3.4253E+15
15	10c1	4.0266E+15	3.9776E+15	3.9288E+15	3.9046E+15	3.9538E+15	3.9294E+15	3.9542E+15	3.9298E+15	3.9789E+15
	10c2	3.9542E+15	3.9057E+15	3.8575E+15	3.8336E+15	3.8806E+15	3.8565E+15	3.8794E+15	3.8553E+15	3.9024E+15
	10c3	3.9391E+15	3.8904E+15	3.8421E+15	3.8182E+15	3.8653E+15	3.8412E+15	3.8642E+15	3.8401E+15	3.8873E+15
	11a1	3.9943E+15	3.9403E+15	3.8870E+15	3.8610E+15	3.9032E+15	3.8771E+15	3.8930E+15	3.8672E+15	3.9085E+15
	11a2	3.9397E+15	3.8887E+15	3.8386E+15	3.8141E+15	3.8524E+15	3.8279E+15	3.8415E+15	3.8173E+15	3.8548E+15
	11a3	3.8892E+15	3.8370E+15	3.7858E+15	3.7607E+15	3.8003E+15	3.7753E+15	3.7896E+15	3.7649E+15	3.8038E+15
	11b1	3.9308E+15	3.8796E+15	3.8284E+15	3.8030E+15	3.8459E+15	3.8207E+15	3.8385E+15	3.8135E+15	3.8561E+15
	11b2	3.8298E+15	3.7591E+15	3.6910E+15	3.6580E+15	3.7115E+15	3.6783E+15	3.6989E+15	3.6661E+15	3.7197E+15
	11c	3.8871E+15	3.8110E+15	3.7395E+15	3.7056E+15	3.7579E+15	3.7233E+15	3.7415E+15	3.7073E+15	3.7600E+15
	12a1	3.7735E+15	3.6994E+15	3.6295E+15	3.5963E+15	3.6426E+15	3.6088E+15	3.6217E+15	3.5885E+15	3.6350E+15
	12a2	3.7845E+15	3.7045E+15	3.6291E+15	3.5933E+15	3.6442E+15	3.6077E+15	3.6226E+15	3.5867E+15	3.6379E+15
	12b1	3.9576E+15	3.8797E+15	3.8067E+15	3.7724E+15	3.8199E+15	3.7851E+15	3.7979E+15	3.7639E+15	3.8110E+15
	12b2	3.9123E+15	3.8339E+15	3.7603E+15	3.7256E+15	3.7718E+15	3.7365E+15	3.7478E+15	3.7134E+15	3.7593E+15
16	10c1	4.3237E+15	4.2719E+15	4.2202E+15	4.1945E+15	4.2475E+15	4.2216E+15	4.2486E+15	4.2227E+15	4.2754E+15
	10c2	4.2548E+15	4.2036E+15	4.1525E+15	4.1272E+15	4.1776E+15	4.1521E+15	4.1770E+15	4.1515E+15	4.2018E+15
	10c3	4.2391E+15	4.1876E+15	4.1364E+15	4.1110E+15	4.1616E+15	4.1360E+15	4.1611E+15	4.1355E+15	4.1861E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
	11a1	4.2797E+15	4.2227E+15	4.1666E+15	4.1390E+15	4.1841E+15	4.1566E+15	4.1738E+15	4.1466E+15	4.1906E+15
	11a2	4.2342E+15	4.1806E+15	4.1278E+15	4.1019E+15	4.1427E+15	4.1169E+15	4.1316E+15	4.1060E+15	4.1460E+15
	11a3	4.1789E+15	4.1240E+15	4.0699E+15	4.0435E+15	4.0857E+15	4.0592E+15	4.0748E+15	4.0487E+15	4.0901E+15
	11b1	4.2194E+15	4.1657E+15	4.1118E+15	4.0850E+15	4.1308E+15	4.1043E+15	4.1234E+15	4.0971E+15	4.1424E+15
	11b2	4.1193E+15	4.0434E+15	3.9702E+15	3.9347E+15	3.9926E+15	3.9569E+15	3.9794E+15	3.9442E+15	4.0021E+15
	11c	4.1815E+15	4.0996E+15	4.0226E+15	3.9862E+15	4.0428E+15	4.0056E+15	4.0254E+15	3.9887E+15	4.0456E+15
	12a1	4.0561E+15	3.9764E+15	3.9012E+15	3.8655E+15	3.9155E+15	3.8792E+15	3.8934E+15	3.8576E+15	3.9079E+15
	12a2	4.0678E+15	3.9815E+15	3.9003E+15	3.8617E+15	3.9168E+15	3.8775E+15	3.8938E+15	3.8551E+15	3.9106E+15
	12b1	4.2535E+15	4.1697E+15	4.0913E+15	4.0544E+15	4.1058E+15	4.0683E+15	4.0823E+15	4.0458E+15	4.0966E+15
	12b2	4.2027E+15	4.1184E+15	4.0394E+15	4.0021E+15	4.0519E+15	4.0140E+15	4.0263E+15	3.9893E+15	4.0388E+15
17	10c1	4.5506E+15	4.4966E+15	4.4425E+15	4.4156E+15	4.4715E+15	4.4444E+15	4.4731E+15	4.4460E+15	4.5016E+15
	10c2	4.4906E+15	4.4372E+15	4.3838E+15	4.3574E+15	4.4104E+15	4.3838E+15	4.4101E+15	4.3835E+15	4.4364E+15
	10c3	4.4746E+15	4.4209E+15	4.3673E+15	4.3407E+15	4.3941E+15	4.3673E+15	4.3938E+15	4.3670E+15	4.4203E+15
	11a1	4.4953E+15	4.4360E+15	4.3774E+15	4.3485E+15	4.3961E+15	4.3674E+15	4.3858E+15	4.3574E+15	4.4037E+15
	11a2	4.4641E+15	4.4084E+15	4.3534E+15	4.3264E+15	4.3692E+15	4.3423E+15	4.3579E+15	4.3313E+15	4.3731E+15
	11a3	4.4049E+15	4.3477E+15	4.2915E+15	4.2639E+15	4.3081E+15	4.2806E+15	4.2971E+15	4.2698E+15	4.3132E+15
	11b1	4.4439E+15	4.3882E+15	4.3323E+15	4.3044E+15	4.3523E+15	4.3247E+15	4.3449E+15	4.3176E+15	4.3650E+15
	11b2	4.3466E+15	4.2665E+15	4.1892E+15	4.1517E+15	4.2131E+15	4.1754E+15	4.1994E+15	4.1622E+15	4.2235E+15
	11c	4.4127E+15	4.3261E+15	4.2447E+15	4.2062E+15	4.2663E+15	4.2269E+15	4.2481E+15	4.2092E+15	4.2696E+15
	12a1	4.2779E+15	4.1936E+15	4.1141E+15	4.0764E+15	4.1294E+15	4.0910E+15	4.1061E+15	4.0683E+15	4.1217E+15
	12a2	4.2900E+15	4.1987E+15	4.1127E+15	4.0719E+15	4.1304E+15	4.0888E+15	4.1062E+15	4.0653E+15	4.1241E+15
	12b1	4.4858E+15	4.3972E+15	4.3144E+15	4.2754E+15	4.3298E+15	4.2902E+15	4.3052E+15	4.2666E+15	4.3203E+15
	12b2	4.4302E+15	4.3413E+15	4.2578E+15	4.2184E+15	4.2711E+15	4.2311E+15	4.2441E+15	4.2051E+15	4.2574E+15
18	10c1	4.7042E+15	4.6484E+15	4.5924E+15	4.5645E+15	4.6228E+15	4.5948E+15	4.6248E+15	4.5968E+15	4.6545E+15
	10c2	4.6580E+15	4.6030E+15	4.5481E+15	4.5208E+15	4.5757E+15	4.5482E+15	4.5755E+15	4.5480E+15	4.6027E+15
	10c3	4.6421E+15	4.5868E+15	4.5316E+15	4.5041E+15	4.5594E+15	4.5317E+15	4.5593E+15	4.5316E+15	4.5866E+15
	11a1	4.6380E+15	4.5770E+15	4.5165E+15	4.4867E+15	4.5363E+15	4.5066E+15	4.5261E+15	4.4969E+15	4.5450E+15
	11a2	4.6257E+15	4.5687E+15	4.5123E+15	4.4845E+15	4.5287E+15	4.5010E+15	4.5171E+15	4.4898E+15	4.5329E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
	11a3	4.5635E+15	4.5050E+15	4.4472E+15	4.4188E+15	4.4645E+15	4.4362E+15	4.4532E+15	4.4253E+15	4.4699E+15
	11b1	4.6008E+15	4.5439E+15	4.4865E+15	4.4579E+15	4.5073E+15	4.4789E+15	4.4999E+15	4.4718E+15	4.5207E+15
	11b2	4.5079E+15	4.4247E+15	4.3444E+15	4.3054E+15	4.3694E+15	4.3302E+15	4.3553E+15	4.3166E+15	4.3805E+15
	11c	4.5767E+15	4.4867E+15	4.4020E+15	4.3619E+15	4.4246E+15	4.3836E+15	4.4057E+15	4.3653E+15	4.4283E+15
	12a1	4.4351E+15	4.3474E+15	4.2647E+15	4.2254E+15	4.2808E+15	4.2408E+15	4.2566E+15	4.2172E+15	4.2728E+15
	12a2	4.4475E+15	4.3525E+15	4.2629E+15	4.2204E+15	4.2814E+15	4.2381E+15	4.2564E+15	4.2137E+15	4.2751E+15
	12b1	4.6506E+15	4.5585E+15	4.4724E+15	4.4318E+15	4.4884E+15	4.4473E+15	4.4629E+15	4.4227E+15	4.4786E+15
	12b2	4.5913E+15	4.4989E+15	4.4121E+15	4.3711E+15	4.4259E+15	4.3844E+15	4.3979E+15	4.3574E+15	4.4118E+15
19	10c1	4.7837E+15	4.7265E+15	4.6689E+15	4.6402E+15	4.7006E+15	4.6718E+15	4.7030E+15	4.6742E+15	4.7338E+15
	10c2	4.7557E+15	4.6998E+15	4.6439E+15	4.6160E+15	4.6721E+15	4.6441E+15	4.6720E+15	4.6440E+15	4.6998E+15
	10c3	4.7404E+15	4.6841E+15	4.6278E+15	4.5997E+15	4.6562E+15	4.6280E+15	4.6562E+15	4.6280E+15	4.6842E+15
	11a1	4.7087E+15	4.6460E+15	4.5839E+15	4.5532E+15	4.6049E+15	4.5744E+15	4.5950E+15	4.5650E+15	4.6149E+15
	11a2	4.7187E+15	4.6607E+15	4.6032E+15	4.5750E+15	4.6201E+15	4.5919E+15	4.6085E+15	4.5807E+15	4.6246E+15
	11a3	4.6545E+15	4.5949E+15	4.5361E+15	4.5072E+15	4.5539E+15	4.5250E+15	4.5425E+15	4.5141E+15	4.5597E+15
	11b1	4.6902E+15	4.6324E+15	4.5741E+15	4.5450E+15	4.5954E+15	4.5665E+15	4.5880E+15	4.5594E+15	4.6092E+15
	11b2	4.6025E+15	4.5174E+15	4.4351E+15	4.3952E+15	4.4608E+15	4.4206E+15	4.4464E+15	4.4067E+15	4.4723E+15
	11c	4.6730E+15	4.5807E+15	4.4939E+15	4.4528E+15	4.5171E+15	4.4751E+15	4.4979E+15	4.4564E+15	4.5211E+15
	12a1	4.5276E+15	4.4378E+15	4.3530E+15	4.3126E+15	4.3695E+15	4.3285E+15	4.3448E+15	4.3044E+15	4.3615E+15
	12a2	4.5404E+15	4.4429E+15	4.3511E+15	4.3075E+15	4.3701E+15	4.3257E+15	4.3445E+15	4.3007E+15	4.3637E+15
	12b1	4.7482E+15	4.6539E+15	4.5657E+15	4.5241E+15	4.5821E+15	4.5400E+15	4.5560E+15	4.5148E+15	4.5722E+15
	12b2	4.6866E+15	4.5919E+15	4.5030E+15	4.4610E+15	4.5172E+15	4.4746E+15	4.4886E+15	4.4470E+15	4.5028E+15
20	10c1	4.7903E+15	4.7319E+15	4.6731E+15	4.6438E+15	4.7059E+15	4.6765E+15	4.7088E+15	4.6795E+15	4.7405E+15
	10c2	4.7830E+15	4.7267E+15	4.6702E+15	4.6421E+15	4.6987E+15	4.6705E+15	4.6988E+15	4.6705E+15	4.7268E+15
	10c3	4.7686E+15	4.7118E+15	4.6550E+15	4.6267E+15	4.6837E+15	4.6553E+15	4.6837E+15	4.6553E+15	4.7120E+15
	11a1	4.7087E+15	4.6447E+15	4.5811E+15	4.5497E+15	4.6034E+15	4.5723E+15	4.5941E+15	4.5635E+15	4.6151E+15
	11a2	4.7420E+15	4.6834E+15	4.6255E+15	4.5969E+15	4.6426E+15	4.6142E+15	4.6311E+15	4.6031E+15	4.6476E+15
	11a3	4.6770E+15	4.6168E+15	4.5575E+15	4.5283E+15	4.5755E+15	4.5464E+15	4.5642E+15	4.5355E+15	4.5816E+15
	11b1	4.7113E+15	4.6530E+15	4.5943E+15	4.5649E+15	4.6158E+15	4.5867E+15	4.6085E+15	4.5797E+15	4.6299E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
	11b2	4.6293E+15	4.5433E+15	4.4601E+15	4.4197E+15	4.4861E+15	4.4455E+15	4.4715E+15	4.4315E+15	4.4978E+15
	11c	4.7003E+15	4.6070E+15	4.5192E+15	4.4776E+15	4.5427E+15	4.5002E+15	4.5233E+15	4.4814E+15	4.5469E+15
	12a1	4.5544E+15	4.4635E+15	4.3776E+15	4.3367E+15	4.3944E+15	4.3529E+15	4.3695E+15	4.3286E+15	4.3865E+15
	12a2	4.5674E+15	4.4688E+15	4.3759E+15	4.3318E+15	4.3952E+15	4.3503E+15	4.3694E+15	4.3251E+15	4.3889E+15
	12b1	4.7776E+15	4.6822E+15	4.5930E+15	4.5509E+15	4.6097E+15	4.5671E+15	4.5834E+15	4.5417E+15	4.5999E+15
	12b2	4.7150E+15	4.6192E+15	4.5293E+15	4.4868E+15	4.5438E+15	4.5007E+15	4.5149E+15	4.4729E+15	4.5294E+15
21	10c1	4.7269E+15	4.6678E+15	4.6083E+15	4.5785E+15	4.6418E+15	4.6121E+15	4.6452E+15	4.6156E+15	4.6776E+15
	10c2	4.7396E+15	4.6833E+15	4.6269E+15	4.5988E+15	4.6554E+15	4.6272E+15	4.6555E+15	4.6273E+15	4.6837E+15
	10c3	4.7265E+15	4.6696E+15	4.6128E+15	4.5845E+15	4.6416E+15	4.6131E+15	4.6417E+15	4.6132E+15	4.6700E+15
	11a1	4.6416E+15	4.5766E+15	4.5120E+15	4.4801E+15	4.5356E+15	4.5040E+15	4.5270E+15	4.4960E+15	4.5489E+15
	11a2	4.6955E+15	4.6367E+15	4.5786E+15	4.5500E+15	4.5960E+15	4.5676E+15	4.5848E+15	4.5567E+15	4.6015E+15
	11a3	4.6307E+15	4.5704E+15	4.5109E+15	4.4816E+15	4.5292E+15	4.5000E+15	4.5181E+15	4.4893E+15	4.5358E+15
	11b1	4.6639E+15	4.6055E+15	4.5467E+15	4.5172E+15	4.5683E+15	4.5393E+15	4.5612E+15	4.5324E+15	4.5828E+15
	11b2	4.5880E+15	4.5020E+15	4.4188E+15	4.3784E+15	4.4449E+15	4.4044E+15	4.4305E+15	4.3905E+15	4.4567E+15
	11c	4.6582E+15	4.5651E+15	4.4773E+15	4.4357E+15	4.5010E+15	4.4586E+15	4.4818E+15	4.4399E+15	4.5054E+15
	12a1	4.5150E+15	4.4241E+15	4.3381E+15	4.2972E+15	4.3552E+15	4.3136E+15	4.3305E+15	4.2896E+15	4.3477E+15
	12a2	4.5283E+15	4.4299E+15	4.3370E+15	4.2928E+15	4.3565E+15	4.3116E+15	4.3308E+15	4.2865E+15	4.3505E+15
	12b1	4.7383E+15	4.6431E+15	4.5538E+15	4.5117E+15	4.5708E+15	4.5281E+15	4.5447E+15	4.5030E+15	4.5613E+15
	12b2	4.6761E+15	4.5805E+15	4.4906E+15	4.4480E+15	4.5053E+15	4.4622E+15	4.4767E+15	4.4346E+15	4.4913E+15
22	10c1	4.5975E+15	4.5384E+15	4.4789E+15	4.4491E+15	4.5127E+15	4.4831E+15	4.5164E+15	4.4870E+15	4.5489E+15
	10c2	4.6258E+15	4.5699E+15	4.5139E+15	4.4860E+15	4.5424E+15	4.5144E+15	4.5426E+15	4.5147E+15	4.5706E+15
	10c3	4.6143E+15	4.5578E+15	4.5013E+15	4.4732E+15	4.5300E+15	4.5018E+15	4.5302E+15	4.5020E+15	4.5585E+15
	11a1	4.5116E+15	4.4465E+15	4.3819E+15	4.3499E+15	4.4061E+15	4.3746E+15	4.3982E+15	4.3673E+15	4.4207E+15
	11a2	4.5793E+15	4.5207E+15	4.4627E+15	4.4342E+15	4.4806E+15	4.4522E+15	4.4698E+15	4.4418E+15	4.4869E+15
	11a3	4.5160E+15	4.4559E+15	4.3965E+15	4.3673E+15	4.4152E+15	4.3861E+15	4.4045E+15	4.3759E+15	4.4224E+15
	11b1	4.5483E+15	4.4901E+15	4.4315E+15	4.4022E+15	4.4533E+15	4.4244E+15	4.4465E+15	4.4178E+15	4.4681E+15
	11b2	4.4785E+15	4.3934E+15	4.3112E+15	4.2712E+15	4.3372E+15	4.2971E+15	4.3232E+15	4.2837E+15	4.3493E+15
	11c	4.5470E+15	4.4550E+15	4.3682E+15	4.3270E+15	4.3919E+15	4.3500E+15	4.3733E+15	4.3319E+15	4.3968E+15

AT-OUO-ECI
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Layer	Cycle	1	2	3	4	5	6	7	8	9
	12a1	4.4093E+15	4.3194E+15	4.2342E+15	4.1937E+15	4.2515E+15	4.2104E+15	4.2275E+15	4.1870E+15	4.2448E+15
	12a2	4.4229E+15	4.3257E+15	4.2338E+15	4.1901E+15	4.2535E+15	4.2091E+15	4.2284E+15	4.1848E+15	4.2482E+15
	12b1	4.6301E+15	4.5359E+15	4.4476E+15	4.4059E+15	4.4648E+15	4.4226E+15	4.4394E+15	4.3982E+15	4.4563E+15
	12b2	4.5696E+15	4.4751E+15	4.3862E+15	4.3440E+15	4.4012E+15	4.3586E+15	4.3733E+15	4.3318E+15	4.3882E+15
23	10c1	4.4064E+15	4.3482E+15	4.2896E+15	4.2603E+15	4.3231E+15	4.2940E+15	4.3269E+15	4.2980E+15	4.3590E+15
	10c2	4.4440E+15	4.3889E+15	4.3337E+15	4.3062E+15	4.3620E+15	4.3344E+15	4.3625E+15	4.3350E+15	4.3902E+15
	10c3	4.4342E+15	4.3785E+15	4.3227E+15	4.2950E+15	4.3513E+15	4.3235E+15	4.3517E+15	4.3240E+15	4.3797E+15
	11a1	4.3236E+15	4.2594E+15	4.1957E+15	4.1642E+15	4.2200E+15	4.1890E+15	4.2127E+15	4.1824E+15	4.2352E+15
	11a2	4.3965E+15	4.3383E+15	4.2806E+15	4.2523E+15	4.2990E+15	4.2709E+15	4.2890E+15	4.2613E+15	4.3064E+15
	11a3	4.3357E+15	4.2760E+15	4.2170E+15	4.1881E+15	4.2362E+15	4.2074E+15	4.2262E+15	4.1979E+15	4.2444E+15
	11b1	4.3673E+15	4.3096E+15	4.2514E+15	4.2224E+15	4.2735E+15	4.2449E+15	4.2671E+15	4.2389E+15	4.2888E+15
	11b2	4.3033E+15	4.2200E+15	4.1396E+15	4.1004E+15	4.1655E+15	4.1263E+15	4.1522E+15	4.1136E+15	4.1780E+15
	11c	4.3692E+15	4.2793E+15	4.1944E+15	4.1540E+15	4.2181E+15	4.1771E+15	4.2003E+15	4.1599E+15	4.2237E+15
	12a1	4.2397E+15	4.1517E+15	4.0682E+15	4.0284E+15	4.0858E+15	4.0456E+15	4.0629E+15	4.0233E+15	4.0804E+15
	12a2	4.2536E+15	4.1587E+15	4.0689E+15	4.0261E+15	4.0887E+15	4.0453E+15	4.0648E+15	4.0222E+15	4.0845E+15
	12b1	4.4552E+15	4.3632E+15	4.2767E+15	4.2357E+15	4.2942E+15	4.2529E+15	4.2700E+15	4.2297E+15	4.2870E+15
	12b2	4.3978E+15	4.3054E+15	4.2184E+15	4.1770E+15	4.2338E+15	4.1921E+15	4.2072E+15	4.1666E+15	4.2224E+15
24	10c1	4.1573E+15	4.1008E+15	4.0440E+15	4.0157E+15	4.0765E+15	4.0484E+15	4.0803E+15	4.0524E+15	4.1114E+15
	10c2	4.1980E+15	4.1440E+15	4.0900E+15	4.0632E+15	4.1180E+15	4.0911E+15	4.1188E+15	4.0920E+15	4.1461E+15
	10c3	4.1901E+15	4.1354E+15	4.0809E+15	4.0538E+15	4.1091E+15	4.0820E+15	4.1099E+15	4.0829E+15	4.1375E+15
	11a1	4.0815E+15	4.0190E+15	3.9570E+15	3.9265E+15	3.9809E+15	3.9508E+15	3.9741E+15	3.9447E+15	3.9962E+15
	11a2	4.1516E+15	4.0939E+15	4.0369E+15	4.0089E+15	4.0558E+15	4.0281E+15	4.0467E+15	4.0195E+15	4.0645E+15
	11a3	4.0943E+15	4.0352E+15	3.9770E+15	3.9485E+15	3.9966E+15	3.9683E+15	3.9875E+15	3.9597E+15	4.0061E+15
	11b1	4.1257E+15	4.0685E+15	4.0112E+15	3.9826E+15	4.0335E+15	4.0053E+15	4.0276E+15	3.9999E+15	4.0493E+15
	11b2	4.0668E+15	3.9863E+15	3.9084E+15	3.8705E+15	3.9340E+15	3.8962E+15	3.9216E+15	3.8845E+15	3.9469E+15
	11c	4.1292E+15	4.0425E+15	3.9605E+15	3.9215E+15	3.9841E+15	3.9445E+15	3.9675E+15	3.9287E+15	3.9906E+15
	12a1	4.0103E+15	3.9252E+15	3.8444E+15	3.8059E+15	3.8623E+15	3.8234E+15	3.8409E+15	3.8028E+15	3.8585E+15
	12a2	4.0245E+15	3.9330E+15	3.8464E+15	3.8050E+15	3.8662E+15	3.8244E+15	3.8439E+15	3.8029E+15	3.8634E+15

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VOID

Layer	Cycle	1	2	3	4	5	6	7	8	9
	12b1	4.2176E+15	4.1289E+15	4.0452E+15	4.0056E+15	4.0631E+15	4.0231E+15	4.0405E+15	4.0017E+15	4.0577E+15
	12b2	4.1646E+15	4.0755E+15	3.9913E+15	3.9513E+15	4.0071E+15	3.9669E+15	3.9823E+15	3.9431E+15	3.9977E+15
25	10c1	3.8527E+15	3.7989E+15	3.7450E+15	3.7182E+15	3.7757E+15	3.7491E+15	3.7793E+15	3.7529E+15	3.8088E+15
	10c2	3.8915E+15	3.8395E+15	3.7877E+15	3.7619E+15	3.8148E+15	3.7891E+15	3.8158E+15	3.7903E+15	3.8422E+15
	10c3	3.8855E+15	3.8329E+15	3.7804E+15	3.7544E+15	3.8078E+15	3.7818E+15	3.8088E+15	3.7830E+15	3.8354E+15
	11a1	3.7858E+15	3.7262E+15	3.6673E+15	3.6383E+15	3.6901E+15	3.6615E+15	3.6837E+15	3.6558E+15	3.7048E+15
	11a2	3.8476E+15	3.7917E+15	3.7364E+15	3.7093E+15	3.7555E+15	3.7287E+15	3.7473E+15	3.7211E+15	3.7651E+15
	11a3	3.7947E+15	3.7376E+15	3.6813E+15	3.6537E+15	3.7009E+15	3.6735E+15	3.6927E+15	3.6660E+15	3.7112E+15
	11b1	3.8257E+15	3.7703E+15	3.7149E+15	3.6873E+15	3.7369E+15	3.7097E+15	3.7317E+15	3.7050E+15	3.7529E+15
	11b2	3.7716E+15	3.6953E+15	3.6214E+15	3.5855E+15	3.6462E+15	3.6104E+15	3.6350E+15	3.5999E+15	3.6593E+15
	11c	3.8297E+15	3.7476E+15	3.6699E+15	3.6328E+15	3.6928E+15	3.6554E+15	3.6778E+15	3.6411E+15	3.7001E+15
	12a1	3.7229E+15	3.6422E+15	3.5655E+15	3.5288E+15	3.5833E+15	3.5463E+15	3.5637E+15	3.5276E+15	3.5810E+15
	12a2	3.7370E+15	3.6506E+15	3.5685E+15	3.5293E+15	3.5880E+15	3.5485E+15	3.5676E+15	3.5289E+15	3.5867E+15
	12b1	3.9185E+15	3.8344E+15	3.7550E+15	3.7173E+15	3.7728E+15	3.7349E+15	3.7522E+15	3.7154E+15	3.7692E+15
	12b2	3.8705E+15	3.7861E+15	3.7062E+15	3.6681E+15	3.7221E+15	3.6840E+15	3.6995E+15	3.6624E+15	3.7149E+15
26	10c1	3.4964E+15	3.4461E+15	3.3960E+15	3.3712E+15	3.4244E+15	3.3997E+15	3.4276E+15	3.4032E+15	3.4549E+15
	10c2	3.5306E+15	3.4816E+15	3.4329E+15	3.4088E+15	3.4585E+15	3.4344E+15	3.4597E+15	3.4358E+15	3.4845E+15
	10c3	3.5264E+15	3.4767E+15	3.4274E+15	3.4031E+15	3.4533E+15	3.4289E+15	3.4544E+15	3.4303E+15	3.4795E+15
	11a1	3.4400E+15	3.3843E+15	3.3294E+15	3.3025E+15	3.3506E+15	3.3241E+15	3.3448E+15	3.3189E+15	3.3645E+15
	11a2	3.4913E+15	3.4382E+15	3.3859E+15	3.3603E+15	3.4045E+15	3.3792E+15	3.3973E+15	3.3726E+15	3.4146E+15
	11a3	3.4437E+15	3.3895E+15	3.3363E+15	3.3102E+15	3.3553E+15	3.3295E+15	3.3481E+15	3.3229E+15	3.3660E+15
	11b1	3.4741E+15	3.4215E+15	3.3690E+15	3.3429E+15	3.3901E+15	3.3645E+15	3.3855E+15	3.3605E+15	3.4059E+15
	11b2	3.4244E+15	3.3535E+15	3.2850E+15	3.2518E+15	3.3084E+15	3.2754E+15	3.2986E+15	3.2662E+15	3.3214E+15
	11c	3.4773E+15	3.4013E+15	3.3292E+15	3.2949E+15	3.3510E+15	3.3164E+15	3.3377E+15	3.3038E+15	3.3588E+15
	12a1	3.3838E+15	3.3089E+15	3.2377E+15	3.2037E+15	3.2549E+15	3.2207E+15	3.2375E+15	3.2041E+15	3.2541E+15
	12a2	3.3975E+15	3.3175E+15	3.2416E+15	3.2054E+15	3.2603E+15	3.2238E+15	3.2422E+15	3.2065E+15	3.2603E+15
	12b1	3.5640E+15	3.4860E+15	3.4124E+15	3.3774E+15	3.4297E+15	3.3946E+15	3.4114E+15	3.3774E+15	3.4278E+15
	12b2	3.5218E+15	3.4435E+15	3.3694E+15	3.3341E+15	3.3850E+15	3.3497E+15	3.3649E+15	3.3306E+15	3.3799E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
27	10c1	3.0930E+15	3.0467E+15	3.0011E+15	2.9787E+15	3.0268E+15	3.0044E+15	3.0297E+15	3.0075E+15	3.0546E+15
	10c2	3.1221E+15	3.0766E+15	3.0319E+15	3.0099E+15	3.0555E+15	3.0334E+15	3.0568E+15	3.0350E+15	3.0798E+15
	10c3	3.1194E+15	3.0734E+15	3.0281E+15	3.0058E+15	3.0519E+15	3.0296E+15	3.0532E+15	3.0311E+15	3.0764E+15
	11a1	3.0487E+15	2.9973E+15	2.9471E+15	2.9227E+15	2.9666E+15	2.9424E+15	2.9615E+15	2.9380E+15	2.9798E+15
	11a2	3.0894E+15	3.0398E+15	2.9915E+15	2.9679E+15	3.0090E+15	2.9858E+15	3.0030E+15	2.9803E+15	3.0195E+15
	11a3	3.0478E+15	2.9973E+15	2.9481E+15	2.9242E+15	2.9661E+15	2.9424E+15	2.9600E+15	2.9369E+15	2.9770E+15
	11b1	3.0776E+15	3.0284E+15	2.9798E+15	2.9558E+15	2.9995E+15	2.9760E+15	2.9956E+15	2.9726E+15	3.0147E+15
	11b2	3.0320E+15	2.9678E+15	2.9060E+15	2.8761E+15	2.9275E+15	2.8977E+15	2.9190E+15	2.8900E+15	2.9400E+15
	11c	3.0792E+15	3.0106E+15	2.9457E+15	2.9149E+15	2.9659E+15	2.9348E+15	2.9544E+15	2.9241E+15	2.9739E+15
	12a1	2.9999E+15	2.9322E+15	2.8680E+15	2.8374E+15	2.8841E+15	2.8534E+15	2.8692E+15	2.8392E+15	2.8848E+15
	12a2	3.0130E+15	2.9409E+15	2.8727E+15	2.8402E+15	2.8901E+15	2.8574E+15	2.8745E+15	2.8426E+15	2.8914E+15
	12b1	3.1614E+15	3.0910E+15	3.0246E+15	2.9931E+15	3.0410E+15	3.0094E+15	3.0254E+15	2.9948E+15	3.0410E+15
	12b2	3.1256E+15	3.0548E+15	2.9880E+15	2.9562E+15	3.0030E+15	2.9711E+15	2.9858E+15	2.9549E+15	3.0002E+15
28	10c1	2.6480E+15	2.6062E+15	2.5657E+15	2.5461E+15	2.5883E+15	2.5686E+15	2.5909E+15	2.5715E+15	2.6130E+15
	10c2	2.6719E+15	2.6306E+15	2.5907E+15	2.5714E+15	2.6117E+15	2.5923E+15	2.6131E+15	2.5940E+15	2.6339E+15
	10c3	2.6706E+15	2.6288E+15	2.5884E+15	2.5688E+15	2.6096E+15	2.5899E+15	2.6109E+15	2.5915E+15	2.6319E+15
	11a1	2.6147E+15	2.5683E+15	2.5238E+15	2.5025E+15	2.5413E+15	2.5201E+15	2.5373E+15	2.5167E+15	2.5540E+15
	11a2	2.6459E+15	2.6008E+15	2.5576E+15	2.5369E+15	2.5738E+15	2.5532E+15	2.5691E+15	2.5491E+15	2.5846E+15
	11a3	2.6109E+15	2.5650E+15	2.5211E+15	2.5001E+15	2.5376E+15	2.5166E+15	2.5329E+15	2.5125E+15	2.5488E+15
	11b1	2.6394E+15	2.5944E+15	2.5509E+15	2.5298E+15	2.5688E+15	2.5479E+15	2.5658E+15	2.5455E+15	2.5834E+15
	11b2	2.5996E+15	2.5428E+15	2.4888E+15	2.4630E+15	2.5080E+15	2.4822E+15	2.5013E+15	2.4762E+15	2.5202E+15
	11c	2.6404E+15	2.5800E+15	2.5235E+15	2.4968E+15	2.5416E+15	2.5147E+15	2.5324E+15	2.5063E+15	2.5502E+15
	12a1	2.5753E+15	2.5157E+15	2.4597E+15	2.4332E+15	2.4745E+15	2.4478E+15	2.4624E+15	2.4365E+15	2.4769E+15
	12a2	2.5873E+15	2.5241E+15	2.4648E+15	2.4367E+15	2.4806E+15	2.4523E+15	2.4679E+15	2.4404E+15	2.4835E+15
	12b1	2.7145E+15	2.6525E+15	2.5945E+15	2.5672E+15	2.6097E+15	2.5823E+15	2.5971E+15	2.5707E+15	2.6119E+15
	12b2	2.6851E+15	2.6228E+15	2.5644E+15	2.5369E+15	2.5784E+15	2.5508E+15	2.5646E+15	2.5378E+15	2.5783E+15
29	10c1	2.1704E+15	2.1317E+15	2.0965E+15	2.0804E+15	2.1156E+15	2.0990E+15	2.1182E+15	2.1022E+15	2.1379E+15
	10c2	2.1899E+15	2.1514E+15	2.1166E+15	2.1007E+15	2.1346E+15	2.1182E+15	2.1363E+15	2.1205E+15	2.1551E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9
	10c3	2.1896E+15	2.1507E+15	2.1155E+15	2.0993E+15	2.1336E+15	2.1170E+15	2.1353E+15	2.1193E+15	2.1543E+15
	11a1	2.1467E+15	2.1041E+15	2.0655E+15	2.0479E+15	2.0809E+15	2.0631E+15	2.0785E+15	2.0615E+15	2.0943E+15
	11a2	2.1704E+15	2.1286E+15	2.0908E+15	2.0737E+15	2.1054E+15	2.0880E+15	2.1026E+15	2.0860E+15	2.1176E+15
	11a3	2.1424E+15	2.1001E+15	2.0618E+15	2.0444E+15	2.0765E+15	2.0588E+15	2.0737E+15	2.0568E+15	2.0889E+15
	11b1	2.1688E+15	2.1269E+15	2.0887E+15	2.0712E+15	2.1045E+15	2.0868E+15	2.1028E+15	2.0858E+15	2.1193E+15
	11b2	2.1382E+15	2.0875E+15	2.0416E+15	2.0205E+15	2.0582E+15	2.0369E+15	2.0537E+15	2.0332E+15	2.0711E+15
	11c	2.1721E+15	2.1187E+15	2.0709E+15	2.0493E+15	2.0868E+15	2.0646E+15	2.0805E+15	2.0592E+15	2.0971E+15
	12a1	2.1211E+15	2.0685E+15	2.0211E+15	1.9996E+15	2.0344E+15	2.0124E+15	2.0258E+15	2.0047E+15	2.0398E+15
	12a2	2.1316E+15	2.0762E+15	2.0263E+15	2.0037E+15	2.0404E+15	2.0172E+15	2.0314E+15	2.0091E+15	2.0461E+15
	12b1	2.2345E+15	2.1799E+15	2.1309E+15	2.1088E+15	2.1446E+15	2.1220E+15	2.1358E+15	2.1142E+15	2.1502E+15
	12b2	2.2116E+15	2.1567E+15	2.1075E+15	2.0851E+15	2.1203E+15	2.0975E+15	2.1105E+15	2.0887E+15	2.1241E+15

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Table 18. Total Flux in Each Pin Segment by Cycle for MFF-5

Layer	Cycle	1	2	3	4	5	6	7	8	9	10
12	11b1	2.6630E+15	2.6643E+15	2.6659E+15	2.6767E+15	2.6783E+15	2.6802E+15	2.6892E+15	2.6911E+15	2.6932E+15	2.7090E+15
	11b2	2.7195E+15	2.7176E+15	2.7157E+15	2.7362E+15	2.7342E+15	2.7323E+15	2.7554E+15	2.7534E+15	2.7515E+15	2.7695E+15
	11c	2.7492E+15	2.7479E+15	2.7467E+15	2.7667E+15	2.7653E+15	2.7640E+15	2.7863E+15	2.7848E+15	2.7833E+15	2.8021E+15
	12a1	2.9105E+15	2.9136E+15	2.9166E+15	2.9237E+15	2.9265E+15	2.9292E+15	2.9345E+15	2.9369E+15	2.9394E+15	2.9525E+15
	12a2	2.9248E+15	2.9275E+15	2.9301E+15	2.9386E+15	2.9409E+15	2.9432E+15	2.9503E+15	2.9524E+15	2.9545E+15	2.9683E+15
	12b1	2.9526E+15	2.9578E+15	2.9628E+15	2.9691E+15	2.9740E+15	2.9788E+15	2.9811E+15	2.9858E+15	2.9905E+15	3.0074E+15
	12b2	2.9565E+15	2.9613E+15	2.9661E+15	2.9736E+15	2.9781E+15	2.9826E+15	2.9864E+15	2.9907E+15	2.9951E+15	3.0124E+15
13	11b1	3.0689E+15	3.0692E+15	3.0695E+15	3.0835E+15	3.0843E+15	3.0850E+15	3.0980E+15	3.0992E+15	3.1005E+15	3.1178E+15
	11b2	3.1383E+15	3.1350E+15	3.1313E+15	3.1571E+15	3.1536E+15	3.1498E+15	3.1798E+15	3.1765E+15	3.1730E+15	3.1933E+15
	11c	3.1709E+15	3.1682E+15	3.1652E+15	3.1908E+15	3.1878E+15	3.1847E+15	3.2141E+15	3.2112E+15	3.2082E+15	3.2294E+15
	12a1	3.3734E+15	3.3772E+15	3.3807E+15	3.3879E+15	3.3912E+15	3.3943E+15	3.3993E+15	3.4023E+15	3.4052E+15	3.4194E+15
	12a2	3.3887E+15	3.3921E+15	3.3952E+15	3.4040E+15	3.4068E+15	3.4095E+15	3.4166E+15	3.4192E+15	3.4217E+15	3.4368E+15
	12b1	3.4189E+15	3.4252E+15	3.4313E+15	3.4374E+15	3.4433E+15	3.4490E+15	3.4502E+15	3.4560E+15	3.4616E+15	3.4802E+15
	12b2	3.4209E+15	3.4269E+15	3.4327E+15	3.4400E+15	3.4456E+15	3.4511E+15	3.4539E+15	3.4593E+15	3.4646E+15	3.4838E+15
14	11b1	3.4486E+15	3.4482E+15	3.4476E+15	3.4641E+15	3.4642E+15	3.4641E+15	3.4800E+15	3.4808E+15	3.4814E+15	3.4998E+15
	11b2	3.5325E+15	3.5280E+15	3.5229E+15	3.5532E+15	3.5485E+15	3.5433E+15	3.5788E+15	3.5745E+15	3.5698E+15	3.5923E+15
	11c	3.5678E+15	3.5640E+15	3.5597E+15	3.5897E+15	3.5856E+15	3.5812E+15	3.6163E+15	3.6123E+15	3.6082E+15	3.6317E+15
	12a1	3.8069E+15	3.8113E+15	3.8154E+15	3.8226E+15	3.8264E+15	3.8299E+15	3.8347E+15	3.8382E+15	3.8415E+15	3.8566E+15
	12a2	3.8234E+15	3.8273E+15	3.8309E+15	3.8400E+15	3.8433E+15	3.8463E+15	3.8535E+15	3.8566E+15	3.8594E+15	3.8757E+15
	12b1	3.8553E+15	3.8625E+15	3.8694E+15	3.8753E+15	3.8821E+15	3.8884E+15	3.8888E+15	3.8955E+15	3.9018E+15	3.9218E+15
	12b2	3.8554E+15	3.8624E+15	3.8691E+15	3.8763E+15	3.8827E+15	3.8889E+15	3.8910E+15	3.8972E+15	3.9032E+15	3.9240E+15
15	11b1	3.7821E+15	3.7812E+15	3.7799E+15	3.7982E+15	3.7978E+15	3.7970E+15	3.8152E+15	3.8155E+15	3.8156E+15	3.8346E+15
	11b2	3.8794E+15	3.8741E+15	3.8680E+15	3.9018E+15	3.8962E+15	3.8901E+15	3.9299E+15	3.9248E+15	3.9193E+15	3.9434E+15
	11c	3.9166E+15	3.9120E+15	3.9068E+15	3.9404E+15	3.9355E+15	3.9301E+15	3.9695E+15	3.9649E+15	3.9599E+15	3.9853E+15
	12a1	4.1864E+15	4.1914E+15	4.1960E+15	4.2032E+15	4.2074E+15	4.2113E+15	4.2157E+15	4.2197E+15	4.2234E+15	4.2393E+15
	12a2	4.2037E+15	4.2082E+15	4.2122E+15	4.2215E+15	4.2253E+15	4.2286E+15	4.2357E+15	4.2392E+15	4.2423E+15	4.2596E+15
	12b1	4.2365E+15	4.2445E+15	4.2520E+15	4.2578E+15	4.2652E+15	4.2721E+15	4.2718E+15	4.2791E+15	4.2860E+15	4.3071E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9	10
	12b2	4.2347E+15	4.2424E+15	4.2497E+15	4.2569E+15	4.2640E+15	4.2708E+15	4.2723E+15	4.2791E+15	4.2857E+15	4.3076E+15
16	11b1	4.0602E+15	4.0589E+15	4.0572E+15	4.0769E+15	4.0761E+15	4.0749E+15	4.0948E+15	4.0949E+15	4.0946E+15	4.1144E+15
	11b2	4.1698E+15	4.1639E+15	4.1572E+15	4.1937E+15	4.1875E+15	4.1806E+15	4.2238E+15	4.2183E+15	4.2121E+15	4.2379E+15
	11c	4.2088E+15	4.2037E+15	4.1979E+15	4.2343E+15	4.2288E+15	4.2228E+15	4.2656E+15	4.2604E+15	4.2548E+15	4.2820E+15
	12a1	4.5037E+15	4.5092E+15	4.5142E+15	4.5215E+15	4.5262E+15	4.5304E+15	4.5346E+15	4.5389E+15	4.5430E+15	4.5597E+15
	12a2	4.5218E+15	4.5267E+15	4.5311E+15	4.5407E+15	4.5448E+15	4.5484E+15	4.5556E+15	4.5595E+15	4.5629E+15	4.5811E+15
	12b1	4.5551E+15	4.5638E+15	4.5719E+15	4.5776E+15	4.5856E+15	4.5930E+15	4.5922E+15	4.6001E+15	4.6075E+15	4.6297E+15
	12b2	4.5516E+15	4.5599E+15	4.5678E+15	4.5751E+15	4.5828E+15	4.5901E+15	4.5911E+15	4.5986E+15	4.6057E+15	4.6288E+15
17	11b1	4.2773E+15	4.2757E+15	4.2737E+15	4.2945E+15	4.2934E+15	4.2919E+15	4.3132E+15	4.3130E+15	4.3125E+15	4.3329E+15
	11b2	4.3978E+15	4.3915E+15	4.3842E+15	4.4228E+15	4.4162E+15	4.4089E+15	4.4546E+15	4.4487E+15	4.4421E+15	4.4691E+15
	11c	4.4382E+15	4.4327E+15	4.4264E+15	4.4650E+15	4.4591E+15	4.4527E+15	4.4981E+15	4.4926E+15	4.4865E+15	4.5151E+15
	12a1	4.7527E+15	4.7586E+15	4.7639E+15	4.7713E+15	4.7763E+15	4.7808E+15	4.7848E+15	4.7895E+15	4.7938E+15	4.8113E+15
	12a2	4.7713E+15	4.7766E+15	4.7813E+15	4.7912E+15	4.7956E+15	4.7994E+15	4.8066E+15	4.8108E+15	4.8145E+15	4.8335E+15
	12b1	4.8050E+15	4.8142E+15	4.8227E+15	4.8285E+15	4.8369E+15	4.8447E+15	4.8436E+15	4.8519E+15	4.8597E+15	4.8828E+15
	12b2	4.7997E+15	4.8086E+15	4.8170E+15	4.8243E+15	4.8325E+15	4.8402E+15	4.8409E+15	4.8488E+15	4.8564E+15	4.8805E+15
18	11b1	4.4301E+15	4.4283E+15	4.4260E+15	4.4476E+15	4.4463E+15	4.4445E+15	4.4668E+15	4.4665E+15	4.4657E+15	4.4864E+15
	11b2	4.5595E+15	4.5530E+15	4.5455E+15	4.5855E+15	4.5787E+15	4.5710E+15	4.6184E+15	4.6123E+15	4.6054E+15	4.6334E+15
	11c	4.6011E+15	4.5953E+15	4.5888E+15	4.6289E+15	4.6227E+15	4.6160E+15	4.6632E+15	4.6574E+15	4.6511E+15	4.6807E+15
	12a1	4.9299E+15	4.9361E+15	4.9417E+15	4.9491E+15	4.9544E+15	4.9591E+15	4.9629E+15	4.9679E+15	4.9724E+15	4.9903E+15
	12a2	4.9488E+15	4.9544E+15	4.9593E+15	4.9693E+15	4.9739E+15	4.9780E+15	4.9851E+15	4.9895E+15	4.9934E+15	5.0130E+15
	12b1	4.9826E+15	4.9922E+15	5.0010E+15	5.0068E+15	5.0155E+15	5.0236E+15	5.0222E+15	5.0309E+15	5.0389E+15	5.0626E+15
	12b2	4.9758E+15	4.9850E+15	4.9937E+15	5.0011E+15	5.0096E+15	5.0175E+15	5.0182E+15	5.0263E+15	5.0341E+15	5.0589E+15
19	11b1	4.5169E+15	4.5150E+15	4.5126E+15	4.5347E+15	4.5333E+15	4.5314E+15	4.5543E+15	4.5538E+15	4.5529E+15	4.5739E+15
	11b2	4.6539E+15	4.6472E+15	4.6395E+15	4.6805E+15	4.6735E+15	4.6657E+15	4.7141E+15	4.7079E+15	4.7008E+15	4.7294E+15
	11c	4.6967E+15	4.6909E+15	4.6842E+15	4.7252E+15	4.7189E+15	4.7120E+15	4.7603E+15	4.7544E+15	4.7480E+15	4.7782E+15
	12a1	5.0355E+15	5.0419E+15	5.0476E+15	5.0551E+15	5.0606E+15	5.0654E+15	5.0692E+15	5.0743E+15	5.0790E+15	5.0972E+15
	12a2	5.0546E+15	5.0603E+15	5.0654E+15	5.0756E+15	5.0804E+15	5.0846E+15	5.0917E+15	5.0963E+15	5.1003E+15	5.1203E+15
	12b1	5.0888E+15	5.0985E+15	5.1075E+15	5.1134E+15	5.1223E+15	5.1305E+15	5.1291E+15	5.1380E+15	5.1462E+15	5.1703E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9	10
	12b2	5.0807E+15	5.0901E+15	5.0990E+15	5.1066E+15	5.1152E+15	5.1233E+15	5.1239E+15	5.1323E+15	5.1403E+15	5.1655E+15
20	11b1	4.5372E+15	4.5352E+15	4.5327E+15	4.5551E+15	4.5536E+15	4.5516E+15	4.5749E+15	4.5744E+15	4.5734E+15	4.5945E+15
	11b2	4.6800E+15	4.6733E+15	4.6656E+15	4.7069E+15	4.6999E+15	4.6920E+15	4.7409E+15	4.7346E+15	4.7275E+15	4.7565E+15
	11c	4.7244E+15	4.7185E+15	4.7118E+15	4.7532E+15	4.7469E+15	4.7399E+15	4.7887E+15	4.7828E+15	4.7763E+15	4.8068E+15
	12a1	5.0688E+15	5.0753E+15	5.0811E+15	5.0887E+15	5.0941E+15	5.0990E+15	5.1029E+15	5.1080E+15	5.1127E+15	5.1312E+15
	12a2	5.0880E+15	5.0939E+15	5.0990E+15	5.1092E+15	5.1141E+15	5.1184E+15	5.1255E+15	5.1302E+15	5.1343E+15	5.1545E+15
	12b1	5.1228E+15	5.1326E+15	5.1416E+15	5.1476E+15	5.1566E+15	5.1648E+15	5.1636E+15	5.1725E+15	5.1807E+15	5.2051E+15
	12b2	5.1138E+15	5.1233E+15	5.1322E+15	5.1399E+15	5.1486E+15	5.1567E+15	5.1575E+15	5.1659E+15	5.1739E+15	5.1994E+15
21	11b1	4.4910E+15	4.4891E+15	4.4865E+15	4.5090E+15	4.5075E+15	4.5055E+15	4.5288E+15	4.5283E+15	4.5273E+15	4.5485E+15
	11b2	4.6378E+15	4.6312E+15	4.6235E+15	4.6647E+15	4.6577E+15	4.6499E+15	4.6986E+15	4.6924E+15	4.6854E+15	4.7143E+15
	11c	4.6840E+15	4.6781E+15	4.6714E+15	4.7128E+15	4.7065E+15	4.6995E+15	4.7482E+15	4.7423E+15	4.7358E+15	4.7663E+15
	12a1	5.0297E+15	5.0361E+15	5.0418E+15	5.0496E+15	5.0550E+15	5.0598E+15	5.0638E+15	5.0690E+15	5.0736E+15	5.0921E+15
	12a2	5.0490E+15	5.0548E+15	5.0599E+15	5.0702E+15	5.0751E+15	5.0793E+15	5.0866E+15	5.0912E+15	5.0953E+15	5.1156E+15
	12b1	5.0844E+15	5.0941E+15	5.1030E+15	5.1093E+15	5.1181E+15	5.1262E+15	5.1254E+15	5.1342E+15	5.1423E+15	5.1667E+15
	12b2	5.0750E+15	5.0843E+15	5.0931E+15	5.1011E+15	5.1097E+15	5.1177E+15	5.1189E+15	5.1272E+15	5.1350E+15	5.1605E+15
22	11b1	4.3795E+15	4.3777E+15	4.3752E+15	4.3975E+15	4.3960E+15	4.3940E+15	4.4171E+15	4.4167E+15	4.4157E+15	4.4367E+15
	11b2	4.5280E+15	4.5216E+15	4.5141E+15	4.5546E+15	4.5479E+15	4.5402E+15	4.5881E+15	4.5820E+15	4.5752E+15	4.6038E+15
	11c	4.5761E+15	4.5703E+15	4.5637E+15	4.6045E+15	4.5983E+15	4.5914E+15	4.6394E+15	4.6336E+15	4.6272E+15	4.6574E+15
	12a1	4.9186E+15	4.9248E+15	4.9304E+15	4.9382E+15	4.9435E+15	4.9482E+15	4.9525E+15	4.9575E+15	4.9620E+15	4.9803E+15
	12a2	4.9378E+15	4.9435E+15	4.9485E+15	4.9589E+15	4.9636E+15	4.9677E+15	4.9751E+15	4.9797E+15	4.9836E+15	5.0037E+15
	12b1	4.9738E+15	4.9832E+15	4.9918E+15	4.9985E+15	5.0071E+15	5.0149E+15	5.0146E+15	5.0231E+15	5.0310E+15	5.0552E+15
	12b2	4.9642E+15	4.9734E+15	4.9819E+15	4.9902E+15	4.9985E+15	5.0062E+15	5.0079E+15	5.0159E+15	5.0235E+15	5.0488E+15
23	11b1	4.2053E+15	4.2036E+15	4.2012E+15	4.2230E+15	4.2217E+15	4.2198E+15	4.2423E+15	4.2420E+15	4.2412E+15	4.2619E+15
	11b2	4.3531E+15	4.3470E+15	4.3397E+15	4.3791E+15	4.3726E+15	4.3652E+15	4.4117E+15	4.4060E+15	4.3994E+15	4.4273E+15
	11c	4.4029E+15	4.3974E+15	4.3909E+15	4.4307E+15	4.4247E+15	4.4179E+15	4.4647E+15	4.4591E+15	4.4529E+15	4.4823E+15
	12a1	4.7375E+15	4.7435E+15	4.7487E+15	4.7568E+15	4.7618E+15	4.7662E+15	4.7708E+15	4.7757E+15	4.7799E+15	4.7979E+15
	12a2	4.7566E+15	4.7621E+15	4.7669E+15	4.7772E+15	4.7818E+15	4.7857E+15	4.7932E+15	4.7976E+15	4.8015E+15	4.8212E+15
	12b1	4.7930E+15	4.8020E+15	4.8102E+15	4.8172E+15	4.8255E+15	4.8329E+15	4.8333E+15	4.8415E+15	4.8490E+15	4.8727E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9	10
	12b2	4.7837E+15	4.7925E+15	4.8006E+15	4.8092E+15	4.8171E+15	4.8244E+15	4.8267E+15	4.8345E+15	4.8417E+15	4.8664E+15
24	11b1	3.9717E+15	3.9702E+15	3.9681E+15	3.9891E+15	3.9880E+15	3.9863E+15	4.0079E+15	4.0078E+15	4.0072E+15	4.0276E+15
	11b2	4.1163E+15	4.1106E+15	4.1037E+15	4.1415E+15	4.1354E+15	4.1283E+15	4.1728E+15	4.1674E+15	4.1612E+15	4.1882E+15
	11c	4.1678E+15	4.1626E+15	4.1563E+15	4.1946E+15	4.1888E+15	4.1823E+15	4.2273E+15	4.2220E+15	4.2161E+15	4.2444E+15
	12a1	4.4894E+15	4.4950E+15	4.4999E+15	4.5081E+15	4.5128E+15	4.5168E+15	4.5220E+15	4.5265E+15	4.5304E+15	4.5480E+15
	12a2	4.5083E+15	4.5136E+15	4.5180E+15	4.5284E+15	4.5327E+15	4.5363E+15	4.5440E+15	4.5482E+15	4.5518E+15	4.5710E+15
	12b1	4.5448E+15	4.5534E+15	4.5611E+15	4.5685E+15	4.5762E+15	4.5831E+15	4.5844E+15	4.5921E+15	4.5991E+15	4.6223E+15
	12b2	4.5364E+15	4.5447E+15	4.5522E+15	4.5611E+15	4.5685E+15	4.5754E+15	4.5784E+15	4.5857E+15	4.5925E+15	4.6166E+15
25	11b1	3.6829E+15	3.6817E+15	3.6799E+15	3.6998E+15	3.6989E+15	3.6974E+15	3.7176E+15	3.7178E+15	3.7174E+15	3.7371E+15
	11b2	3.8209E+15	3.8157E+15	3.8094E+15	3.8448E+15	3.8392E+15	3.8327E+15	3.8743E+15	3.8695E+15	3.8637E+15	3.8894E+15
	11c	3.8729E+15	3.8681E+15	3.8623E+15	3.8982E+15	3.8929E+15	3.8868E+15	3.9290E+15	3.9242E+15	3.9187E+15	3.9455E+15
	12a1	4.1752E+15	4.1804E+15	4.1849E+15	4.1931E+15	4.1974E+15	4.2010E+15	4.2066E+15	4.2107E+15	4.2143E+15	4.2311E+15
	12a2	4.1937E+15	4.1986E+15	4.2026E+15	4.2128E+15	4.2168E+15	4.2200E+15	4.2278E+15	4.2318E+15	4.2350E+15	4.2534E+15
	12b1	4.2295E+15	4.2375E+15	4.2446E+15	4.2522E+15	4.2593E+15	4.2656E+15	4.2676E+15	4.2748E+15	4.2812E+15	4.3034E+15
	12b2	4.2221E+15	4.2297E+15	4.2367E+15	4.2457E+15	4.2525E+15	4.2587E+15	4.2624E+15	4.2692E+15	4.2754E+15	4.2984E+15
26	11b1	3.3444E+15	3.3436E+15	3.3422E+15	3.3604E+15	3.3599E+15	3.3588E+15	3.3771E+15	3.3775E+15	3.3774E+15	3.3961E+15
	11b2	3.4722E+15	3.4678E+15	3.4622E+15	3.4945E+15	3.4896E+15	3.4839E+15	3.5216E+15	3.5175E+15	3.5124E+15	3.5363E+15
	11c	3.5234E+15	3.5192E+15	3.5141E+15	3.5469E+15	3.5423E+15	3.5368E+15	3.5753E+15	3.5711E+15	3.5662E+15	3.5910E+15
	12a1	3.8001E+15	3.8048E+15	3.8088E+15	3.8169E+15	3.8208E+15	3.8240E+15	3.8297E+15	3.8335E+15	3.8367E+15	3.8526E+15
	12a2	3.8177E+15	3.8221E+15	3.8258E+15	3.8356E+15	3.8392E+15	3.8421E+15	3.8498E+15	3.8534E+15	3.8563E+15	3.8736E+15
	12b1	3.8520E+15	3.8592E+15	3.8656E+15	3.8732E+15	3.8797E+15	3.8855E+15	3.8880E+15	3.8945E+15	3.9004E+15	3.9213E+15
	12b2	3.8457E+15	3.8527E+15	3.8589E+15	3.8678E+15	3.8741E+15	3.8797E+15	3.8838E+15	3.8899E+15	3.8955E+15	3.9172E+15
27	11b1	2.9623E+15	2.9620E+15	2.9612E+15	2.9772E+15	2.9772E+15	2.9767E+15	2.9924E+15	2.9932E+15	2.9936E+15	3.0111E+15
	11b2	3.0766E+15	3.0731E+15	3.0686E+15	3.0969E+15	3.0930E+15	3.0883E+15	3.1212E+15	3.1179E+15	3.1139E+15	3.1358E+15
	11c	3.1258E+15	3.1225E+15	3.1184E+15	3.1472E+15	3.1435E+15	3.1390E+15	3.1726E+15	3.1693E+15	3.1653E+15	3.1881E+15
	12a1	3.3704E+15	3.3746E+15	3.3782E+15	3.3859E+15	3.3894E+15	3.3923E+15	3.3980E+15	3.4014E+15	3.4043E+15	3.4192E+15
	12a2	3.3869E+15	3.3910E+15	3.3943E+15	3.4035E+15	3.4067E+15	3.4094E+15	3.4167E+15	3.4200E+15	3.4227E+15	3.4388E+15
	12b1	3.4187E+15	3.4252E+15	3.4310E+15	3.4384E+15	3.4442E+15	3.4494E+15	3.4523E+15	3.4582E+15	3.4636E+15	3.4832E+15

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Layer	Cycle	1	2	3	4	5	6	7	8	9	10
	12b2	3.4140E+15	3.4203E+15	3.4259E+15	3.4345E+15	3.4401E+15	3.4451E+15	3.4495E+15	3.4550E+15	3.4600E+15	3.4803E+15
28	11b1	2.5433E+15	2.5435E+15	2.5435E+15	2.5565E+15	2.5571E+15	2.5573E+15	2.5698E+15	2.5709E+15	2.5718E+15	2.5878E+15
	11b2	2.6401E+15	2.6380E+15	2.6351E+15	2.6581E+15	2.6557E+15	2.6526E+15	2.6790E+15	2.6769E+15	2.6742E+15	2.6938E+15
	11c	2.6854E+15	2.6834E+15	2.6809E+15	2.7043E+15	2.7019E+15	2.6991E+15	2.7260E+15	2.7239E+15	2.7213E+15	2.7416E+15
	12a1	2.8907E+15	2.8945E+15	2.8979E+15	2.9047E+15	2.9079E+15	2.9106E+15	2.9157E+15	2.9188E+15	2.9215E+15	2.9354E+15
	12a2	2.9057E+15	2.9094E+15	2.9126E+15	2.9205E+15	2.9236E+15	2.9262E+15	2.9326E+15	2.9356E+15	2.9381E+15	2.9530E+15
	12b1	2.9332E+15	2.9390E+15	2.9443E+15	2.9509E+15	2.9562E+15	2.9610E+15	2.9637E+15	2.9689E+15	2.9737E+15	2.9917E+15
	12b2	2.9302E+15	2.9357E+15	2.9408E+15	2.9485E+15	2.9535E+15	2.9581E+15	2.9621E+15	2.9670E+15	2.9716E+15	2.9901E+15
29	11b1	2.0942E+15	2.0949E+15	2.0960E+15	2.1051E+15	2.1063E+15	2.1079E+15	2.1161E+15	2.1175E+15	2.1193E+15	2.1338E+15
	11b2	2.1723E+15	2.1719E+15	2.1714E+15	2.1876E+15	2.1870E+15	2.1864E+15	2.2047E+15	2.2039E+15	2.2033E+15	2.2209E+15
	11c	2.2118E+15	2.2116E+15	2.2114E+15	2.2278E+15	2.2273E+15	2.2270E+15	2.2455E+15	2.2448E+15	2.2442E+15	2.2624E+15
	12a1	2.3715E+15	2.3749E+15	2.3783E+15	2.3837E+15	2.3867E+15	2.3898E+15	2.3939E+15	2.3965E+15	2.3993E+15	2.4128E+15
	12a2	2.3847E+15	2.3880E+15	2.3913E+15	2.3975E+15	2.4004E+15	2.4034E+15	2.4085E+15	2.4110E+15	2.4137E+15	2.4279E+15
	12b1	2.4063E+15	2.4112E+15	2.4161E+15	2.4214E+15	2.4260E+15	2.4306E+15	2.4331E+15	2.4373E+15	2.4417E+15	2.4584E+15
	12b2	2.4051E+15	2.4097E+15	2.4144E+15	2.4206E+15	2.4249E+15	2.4294E+15	2.4329E+15	2.4369E+15	2.4410E+15	2.4582E+15

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7.4 Cross Sections for Axial Segments of Selected Pins

The process for generating cross sections for the ORIGEN2 calculations is described in detail in Appendix C. For each of the pin segment total flux values in Tables 15 and 16, effective one group fission and capture reaction cross sections for ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, and ^{241}Pu were generated for each pin segment for each cycle. This was done by running the HEDPIN code on the same 3DBF flux files for each cycle, but this time multiplying the multi-group flux by the metal fuel test multi-group cross sections to calculate reaction rates instead of total flux, and using the HEDPIN interpolating fit to obtain the values for each pin segment. The effective one group reaction cross sections were then obtained by dividing the reaction rates by the total flux. These pin-segment-cycle-dependent cross sections were substituted into the FFTF metal fuel specific ORIGEN2 cross section library for each ORIGEN2 calculation.

For MFF-3 there were a total of 702 HEDPIN runs (3 reactions*13 cycles*18 layers). For MFF-5 there were a total 378 HEDPIN runs (3 reactions*7 cycles*18 layers). Because these cross section data files are very large, they are provided on CD, rather than printed out.

7.5 Irradiation and Decay Times

The ORIGEN2 input files for each pin segment were constructed using the total flux values from Tables 15 and 16 as constant over each cycle, with irradiation times and decay times between cycles as described in Table 2. Table 19 shows the time periods where nuclide inventories for each pin segment were calculated, which included the beginning and end of each operating cycle and twelve decay times extending out to the year 2040 following the end of irradiation.

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Table 19. Irradiation and Decay Times for MFF-3 and MFF-5 Pin Segment Inventory Calculations

MFF-3	MFF-5
BOC10C1	
EOC10C1	
BOC10C2	
EOC10C2	
BOC10C3	
EOC10C3	
BOC11A1	
EOC11A1	
BOC11A2	
EOC11A2	
BOC11A3	
EOC11A3	
BOC11B1	BOC11B1
EOC11B1	EOC11B1
BOC11B2	BOC11B2
EOC11B2	EOC11B2
BOC11C	BOC11C
EOC11C	EOC11C
BOC12A1	BOC12A1
EOC12A1	EOC12A1
BOC12A2	BOC12A2
EOC12A2	EOC12A2
BOC12B1	BOC12B1
EOC12B1	EOC12B1
BOC12B2	BOC12B2
EOC12B2	EOC12B2
Post Irradiation Decay Times	
5/25/1992	
3/1/1997	
3/1/2002	
3/1/2007	
3/1/2010	
3/1/2011	
3/1/2012	
3/1/2013	
3/1/2014	
3/1/2020	
3/1/2040	

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7.6 Radionuclide Inventories for Axial Segments of Selected Pins

The process described above and in more detail in Appendix C was used to generate actinide and fission product nuclide inventories in grams for each pin segment for the beginning and end of each operating cycle and for twelve decay times following discharge.

For MFF-3 there were a total of 162 ORIGEN2 runs (9 pins *18 axial layers). For MFF-5 there were a total of 180 ORIGEN2 runs (10 pins * 18 axial layers). Because these data files are very large, they are provided on CD, rather than printed out.

7.7Calculation of Pin Powers

The peak linear power for each assembly can be calculated by multiplying the assembly fission power, a factor accounting for the difference in the power deposited in the pin (fuel and cladding) and the fission power, and the radial and axial peaking factors. The pin energy deposition for the U10Zr metal fuel pins differs from the standard mixed U/PuO_2 fuel pins in FFTF because the ^{235}U enriched pins release less energy per fission than pins driven by ^{239}Pu fission and have a different composition with internal sodium and zirconium. The slightly different pin energy deposition rates for the metal fuel pins were included in the calculated peak pin powers.

The total heat distribution for the FFTF core (including nonfueled components) is obtained by combining the local direct fission heat production with other nuclear heat sources, such as gamma ray absorption, charged particle reactions and neutron scattering recoils. The energy produced from all of these sources is combined and adjusted so that the total is properly normalized for a recoverable heat energy of 291 MW at full power for Cycles 9 through 12 (previously 400MW for Cycles 1 through 8).

Pin fission power can be calculated as

$$PP_F = AP_F * R/N$$

where

PP_F = pin fission power
AP_F = assembly fission power
N = number of pins = 169
R = ratio of particular pin power to assembly average pin power = assembly map of radial pin power distribution normalized to assembly average of 1.0

Pin deposited power can be calculated as

$$PP_D = PP_F * D$$

where

PP_D = pin deposited power

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D = ratio of power deposited in pin (fuel and cladding) to fission power generated in pin, as listed in Table 20

Power in each of the eighteen axial pin segments can be obtained by multiplying the pin powers by the axial power profile (which has been normalized to an axial average of 1.0) and dividing by 18.

The pin segment power can be converted to linear powers at specific axial elevations by dividing by the fuel segment height (5.127 cm in the model)

Table 20. Ratio of Pin Deposited Power to Pin Fission Power By Cycle for MFF-3 and MFF-5

Cycle	MFF-3	MFF-5
10C	0.915	
11A	0.917	
11B1	0.919	0.915
11B2	0.921	0.919
11C	0.922	0.920
12A	0.923	0.922
12B	0.924	0.923

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8.0 References and Bibliography

Sections 8.1 through 8.5 provide a list of references and other relevant to the construction and analysis of MFF-3 and MFF-5. The documents listed in Section 8.1 (MFF-3 and MFF-5 Documentation) are ordered by test assembly (MFF-3 then MFF-5) and secondarily by date. The documents listed in Sections 8.2 (FFTF Reload Design Reports) and 8.3 (FFTF Outage and operating Reports) are in chronological (cycle) order. The documents listed in Sections 8.4 (Computer Codes and Methods Documentation) and 8.5 (Other Documents) are in alphabetic order by author.

8.1MFF-3 and MFF-5 Documentation

Benecke, M. W., 1990, *Test Design Description for the Enriched U-10 Zr Metal Fuel Test MFF-5 (HK195), Volume II, Part 1, WHC-SD-FF-TDD-009, Rev. 0*, Westinghouse Hanford Company, Richland, Washington.[Applied Technology]

Bridges, A. E., F. E. Bard and A. L. Pitner, 1988,*Test Design Description Volume 1A for the Enriched U-10 Zr Metal Fuel Test MFF-3 (HK193), WHC-SD-FF-TDD-00001*, Rev. 0, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Dittmer, J. O., 1988, *Test Design Description for the Enriched U-10 Zr Metal Fuel Test MFF-3 (HK193), Volume II, Part 2, WHC-SP-0369*, Westinghouse Hanford Company, Richland, Washington, September 1988. [Applied Technology]

Dittmer, J. O. and A. H. Otte, 1988, *Master data Package for the Enriched U-10 Zr Metal Fuel Test MFF-3 (HK193), WHC-SP-0372*, Westinghouse Hanford Company, Richland, Washington, September 1988. [Applied Technology]

Dittmer, J. O., 1989,*Test Design Description for the Enriched U-10 Zr Metal Fuel Test MFF-5 (HK195), Volume II, Part 2, WHC-SD-FF-TDD-011, Rev. 0*, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Dittmer, J. O. and L. L. Elberg, 1991, *Master data Package for the Enriched U-10 Zr Metal Fuel Test MFF-5 (HK195), WHC-SD-FF-DP-005*, Westinghouse Hanford Company, Richland, Washington, May 1991. [Applied Technology]

Graves, D. B., 1988,*Test Design Description Volume 1B for the Enriched U-10 Zr Metal Fuel Tests MFF-5 through MFF-10, WHC-SP-0394*, Westinghouse Hanford Company, Richland, Washington, October 1988. [Applied Technology]

Nansen, C. L., 1988, *Test Design Description for the Enriched U-10 Zr Metal Fuel Test MFF-3 (HK193), Volume II, Part 1, WHC-SP-0368*, Westinghouse Hanford Company, Richland, Washington, September 1988. [Applied Technology]

AT-QUO-ECI
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Pitner, A. L. and N. E. Dodds, 1987, *Test Design Description Volume 1B, Enriched U-10 Zr Metal Fuel Tests MFF-2 (HK192 and MFF-3 (HK193), WHC-SP-0027*, Westinghouse Hanford Company, Richland, Washington, September 1987. [Applied Technology]

8.2FFTF Core Reload Design Reports

Dobbin, K. D. et al, 1989, *FFTF Core Reload Design Report for Cycle 10C*, WHC-SP-0420, Rev. 4, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Campbell, L. R. et al., 1989, *FFTF Core Reload Design Report for Cycle 11A*, WHC-SP-0473, Rev. 3, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Campbell, L. R. et al., 1990, *FFTF Core Reload Design Report for Cycle 11B.1*, WHC-SP-0547, Rev. 1, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Bennett, C. L. and R. F. Richard 1990, *FFTF Core Reload Design Report for Cycle 11B-2*, WHC-SD-FF-DR-001, Rev. 0-A, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Campbell, L. R. and R. F. Richard 1990, *FFTF Core Reload Design Report for Cycle 11C*, WHC-SD-FF-DR-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Dobbin, K. D. et al., 1991, *FFTF Core Reload Design Report for Cycle 12A*, WHC-SD-FF-DR-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Richard, R. F., 1991, *FFTF Core Reload Design Report for Cycle 12B*, WHC-SD-FF-DR-005, Rev. 0-A, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

8.3FFTF Outage and Operating Reports

Newland, D. J., M. L. Polk and R. A. Bennett, 1991, *Fast Flux Test Facility Outage and Operating Report, Cycle 10C, October 17, 1988 – March 13, 1989*, WHC-SP-0521-1, Westinghouse Hanford Company, Richland WA, October 1991. [Applied Technology]

Swaim, D. J. and R. A. Bennett, 1993, *Fast Flux Test Facility Outage and Operating Report, Cycle 11, March 14, 1989 – March 19, 1991*, WHC-SP-0521-2, Westinghouse Hanford Company, Richland WA, February 1993. [Applied Technology]

AT-OUO-ECI
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Loika, E. J. and R. A. Bennett, 1993, *Fast Flux Test Facility Outage and Operating Report, Cycle 12, March 19, 1991 – March 19, 1992*, WHC-SP-0521-3, Westinghouse Hanford Company, Richland WA, May 1993. [Applied Technology]

8.4Computer Code and Methods Documentation

Bennett, R. A., et. al., 1994, *FFTF Core Management Methods*, WHC-SD-FF-CMMD-001, Rev. 0E, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Cappiello, M. W. 1976, *HEDPIN: A Computer Program to Estimate Pinwise Power Density*, HEDL-TME 76-49, Westinghouse Hanford Company, Richland, Washington.

Cramer, 1990, *Computer Code "SUPERENERGY"*, WHC-SD-FF-CSUD-022, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Gedeon, S. R., 1990, *Certification of 2DBHNG*, WHC-SD-FF-SWD-027, Rev 0, Westinghouse Hanford Company, Richland, Washington.

Gilbert, M. R., 1990, *ORIGEN Program Listing*, WHC-SD-FF-SWD-011, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Gilbert, M. R., 1992, *CONVT User Documentation*, WHC-SD-FF-SWD-055, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Gilbert, M. R., 1992a, *WATTSAT Program Documentation*, WHC-SD-FF-SWD-056, Rev 0, Westinghouse Hanford Company, Richland, Washington.

Gilbert, M. R., 1994, *DECAY Program Documentation*, WHC-SD-FF-SWD-024, Rev. 0B, Westinghouse Hanford Company, Richland WA, May 1994.

Ludwig, S., 1992, ORIGEN2.2 Code Package CCC-371, June 2002.

Nelson, J. V., 1990, *3DBF User's Manual*, WHC-SD-FF-SWD-037, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1990a, *Validation of the 2DBFM Program*, WHC-SD-FF-TRP-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1991, *3DBF and BURN3D Program Validation*, WHC-SD-FF-SWD-038, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1991a, *Documentation of the RCALC Computer Program*,

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WHC-SD-FF-SWD-045, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1991b, *GIF2DB User's Guide*, WHC-SD-FF-CSUD-005, Rev 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1991c, *GIF2DB Requirements Specification, Source Code Listing and Validation*, WHC-SD-FF-TRP-006, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1991d, *2DBFM User's Guide*, WHC-SD-FF-CSUD-00003, Rev 0-A, Westinghouse Hanford Company, Richland, Washington.

Nelson, J. V., 1992, *GIF3DB User's Guide*, WHC-SD-FF-SWD-039, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Ombrellaro, P. A. and M . R. Gilbert, 1990, *ANADBU System: An Automated System for Updating a Nuclear Analysis Data Base with the Cray Computer*, WHC-SD-FF-SWD-011, Rev. 0, Westinghouse Hanford Company, Richland Washington.

8.5Other Documents

Graves, N. J. and A. E. Bridges, 1992, *Irradiation History for the Enriched Metal Fuel Test MFF-2, WHC-SP-0889*, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

Nelson, J. V. and E. R. Cramer, 1997, *Irradiation Data for the MFA-1 and MFA-2 Tests in the FFTF*, HFN-SD-FF-ANAL-009, Rev. 1, Fluor Daniel Northwest, Inc., Richland, Washington.

Nelson, J. V. and R. L. Simons, 1997, *Notes on Calculation of Irradiation Data for the MFA-1 and MFA-2 Tests in the FFTF*, HFN-SD-FF-CN-009, Rev. 0, Fluor Daniel Northwest, Inc., Richland, Washington. [Applied Technology]

Wootan, D. W., J. A. Rawlins, K. D. Dobbin and J. V. Nelson, 1986, *FFTF Neutron Cross Section Set 500A Validation Studies*, HEDL-TC-2780, Westinghouse Hanford Company, Richland, Washington. [Applied Technology]

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9.0 Drawings

H-3-53218, CDE Retainer.

H-3-53221, CDE Handling Socket.

H-3-53223, CDE Duct Tube.

H-3-53235, Locking Bar.

H-3-57534, MFF-2 and MFF-3 Metal Fuel Test Assembly.

H-3-57534, MFF-2 and MFF-3 Metal Fuel Pin Assembly.

H-3-57536, MFF-2 and MFF-3 Metal Fuel Pin Details.

H-3-57566, MFF-2 and MFF-3 Duct Tube and Handling Socket Assembly.

H-4-54138, DFA Tag Gas Capsule Assembly.

H-4-54139, DFA Tag Gas Capsule Details.

H-4-54177, Attachment Rails.

H-4-61479, Diffuser.

H-4-61482, Retainer.

H-4-62577, Standard Fuel Test Adaptor.

H-4-62700, Orifice Plate.

H-4-62746, Shield and Inlet Assembly.

H-4-64906, Core Component Piston Ring - C.

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APPENDIX A

METHODS, COMPUTER PROGRAMS AND INPUT DATA FOR ASSEMBLY DATA BY CYCLE

A.1.0 Purpose

The purpose of this appendix is to document the methods, computer programs and input data used in generating the information provided in the body of this report for assembly power, neutron flux, and fuel composition by cycle. The computer programs used in the process are first described or referenced. Next, the calculational sequence is described. Then, the input files for the major programs are discussed. Finally, as a coarse check of the calculations, the computed beginning-of-cycle (BOC) and end-of-cycle (EOC) reactivities are compared with measurements (Section A.6.0), and MFF-3 and MFF-5 assembly powers are compared to computed values reported in the FFTF operating reports for Cycles 10C through 12B (Newland, Polk and Bennett 1991, Swaim and Bennett 1993 and Loika and Bennett 1993) (Section A.7.0).

A.2.0 Methods and Computer Programs Applied

Power, flux and composition data were computed using standard FFTF three-dimensional diffusion theory and burnup methods (Bennett 1994). All related computer calculations were performed on a desktop computer running under the Solaris®[1] operating System.

Sodium temperature and flow rate data, on the other hand, were obtained from two-dimensional analyses. Most of these data (described and presented in Appendix B) were obtained from previous analyses that were done as a part of the core reload design process for each cycle. FFTF core reload design calculations were based on two-dimensional (2-D) diffusion theory methods (Bennett 1994).

The main computer programs employed are listed in Table A.1. Also given in this table is the function of each program and its documentation status. Most of these programs have been classified as inactive since nuclear operations at the FFTF ended in 1992. Up to that time, they were normally run on a Hanford Cray®[2] computer or engineering workstations.

Programs used in the analysis of MFF-3 and MFF-5 were migrated to a desktop computer running under the Solaris operating System. Using a Solaris-based computer minimized the effort required to migrate needed codes from the engineering workstations that no longer exist. No programs have been formally validated on the Solaris-based computer. However, all programs used were tested to verify that the options used in this work give accurate results or results consistent with results obtained when the programs were formally validated. Validation of the methods and data employed is addressed in Sections A.5.2, A.6.0 and A.7.0.

[1] ® Solaris is a registered trademark of Oracle Corporation, Redwood Shores, California.

[2] ® Cray is a registered trademark of Cray, Inc., Seattle, WA.

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Several other post-processing programs were written specifically for a similar application (Nelson and Cramer 1997, and Nelson and Simons 1997). These programs were adapted, as necessary for this analysis to produce the required data tables. These supporting programs are described in the Sections A.3.0 through A.3.7. Also, two new programs were written to produce isotope fission rate tables. These programs are described in Sections A.3.8 and A.3.9.

Table A-1. Summary of Major Computer Programs Used

Program	Description	Reference
GIF3DB	Generates input files for 3DBF	Nelson 1992
3DBF	Three-dimensional neutron diffusion theory program	Nelson 1990, Nelson 1991
BURN3D	Isotope buildup/depletion code	Nelson 1990, Nelson 1991
FILEBC	Stores updated compositions generated by BURN3D in an NADB[a]	Bennett 1994
DECAY	Computes composition changes due to decay of Pu-241	Gilbert 1994
HEDPIN	Interpolates pin powers/fluxes from a 2-D or 3-D flux file	Cappiello 1976
RCALC	Computes reaction rates, total flux from a 2-D or 3-D flux file	Nelson 1991a
ZPWR	Outputs a breakdown of fission power within an assembly	Bennett 1994

[a] NADB = nuclear analysis data base

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A.3.0 Description of Undocumented Programs

Several programs were adapted to accomplish certain post-processing tasks. These programs (ADJPWR, BORE, CYCNAM, FMTASY, FMTDWF, FMTFLX, RCFMT and ZAVFLX), originally documented in Nelson and Simons 1997 plus two new programs (AVGN and CALCRFR) are described below.

A.3.1 ADJPWR Ver. 2.1 2/21/10

ADJPWR reads ZPWR output files and adjusts the data in the tables to account for row dependant power biases. The biases were obtained from the FFTF Core Management Methods Document (CMMD) (Bennett 1994), Table 3.3. These bias factors are 0.988 for rows 1 - 4, 0.984 for row 5 and 1.040 for row 6. ADJPWR does not apply unique bias factors for in-core blanket assemblies. These factors, obtained from Reload Design Reports (see Section 5.1 in the main part of his report), were applied manually.

A.3.2 BORE Ver. 1.0 12/19/96 and CYCNAM Ver. 1.0 12/19/96

BORE and CYCNAM are very simple programs used in constructing table headings. BORE returns a 'B' or an 'E' depending on the case identifier which is specified on the command line (e.g., given 'b10a1', BORE prints 'B', or given 'e10a1' BORE prints 'E'. CYCNAM prints a cycle name from a case identifier specified on the command line (e.g., given 'b10a1', CYCNAM prints 'B10A-1'. These programs were not changed from their original documentation (Nelson and Simons 1997), so are not listed in this report. They were validated simply by interactively running them. Because BORE and CYCNAM are both trivial programs, no further validation of their documentation is given.

B.3.3 FMTASY Ver. 3.1 11/02/10

FMTASY reads a nuclear analysis data base (NADB) assembly file and reformats it for display in this report. The format of NADB composition files is given in the GIF3DB User's Guide. FMTASY not only reformats NADB files, but also puts the constituents in the following order: U-235, U-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, FP, O-16, Na-23, and SS-316 (or HT9). Only these constituents are listed, and only if their atom density is non-zero.

A.3.4 FMTDWF Ver. 1.1 12/19/96

FMTDWF reads an RCALC print file in which two points, one on each side of a duct wall were averaged. It scales the averaged data using the row-dependent bias factors described in Section A.3.1 and then formats the results into the tables containing approximate values of duct wall fluxes for MFF-3 and MFF-5 presented in the main part of this report. The program assumes

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there are NAV/6 sets of 6 data points, where NAV is the number of two-point averages read from the RCALC print file. Besides the RCALC print file, which is read from file rcpr, FMTDWF reads the following information from the standard input file:

1. A scaling factor for each of the NAV averages in generalized input (GI) floating point format (see Nelson 1990 for a description of GI input),

2. An identifier for each NAV/6 set of data points, read in fields of eight characters each (identifiers should be left justified in a field),

3. An identifier for each of the six sides of a duct, read in fields of three characters, left justified (e.g., E SE SW W NW NE).

The output tables containing the scaled duct wall fast flux data are written to the standard output file.

A.3.5 FMTFLX Ver. 1.1 7/22/10

FMTFLX formats, adjusts and tabulates assembly-averaged total and fast fluxes read for MFF-3 and MFF-5. The output of FMTFLX, written to the standard output file, is tabulated in the main part of this report by cycle.

The input, read from the standard input file, consists of the consecutive listings of two ZPWR pwrout files. The first contains fast flux data for: MFF-3, its six surrounding assemblies, and MFF-5, and its six surrounding assemblies. The second contains total flux data in the same format and order. FMTFLX also applies row bias factors from Section A.3.1 to the flux data for MFF-3 and MFF-5.

A.3.6 RCFMT Ver. 1.0 7/30/96

RCFMT was used to generate axial distributions of flux and power for MFF-3 and MFF-5 tabulated in the main part of this report. The program first reads an RCALC print file, extracting power, fast flux and total flux data that have been averaged over the six mesh points of an assembly in the X-Y plane. It then normalizes each point in each distribution to the assembly-averaged value in the core region. The normalized data for each of the three distributions are then written to the standard output file.

Besides the RCALC print file, which is read from file rcpr, RCFMT reads the following information from the standard input file:

1. The sequence numbers of the axial mesh points KCB and KCT that are the lowest and highest in the core region (read as two integers in free-field format),

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2. The axial mesh point array in GI floating point format.

Each flux or power value P_k read is normalized using the equation:

$$P_k = P_k / \bar{P}$$

where P_k is the normalized value of P_k.

$\bar{P}$ is the axial average of P_k over the range KCB to KCT. That is,

$$\bar{P} = \frac{\sum_{k=KCB}^{KCT} P_k*(Z_{k+1}-Z_k)}{Z_{KCT+1}-Z_{KCB}}$$

where Z_k is the k^{th} axial mesh point, and the quantity $(Z_{KCT+1}-Z_{KCB})$ is the core height.

A.3.7 ZAVFLX Ver. 1.0 7/17/96

ZAVFLX averages three-dimensional (3-D) flux and power distributions from a 3DBF flux file over a specified axial range, and writes averages as a binary 2-D flux file. The flux file created is read by HEDPIN to generate axially-averaged pin distributions of power and fast flux, and by RCALC to generate total flux and fast flux files.

The 3-D flux file is read from file flxinp and ZAVFLX writes the 2-D flux file produced to flxout. ZAVFLX also reads two data records from the standard input file:

1. The first record contains five integers (IM, JM, KM, IGM, KCB and KCT) in free field format. The first three (IM, JM, KM) are the number of mesh points in the X, Y and Z directions, respectively. IGM is the number of energy groups. KCB and KCT are the sequence numbers of the axial mesh points the lowest and highest in the core region.

2. The second record contains the axial mesh point array in GI floating point format.

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Each flux value ($\varphi_{i,j}$) in the 2-D distribution is computed as an axial average over the range KCB to KCT using the equation:

$$\varphi_{i,j} = \frac{\sum_{k=KCB}^{KCT} \varphi_{i,j,k}*(Z_{k+1}-Z_k)}{Z_{KCT+1}-Z_{KCB}}$$

where $\varphi_{i,j,k}$ is a group flux value from the 3-D flux file,

Z_k is the k^{th} axial mesh point.

The flux data represented by $\varphi_{i,j}$ and $\varphi_{i,j,k}$ are also a function of energy, but the energy variable is not shown.

The ZAVFLX program has not been changed from its original description in Nelson and Simons 1997.

A.3.8 AVGN Ver. 1.1 11/22/10

AVGN reads an NADB assembly file for MFF-3 or MFF-5 and axially averages ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu and ^{241}Am atom densities and prints them out for input to HEDPIN for pin power calculations (see Section 5.4 in the main part of this report) and for use in computing fission fractions by isotope in MFF-3 and MFF-5 (see Section 5.7 in the main part of this report).

The atom densities of the fissile and fissionable isotopes listed above vary axially after exposure in the FFTF due to axial variations in the neutron flux, and hence the depletion or buildup of these isotopes. The equation implemented in AVGN to compute axially-averaged atom densities is:

$$\check{N}_i = \sum_{l=1}^{L}(BU_l - BL_l)N_{i,l}) \,/92.28$$

where, $\check{N}_i$ is the average atom density (atoms per barn-cm) of isotope i in MFF-3 or MFF-5 at a particular point in time,
L is the number of axial layers in the fuel region of MFF-3 or MFF-5 (6),
l is the axial layer index (1 – 6)
BU_l is the upper boundary of axial layer l (cm at hot full-power conditions),
BL_l is the lower boundary of axial layer l (cm at hot full-power conditions),
$N_{i,l}$ is the atom density of isotope I in axial layer l, and
92.28 is the modeled length (cm) of the fuel region in MFF-3 or MFF-5 at hot full-power conditions.

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A.3.9 CALCRFR Ver. 11/24/10

CALCRFR computes relative fission rates by isotope in MFF-3 and MFF-5. The program reads assembly-averaged microscopic fission rates from an RCALC print file, and assembly-averaged atom densities of fissile and fissionable isotopes from two files: one containing atom densities for MFF-3 and the other containing atom densities for MFF-5. The assembly-averaged atom density files were generated by AVGN (see Section A. 3.8). Each assembly-averaged microscopic fission rate is multiplied by the assembly-averaged atom density of the isotope to obtain a macroscopic fission rate. The macroscopic fission rate for each isotope is then normalized by dividing it by the sum of the macroscopic fission rates for all isotopes. The input data and computed macroscopic and normalized fission rates are written to file. The normalized fission rates were extracted for tabulation in the main part of this report.

A.4.0 Computer Calculation Flow

Burnup calculations were accomplished with a sequence of GIF3DB, 3DBF, BURN3D and FILEBC runs. This sequence is shown in Figure 3.1 of the GIF3DB User's Guide. Starting with a beginning of cycle (BOC) NADB, completion of this runstream results in an end of cycle (EOC) NADB. The EOC NADB is updated to give an NADB for the beginning of the next cycle by running the DECAY program to account for decay of ^{241}Pu between cycles, and manually updating the NADB loading file, ldg, to include the core loading changes.

The 3DBF runs that were part of the burnup calculation sequence were made with the control rod bank positioned at nominally the cycle averaged position. Sometimes for short cycles these calculations were the source of BOC flux and power distributions used in generating the data tables presented in the main part of this report. For the other cycles, separate 3DBF runs for the BOC were made. In all cases where EOC data were reported, separate 3DBF runs were made. Control rod settings modeled in all 3DBF calculations are listed in Table A-2.

After all the 3DBF runs to generate the required flux and power distributions were completed, six post-processing runs were made for the BOC or EOC of each cycle reported to generate data tables presented in the main part of this report.

The first of the post-processing runs executes the programs ZPWR, ZAVFLX, HEDPIN and RCALC, which read a 3DBF flux file and generate most of the required data. The second post-processing run reads data files created in the first post-processing run and produces the tables giving flux or power data. The second runstream executes programs ADJPWR, FMTFLX, RCFMT, FMTDWF, BORE and CYCNAM. The third runstream was used to generate assembly composition tables at the end of each cycle analyzed. This runstream executes the FMTASY program.

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The last three runstreams were used to obtain relative fission rate distributions by isotope at the beginning and end of each cycle analyzed. The fourth runstream was used in computing assembly average atom densities of fissile and fissionable isotopes. This script executers the AVGN program that performed the necessary computations. The fifth runstream was used in computing microscopic fission rate distribution by isotope in MFF-3 and MFF-5. This runstream executes the RCALC program, which computed the microscopic fission rate for each isotope. The sixth runstream executes the CALCRFR program that used the results from the fourth and fifth runstreams to generate the tables of relative fission rates by isotope that are presented in the main part of this report.

A.5.0 Input Data

A.5.1 Nuclear Analysis Data Bases

Isotopic concentrations and axial dimensions of each region in FFTF assemblies are stored in nuclear analysis data bases (NADBs) (Bennett 1994). Information from an NADB is used as input by GIF3DB to prepare 3DBF input, and by DECAY, which computes ^{241}Pu and ^{241}Am concentration changes in an assembly due to ^{241}Am decay during periods when the FFTF is not at power or when the assembly is not in the core. NADBs are updated by DECAY and FILEBC, which stores updated compositions computed by BURN3D.

The starting point for the calculations described in this report was a BOC 10C-1 NADB from a previous analysis (Nelson and Cramer 1997 and Nelson and Simons 1997). A number of changes were made to this NADB before being used in the analysis of MFF-3 and MFF-5. The significant changes were:

(1) Fuel compositions (U and Zr) in MFF-3, MFF-4, MFF-5 and MFF-6 were updated from planning to as-built data given in the Master Data Packages listed in Section 8.1 in the main part of this report. No adjustments to the MFF-2 fuel composition were needed.

(2) Atom densities of HT9 and sodium in fuel regions of MFF-2, MFF-3, MFF-4, MFF-5 and MFF-6 were recomputed and updated.

(3) In the lower axial reflector region of MFF-2, MFF-3, MFF-4, MFF-5 and MFF-6, the Inconel smear density was reduced based on specifications in the Master Data Packages. Also, the sodium density was increased to account for the sodium bond in pins. The HT9 density was assumed to be the same as in the fuel region.

(4) The upper plenum region in MFF-2, MFF-3, MFF-4, MFF-5 and MFF-6 was divided into two parts: the lower 6.5 in. was assumed to contain sodium bond in the pins at hot, full-power conditions, while in the remainder of the plenum region, no sodium was assumed to be inside the pins. The HT9 density in the plenum region was assumed to be same as in fuel region.

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(5) The length of the lower axial reflector in MFF-4, MFF-5 and MFF-6 was reduced to the specified value of 2.5 in.

NADBs for EOC 10C-3 through EOC 12B-2 were obtained by performing a sequence of burnup calculations using 3DBF and BURN3D and decay calculations using DECAY. The name of each BOC NADB has the form: b{CY}r3d, where {CY} indicates the cycle (10c1, 10c2, 10c3, 11a1, etc.). The name of each EOC NADB is the same as the name of the BOC NADB, except the first letter, "b", is replaced by an "e."

A.5.2 Nuclear Cross Section Data

Two validated Set 500A FFTF twelve group nuclear section libraries (Wootan et al. 1986) were used for all 3DBF, BURN3D, RCALC and HEDPIN calculations. The 12-group energy structure is given in Table 9 in the main part of this report.

One library was designed to be used when significant hydrogen is included in any in-core assembly. This library, which is identified as **nadjx1f**, had a complete down-scattering matrix (11 down-scattering terms) and included a hydrogen cross section set. The **nadjx1f** library was used only for calculations on Cycle 11A-2, which had the hydrogen-moderated Multiple Isotope Production (MIP) test in core location 3808.

The library used for calculations on all cycles except 11A-2 is identified as **axs12hsp**. Nuclear cross section sets in this library have only five down-scattering terms. Cross sections for other nuclear processes (fission, absorption, etc.) are consistent with those in the **nadjx1f** library. Both of these libraries were also used routinely in core reload design calculations. So, both libraries have been well tested.

A.5.3 GIF3DB Input

GIF3DB obtains information from three sources: (1) a user input file, (2) a 3DB skeleton file, and (3) a nuclear analysis data base (NADB). The only parameters in the user input file that changed from case to case were the NADB name, the title card and the control rod bank setting. The control rod positions used for each 3DB calculation are listed in Table A-2. Two different 3DBF skeleton files were used. The first, used for all cycles except 11A-2 is listed below. The second contained three additional zones in row 8 to model the MIP test in core location 3808 and special filter assemblies on either side of the MIP test. The calculational model in the first skeleton file had all row 8 and 9 assemblies combined into one zone because they normally contain the same type of assembly. Another difference between the two skeleton files is the number of down-scattering terms specified (5 in the first file and 11 in the second file). The NADBs used are discussed above. Output of the GIF3DB runs were complete 3DBF input files.

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A.5.4 BURN3D Input

BURN3D reads a complete 3DBF input file, the flux file generated by the 3DBF run and the the same cross section library as the 3DBF run. In addition the program reads a nuclide transmutation matrix for fission capture and decay processes, and the cycle length (EFPDs).

Normally, the only differences in BURN3D input from cycle- to-cycle are the run title (line 1) and the burnup step length on the last line. The burnup steps used were the cycle lengths given in Table A-3. However, there were more differences for Cycle 11A-2, similar to those described for the 3DBF skeleton files discussed in Section A.5.3.

Table A-2. Control Rod Bank Position in all 3DBF Calculations

Cycle	CR Bank Position (cm withdrawn)		
	Burn[a]	BOC[b]	EOC[c]
10C-1	46.14	46.14	61.52
10C-2	61.52	61.52	d
10C-3	61.52	61.52	76.90
11A-1	46.14	46.14	d
11A-2	61.52	61.52	d
11A-3	61.52	61.52	92.28
11B-1	61.52	61.52	92.28
11B-2	61.52	46.14	92.28
11C	61.52	46.14	76.90
12A-1	61.52	61.52	76.90
12A-2	61.52	61.52	76.90
12B-1	61.52	61.52	76.90
12B-2	61.52	61.52	76.90

[a] Burn = Control rod (CR) bank position in the 3DBF/BURN3D calculations to obtain EOC compositions.
[b] BOC = beginning of cycle. Where the CR bank position for the BOC calculation is the same as in the burn up calculation, the 3DBF run that was done for the burn up calculation was used for the BOC; a separate BOC calculation was not done.
[c] EOC = end of cycle.
[d] No 3DBF calculation was done.

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Table A-3. Summary of FFTF Cycles 10C-1 through 12B-2 Power Operation

Cycle	Startup Date	Shutdown Date	Cycle Length (EFPD*)
10C-1	11/ 9/88	1/ 8/89	56.9
10C-2	1/16/89	1/20/89	2.9
10C-3	1/23/89	3/13/89	47.0
11A-1	5/ 3/89	5/16/89	11.3
11A-2	5/21/89	6/ 2/89	10.5
11A-3	6/14/89	9/19/89	94.6
11B-1	1/ 4/90	4/ 8/90	85.5
11B-2	5/29/90	10/27/90	132.7
11C	12/15/90	3/19/91	81.5
12A-1	5/27/91	7/20/91	52.8
12A-2	8/ 1/91	9/21/91	48.6
12B-1	11/22/91	1/15/92	50.3
12B-2	1/26/92	3/19/92	51.6

* EFPD = equivalent full power days. Full power = 291 MW thermal.

A.5.5 FILEBC Input

FILEBC reads data the following files: (1) the NADB that is to be updated, (2) file cmpout generated by GIF3DB that contains the material composition of every zone in the calculational model at the start of the burnup step, (3) file i2out generated by BURN3D that contains the updated atom densities of every isotope in every composition in the model , and (4) a user input file read from the standard input device.

A.5.6 DECAY Input

Input to the DECAY program includes an NADB name, a list of serial numbers for assemblies to be decayed , a decay date and isotope identifiers and decay constants. The input that changed from case to case is the NADB name and the decay date.

A.5.7 HEDPIN Input

HEDPIN was used to compute distributions of power and fast (> 0.1 MeV) flux by pin in MFF-3 and MFF-5. Since HEDPIN only has the options of computing fission power or total flux by pin, distributions of fast flux by pin were obtained by specifying the number of energy groups as 5

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rather than 12. The lower energy bound for group 5 is 0.111 MeV. Thus, distributions of flux greater than 0.111 MeV were generated. However, normalized distributions of flux greater than 0.1 MeV are tabulated in the main part of this report, not absolute values. Thus, the errors due to this approximation are insignificant.

The input file for computing fast flux distributions does not change from cycle-to-cycle. However, the file for computing fission power distributions changes not only cycle-to-cycle, but from BOC to EOC. The input changes from case-to case are limited to the atom densities (atoms/barn-cm) of significant fissile and fissionable isotopes in MFF-3 and MFF-5. Atom densities for the beginning of a cycle are the same as atom densities at the end of the preceding cycle, except that ^{241}Pu decay from EOC to BOC has been accounted for.

A.5.8 RCALC Input

Three RCALC runs were made for the beginning and end of each cycle for which data were tabulated in the main part of this report. All three runs read the same flux file, which was one that was collapsed by ZAVFLX from 3-D to 2-D to give group flux data axially averaged over the core height. The first run was made to compute duct wall flux greater than 0.1 MeV. The second was made to compute the flux greater than 0.1 MeV at each X-Y mesh point. The third was made to compute the total flux at each X-Y mesh point.

A.5.10 ZPWR Input

Three ZPWR runs were made for each cycle. The first was to compute the assembly power in MFF-3, MFF-5 and neighboring assemblies. The second was used to compute the assembly averaged fast flux in MFF-3 and MFF-5. The third was used to compute the assembly averaged total flux in MFF-3 and MFF-5. The last two runs read the same standard input file.

In the first ZPWR run, fission power data were read from a full 3-D flux file generated by 3DBF. In the second and third runs, 2-D, one-group flux files containing fast and total flux data, respectively, were read. These flux files were created by a sequence of ZAVFLX and RCALC runs. ZAVFLX created a 2-D, 12-group flux file. This file was read by two RCALC runs. The first computed and wrote a flux file containing only the 2-D spatial distribution of flux greater than 0.1 MeV. The second computed and wrote a flux file containing only the 2-D spatial distribution of total flux.

ZPWR normally integrates the power densities (MW/l) over an assembly. To get ZPWR to provide assembly averaged flux data, a bogus core height value of 7.933was used as input. This value was derived below to provide the correct flux scaling factor.

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The equation solved in ZPWR is:

$$P = 0.001 \sum_{k=KC}^{KAT} \sum_{i,j} P_{i,j,k} (x_{i+1} - x_i) (y_{j+1} - y_j) (z_{k+1} - z_k)$$

where P is the assembly power in the fuel region (MW),
$P_{i,j,k}$ is the power density (MW/l) at mesh point i,j,k,
x_i is a mesh point location in the X direction (cm),
y_j is a mesh point location in the Y direction (cm),
z_k is a mesh point location in the Z direction (cm).

The multiplier 0.001 is used to convert power densities from MW/l to MW/cm^3.

In this case, there is only one axial interval. Thus,

$$P = 0.001\ H \sum_{i,j} P_{i,j}(x_{i+1} - x_i)(y_{j+1} - y_j)$$

where, H is the core height.

Also in this case, area $A_{xy} = (x_{i+1} - x_i)(y_{j+1} - y_j)$ is a constant:

$$A_{xy} = 3.4827 \times 6.0324 = 21.0090$$

So, $$P = 0.001 * H * A_{xy} * \sum_{i,j} P_{i,j}$$

The assembly-averaged flux in the same case is:

$$\varphi = \sum_{i,j} \varphi_{i,j} / N$$

where, φ is the assembly averaged flux,
$\varphi_{i,j}$ is the flux at mesh point i,j in the assembly,
N is the number of mesh points in the assembly (6), and
the summation is over the six mesh points in the assembly.

Thus, to get P to equal φ,

$$0.001 \times H \times A_{xy} \sum P_{i,j} = \sum \varphi_{i,j} / N$$

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Equating $P_{i,j}$ and $\varphi_{i,j}$, and canceling the summations gives

$$0.001 \times H \times A_{xy} = 1 / N$$

Thus, $H = (0.001 \times (N \times A_{xy}))^{-1} = [0.001 \times (6 * 21.009)]^{-1} = 7.933$.

A.5.12 ADJPWR2 Input

ADJPWR2 reads the contents of a ZPWR output file, pwrout, from the standard input device. The program also reads a case identifier (e.g., b10c1) from the command line.

A.5.13 FMTFLX input

The standard input for FMTFLX version 1.1 consists of the consecutive listings of two ZPWR pwrout files. The first contains fast flux data for MFF-3, its six surrounding assemblies, MFF-5, and its six surrounding assemblies. The program also reads a case identifier from the command line.

A.5.15 FMTASY Input

FMTASY reads an NADB assembly composition file (Bennett 1994 or Nelson 1992) from the standard input device, and a cycle identifier from the command line. The identifier, B10A-1 for example, is used in the output table heading.

A6.0 Computed Neutron Multiplication Constants at BOC and EOC

As a check on the accuracy and consistency of the 3DBF and BURN3D calculations, neutron multiplication constants (k_{eff}) computed by 3DBF for BOC and EOC conditions were corrected to account for differences between control rod settings in the calculational models and indicated BOC and EOC settings given in the FFTF cycle reports (Newland 1989, 1989a, 1991, Swaim 1993 and Loika 1993). The results are shown in Table A-10.

The initial full-power control rod settings listed for BOC conditions were adjusted in the referenced cycle reports to zero burnup from the initial measurements of the control rod bank positions after full power was reached using a factor of 0.1 in./EFPD). No adjustments were made to the EOC settings because any changes would have been very small (0.0001 Δk at most). Corrections to the 3DBF k_{eff} values to account for differences in control rod settings were based on 3DBF calculations of incremental control rod bank worths ($\Delta k/k$ per in.). The computed worths are given in Table A-10.

All core configurations for which 3DBF calculations were made are reported in Table A-10. No critical control rod positions were given in the referenced cycle reports for EOC 10C-1, 10C-2

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and 10C-3. During Cycle 11B-1, full power was not reached until 35 EFPD (equivalent full power days) into the cycle. Thus, no critical control rod bank position at BOC 11B-1 is included in Table A-10 because a large correction to zero burnup would be required. No 3DBF calculations were done for EOC 10C-2, 11A-1 and 11A-2 because of the short length of these cycles.

The k_{eff} bias (calculated k_{eff} - 1.0) showed reasonable consistency. It ranged from 0.0015 to 0.0056, with an average of 0.0040 and a standard deviation of 0.0013. No attempt was made to do a detailed analysis of the bias variations from cycle-to-cycle.

The bias changes from BOC to EOC are also reasonably consistent. This is an indication that the burnup calculations are correct. The average difference in adjusted k_{eff} from BOC to EOC per EFPD exposure was only $1.15 \times 10^{-7} \pm 4.99 \times 10^{-6}$. The reactivity loss rate due to fuel burnup was computed for Cycles 10C-1 to be 2.02×10^{-4} $\Delta k/k$ per EFPD. Thus, the average bias in the burnup reactivity is about 0.06% with a standard deviation of 0.24% of burnup reactivity. This small uncertainty is probably due to the uncertainty in the 3DBF k_{eff} calculations, in which an eigenvalue convergence criteria of 1.0×10^{-5} was used.

Table A-10. Computed and Adjusted Neutron Multiplication Constants

Cycle	BOC or EOC[a]	CR Bank Ht.[b] (in) in Calculations[c]	Computed k_{eff}[d]	Critical CR Bank Ht.[b] (in.) Measured[e]	Computed CR worth ($\Delta k/k$ per in.[f])	Computed k_{eff} Adjusted to Critical CR Bank Ht.[b,g]
10C-1	BOC	18	1.00085	19.4	0.00222	1.00396
	BOC	24	1.01418			
	EOC	24	1.00266			
10C-2	BOC	24	1.00304	24.6		1.00437
10C-3	BOC	24	1.00276	24.8		1.00454
	EOC	30	1.00311			
11A-1	BOC	18	0.99684	20.1	0.00236	1.00179
	BOC	24	1.01097			
11A-2	BOC	24	1.00573	22.7		1.00267
11A-3	BOC	24	1.00642	21.9		1.00147
	EOC	30	0.99766	34.5	0.00090	1.00171
	EOC	36	1.00306			
11B-1	BOC	24	1.00389			
	EOC	36	1.00269	35.6		1.00233
11B-2	BOC	18	1.00461	18.3	0.00228	1.00530
	BOC	24	1.01831			
	EOC	36	1.00510	35.5		1.00465

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11C	BOC	18	1.00183	19.7	0.00219	1.00556
	BOC	24	1.01500			
	EOC	30	1.00695	28.8	0.00166	1.00495
	EOC	24	0.99697			
12A-1	BOC	24	1.00855	22.5		1.00526
	EOC	30	1.00704	29.0		1.00538
12A-2	BOC	24	1.00828	22.4		1.00477
	EOC	30	1.00732	28.5		1.00483
12B-1	BOC	24	1.00514	23.7		1.00448
	EOC	30	1.00363	30.5		1.00446
12B-2	BOC	24	1.00477	23.5		1.00367
	EOC	30	1.00290	30.7		1.00406

[a] BOC = Beginning of Cycle. EOC = End of Cycle.

[b] CR Bank Ht. = control rod bank position given as inches withdrawn.

[c] Calculational model is restricted to six-inch movements in control rods.

[d] k_{eff} = neutron multiplication factor. The statistical uncertainty in the 3DBF-computed k_{eff} values is ~0.00002.

[e] Critical CR bank heights given for BOC conditions are based on measurements extrapolated back to zero exposure in the cycle at full power conditions.

[f] Incremental control rod bank worths (Δk/k per in., the fractional change in the computed k_{eff} per inch of CR bank height movement) were computed when 3DBF calculations were made for a cycle and exposure two using two different control rod bank settings.

[g] Calculated k_{eff} values were adjusted to the given critical control rod bank positions using the computed control rod bank worth (Δk/k per in.) data that are also given. If the CR worth was not computed for a particular cycle and exposure (i.e., BOC or EOC), the most appropriate computed CR bank worth was used.

A.7.0 Comparison of Calculated Power in MFF-3 and MFF-5

As a part of the core reload (RDR) design process for each operating cycle, the fission power produced in each assembly was computed and tabulated in the reload design reports listed in Section 8.2, and also in the cycle reports listed in Section 8.3 in the main part of this report. The assembly powers computed during the RDR process for MFF-3 and MFF-5 at the beginning and end of most operating cycles were extracted from the referenced cycle reports and compared to the data reported in Tables B10C-1.1, E10C-3.1, B11A-2.1, E11A-3.1, etc in the main part of this report. The results are shown in Table A-11. Data for some cycles (at either BOC or EOC) were omitted because the cycles were very short or no data were given in the cycle reports.

Differences between the RDR (two-dimensional (2-D) calculations and the three-dimensional (3-D) 3DBF calculations described in this report were as high as 3%. There appears to be a small bias between the two sets of calculations – the 3DBF results averaged 0.2% high for MFF-3 and 0.6% higher for MFF-5. There did not appear to be a significant trend over time, except

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that the largest differences were at the beginning of life for both MFF-3 and MFF-5 with the exception of Cycle 11A-2. No definite explanation for the biases or variations was found. There are, however, a number of possible contributing factors, including:

- RDR calculations for a cycle are completed well before the prior cycle is completed, so the exact length of the prior cycle is not known, which introduces an uncertainty in the burnup calculations for the prior cycle and hence uncertainties in the fuel atom densities used in the RDR calculations.

- For fuel test assemblies inserted at the beginning of a particular cycle (in particular, MFF-3 at BOC 10C-1 and MFF-5 at BOC 11B-1, as-built atom densities might not have been available for the RDR calculations for the cycle, and hence nominal compositions would have been used (for MFF -3 and MFF-5, the nominal fissile content was about a percent lower than as-built).

- Many modeling approximations were necessary with the 2-D RDR methods, including use of zone-dependant axial buckling to account for axial leakage, use of a diluted B_4C concentration to simulate partially withdrawn control rods, inability to account for axial variations in fuel burnup, uncertainty in the adjustment of the total fission power input value to account for fissions in axial blankets and UO_2 insulator pellets that are above and below the 36-in. long fuel region.

- Control rods at end of cycle were modeled as fully (36 in.) withdrawn in the RDR calculations, whereas some cycles ended with control rods around 30 in. withdrawn.

- On the other hand, limitations in the 3-D models employed allowed control rods to be withdrawn only in 6-in. increments.

Because of the factors listed above, some differences between the RDR 2-D results and the current 3-D calculations were expected. In summary though, the differences seen in Table A-11 are reasonably small and do not indicate any errors in the 3DBF or BURN3D calculations. The results presented in this section and in Section B.6.0 lend credence to the validity the 3DBF and BURN3D calculations and the data tabulated in the main part of this report.

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Table A-11. Comparison of Fission Powers Computed for MFF-3 and MFF-5.

Cycle	Fission Power (MW) in MFF-3			Fission Power (MW) in MFF-5		
	3DBF[a]	RDR[b]	Difference	3DBF[a]	RDR[b]	Difference
BOC 10C-1	7.94	7.87	0.9%			
EOC 10C-3	7.53	7.49	0.5%			
BOC 11A-2	7.41	7.51	-1.3%			
EOC 11A-3	7.00	7.00	0.0%			
BOC 11B-1	7.01	7.02	-0.1%	7.55	7.36	2.6%
EOC 11B-1	6.77	6.79	-0.3%	7.29	7.17	1.7%
BOC 11B-2	6.64	6.64	0.0%	7.47	7.44	0.4%
EOC 11B-2	6.31	6.29	0.3%	7.02	6.97	0.7%
BOC 11C	6.35	6.29	0.9%	7.09	7.01	1.2%
EOC 11C	6.13	6.08	0.8%	6.79	6.71	1.2%
BOC 12A-1	5.89	5.87	0.3%	7.13	7.15	-0.3%
EOC 12A-1	5.80	5.76	0.7%	6.93	6.90	0.4%
BOC 12A-2	5.76	5.74	0.3%	6.98	7.02	-0.6%
EOC 12A-2	5.68	5.64	0.7%	6.79	6.76	0.4%
BOC 12B-1	5.91	5.90	0.2%	6.87	6.88	-0.1%
EOC 12B-1	5.81	5.79	0.3%	6.68	6.66	0.3%
BOC 12B-2	5.71	5.71	0.0%	6.70	6.71	-0.1%
EOC 12B-2	5.62	5.61	0.2%	6.52	6.50	0.3%
Average			0.2%			0.6%
Std. Dev.			0.5%			0.8%
Maximum			0.9%			2.6%
Minimum			-1.3%			-0.6%

[a] 3DBF = Powers from the three-dimensional calculations tabulated in the main part of this report..

[b] RDR = Powers from the two-dimensional core reload design analyses.

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APPENDIX B

METHODS FOR ASSEMBLY OUTLET TEMPERATURE AND SODIUM SUBCHANNEL TEMPERATURE

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B.1.0 Purpose

The purpose of this appendix is to document the methods, computer programs and input data used in generating the information provided in the body of this report for assembly outlet temperatures and sodium subchannel temperatures. The computer programs used in the process and the calculational sequence are described or referenced. Most of these data were obtained from previous analyses that were done as a part of the core reload design process for each cycle.

B.2.0 Methods and Computer Programs Applied

For calculating sodium subchannel temperatures, power and heating distributions were computed using the standard FFTF two-dimensional diffusion theory and burnup methods (Bennett 1994) that were used for core reload design calculations.

The main computer programs employed are listed in Table B.1. Also given in this table is the function of each program. Most of these programs have been classified as inactive since nuclear operations at the FFTF ended in 1992. Up to that time, they were normally run on a Hanford Cray®[2] computer or engineering workstations.

Programs used in the analysis of MFF-3 and MFF-5 were migrated to a desktop computer running under the Solaris®[1] operating System. Using a Solaris-based computer minimized the effort required to migrate needed codes from the engineering workstations that no longer exist. No programs have been formally validated on the Solaris-based computer. However, all programs used were tested to verify that the options used in this work give accurate results or results consistent with results obtained when the programs were formally validated. .

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Table B-1. Summary of Major Computer Programs Used

Program	Description	Reference
GIF2DB	Generates input files for 2DBFM and 2DBHNG	Nelson 1991b, Nelson 1991c
2DBFM	Two-dimensional neutron diffusion theory program	Nelson 1990a, Nelson 1991d
2DBHNG	Two-dimensional neutron diffusion theory program adapted for both neutron and gamma ray heating, and correcting for heating outside the fuel region	Gedeon 1990
WATTSAT	Computes total heating rate distribution for specified materials for input to HEDPIN	Gilbert 1992a
HEDPIN	Interpolates pin powers/fluxes from a 2-D or 3-D flux file or WATTSAT heating file	Cappiello 1976
CONVT	Converts a HEDPIN output file containing pin power or heating data to a format that can be read by SUPERENERGY.	Gilbert 1992
SUPERENERGY	Computes sodium subchannel temperature distributions and assembly outlet temperatures	Cramer 1990

[c] SUPERENERGY calculations, except those for Cycle 10C were run on the Hanford Cray. The program was formally documented and validated for use on the Cray. SUPERENERGY results for Cycle 10C could not be recovered, so needed to be rerun.

B.3.0 Computer Calculation Flow

Sodium subchannel temperatue calculations were accomplished with a sequence of GIF2DB, 2DBFM, 2DBHNG, WATTSAT, HEDPIN, CONVT, and SUPERENERGY runs.

The 2DBFM and 2DBHNG runs that were part of the sodium temperature calculation sequence were made with the control rod bank positioned at either the BOC or EOC position.

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B4.0 Input Data

B.4.1 Nuclear Analysis Data Bases

Isotopic concentrations and axial dimensions of each region in FFTF assemblies are stored in nuclear analysis data bases (NADBs) (Bennett 1994). Information from an NADB is used as input by GIF2DB to prepare 2DBFM input.

B.4.2 Nuclear Cross Section Data

Tho validated Set 500A FFTF twelve group neutron cross section library **axs12hsp** (Wootan et al. 1986) were used for all 2DBFM and 2DBHNG calculations. The **gpadj9a** gamma production cross section library and **njoyd** gamma transport cross section library were used for 2DBHNG calculations.

The **nadjx1f** library was used only for calculations on Cycle 11A-2, which had the hydrogen-moderated Multiple Isotope Production (MIP) test in core location 3808.

All of these libraries were used routinely in core reload design calculations. So, they have been well tested.

B.4.3 GIF2DB Input

GIF2DB serves as an input generator for versions of 2DB (namely 2DBFM and 2DBHNG) that are routinely used to perform FFTF reload design calculations. GIF2DB reads a partial 2DBFM input file (referred to as a skeleton file or skeleton deck), and completes it using data from a nuclear analysis data base (NADB) and case specific user input. The NADB contains reactor loading information and complete descriptions of available assemblies.

GIF2DB obtains information from three sources: (1) a user input file, (2) a 2DBFM skeleton file, and (3) a nuclear analysis data base (NADB). The only parameters in the user input file that change from case to case were the NADB name, the title card and the control rod bank setting. The control rod position used for each 2DBFM calculation is representative of the BOC or EOC secondary bank height, derived from the rod absorber fraction curve for partially inserted secondary rods (Bennett 1994). The curve of effective bank height versus actual bank height is based on the required absorber density reduction from a fully inserted rod density so that a two dimensional hexagonal calculation produces the same k_{eff} as a corresponding three dimensional calculation. The skeleton file includes row and assembly dependent flux and power bias factors. Axial buckling factors by assembly are either included in the skeleton file or read from the NADB. Output of the GIF2DB run is a complete 2DBFM input file.

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For Cycle 10C, the GIF2DB runs created two dimensional 2DBFM input files by collapsing over the 92.28 cm fuel region of the three dimensional NADB from the assembly burnup calculations described in Appendix A.

B.4.4 2DBFM Input

2DBFM is a version of the two-dimensional multigroup diffusion theory burnup program 2DB that was tailored to meet the requirements of FFTF reload design, long range planning, experiment design and analysis and other related analyses. 2DBFM is primarily used to compute reactivity (k_{eff}), spatial distributions of neutron flux and power, isotope buildup and depletion, and reaction rates for decay heat applications. The cross section library used by 2DBFM is described above. 2DBFM input files are generated using the GIF2DB code. The output of 2DBFM is a biased flux and power file.

B.4.5 2DBHNG Input

2DBHNG is a system of three codes, H2DBFM, HCODE5I, and HCODE5H, used for nuclear heat deposition calculations in the FFTF. The heating data calculated by 2DBHNG is used in thermal hydraulic calculations to determine temperatures throughout the reactor and form the basis for some of the Reload Design Report for a given reactor cycle. H2DBFM is a version of the two-dimensional theory code 2DBFM modified to produce neutron and gamma ray energy deposition files. It uses the biased neutron fluxes from 2DBFM to compute both the neutron heat deposition and the gamma ray source. It then solves the gamma ray multigroup diffusion equation with the gamma ray source and computes gamma ray heat deposition. HCODE5I merges the neutron and gamma ray energy deposition files. HCODE5H produces the end-product output file containing nuclear heat deposition by assembly. 2DBHNG reads neutron cross sections, gamma ray transport cross sections, gamma ray production cross sections, neutron flux output from 2DBFM, and an auxiliary input file of axial correction factors. The axial correction factors are used to correct the two dimensional heating contributions from particular assemblies with axial blankets. The output of 2DBHNG includes heating distribution files for each type of fuel and non-fuel assemblies that are processed by the WATTSAT program to create input to HEDPIN calculations of detailed radial pin heating distributions. A file of heating by assembly for the entire core is also used as input to SUPERENERGY temperature calculations.

B.4.6 WATTSAT Input

WATTSAT is a utility program used at FFTF to compute total heating rate distribution for specified materials in the FFTF Reload Design Process. The data used by WATTSAT is from the 2DBHNG program. The program produces files containing heating data for input to the HEDPIN program, which uses the data to interpolate heat deposition rates by pin within an assembly

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B.4.7 HEDPIN Input

For the sodium subchannel temperature calculational sequence, the HEDPIN code is used to compute pin-wise power densitydistributions in FFTF fuel assemblies and detailed heating distributions in non-fuel assemblies such as control rods, reflectors, etc. The program reads a 2DBFM-generated flux and power density file or a heating distribution from WATTSAT. The spatial distributions of power or heating typically have six nodes per assembly in the X-Y plane. HEDPIN reads these coarse distributions and performs a least squares polynomial fit to the data. The derived equations are used to estimate data values at each pin location. These radial pin heating distributions are processed by CONVT for input to the SUPERENERGY temperature calculations.

B.4.8 CONVT Input

CONVT is a utility program used at FFTF to convert HEDPIN binary data files containing pin powers to ASCII files. The resulting files are used as input to SUPERENERGY thermal hydraulics calculations.

B.4.9 SUPERENERGY Input

The SUPERENERGY code is a subchannel code that was designed specifically for hexagon shaped, wire wrapped pin bundles and is used to calculate the FFTF core assembly mixed-mean outlet temperatures, the assembly subchannel temperatures of all core assemblies, the core assembly duct wall temperatures, and the temperature of the reflector assembly coolant channels. SUPERENERGY calculates subchannel temperatures by using energy balances and correlations for subchannel mixing. The flow field is described in terms of two correlated parameters, a subchannel mixing parameter and a swirl flow parameter. These two parameters, along with the energy equation and a subchannel flow split model, can completely describe the temperature field in a pin bundle without the use of momentum and continuity. The mixing parameters and flow split correlations are based on extensive experimental test data. Based on the deposited energy distribution and nominal flow rates for each core component, the outlet temperature for each core location was calculated at BOC and EOC. The assembly flow rates are based on a calculated core pressure drop at the total reactor flow rate of 16.74×10^6 lb/hr and varied slightly from cycle to cycle as the core loadings changed. The pin power distributions from HEDPIN are used as part of the input in determining the subchannel temperatures. Axial power profiles for each type of assembly are input to the code. The deposited power of each pin, the assembly flow distribution and the reactor inlet temperature of 680°F are input to the code.

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B.5.0 Sodium Subchannel Temperature Calculations

The output of SUPERENERGY includes the sodium temperatures at subchannel nodes surrounding the fuel pins and duct at the selected axial elevations for every assembly. The subchannel temperatures for MFF-3 and MFF-5 at three axial elevations for the beginning and end of each cycle can be found in Section 5.0 of the main body of this report.

Figure B-1 shows the typical configuration of subchannel nodes for the SUPERENERGY calculation for a pin assembly. Figure B-2 shows how the SUPERENERGY output of subchannel temperatures correspond to the node map for a 169 pin assembly. All temperatures are in degrees Fahrenheit. The row of numbers just outside the asterisks on each map are calculated duct wall temperatures, and the outside row of temperatures on each map are the temperatures of the sodium between assemblies. The direction north is the same as the HEDPIN pin distributions. As with the assembly outlet temperatures, subchannel temperatures were not computed when short cycles and minor 1oading changes resulted in no significant temperature changes. Subchannel temperatures at the 44.0 inch elevation correspond to the top of the fuel column. Subchannel temperatures at the 50.5 inch elevation correspond to the top of the upper axial reflector in fuel assemblies. Subchannel temperatures at the 92.0 inch elevation correspond to the top of the fuel pin bundle.

Fuel pin cladding temperatures are not available, but can be computed from the data provided.

Figure B-1. SUPERENERGY Subchannel Node Map

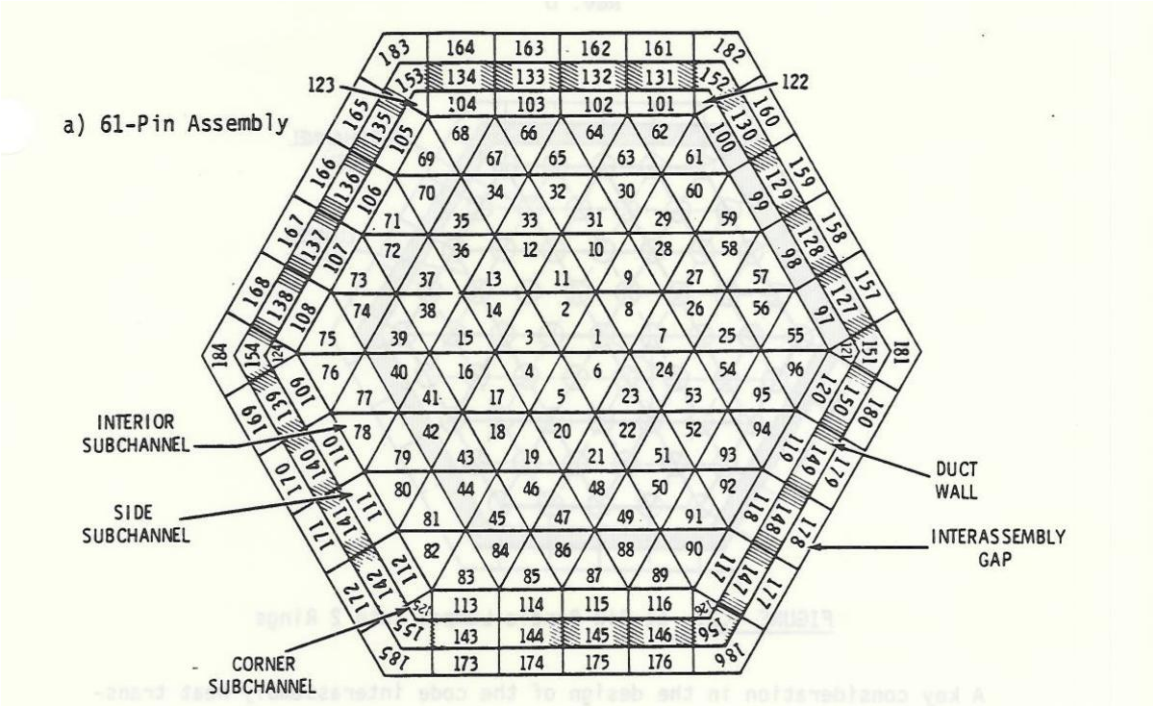

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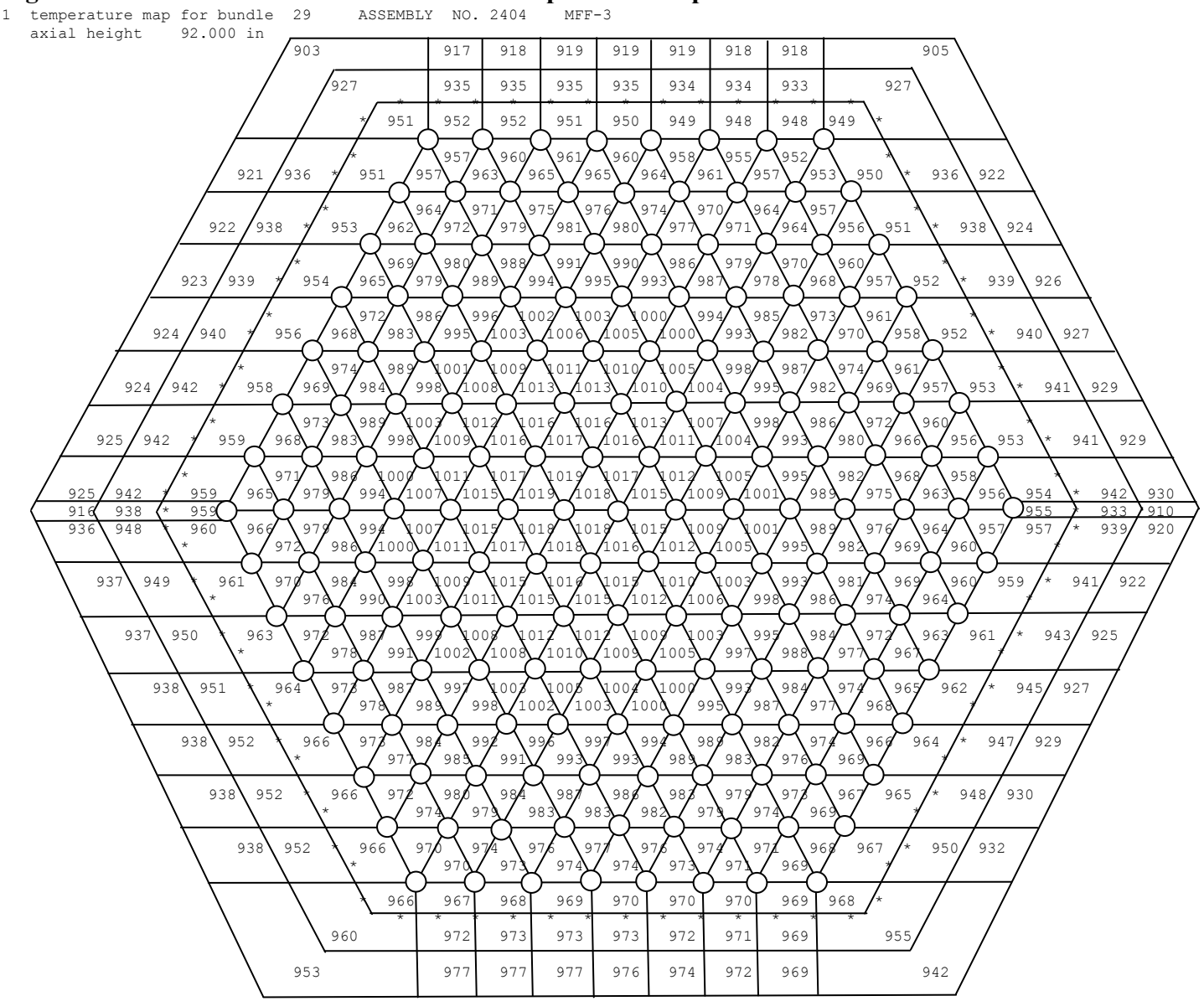
Figure B-2. SUPERENERGY Subchannel Temperature Map for 169 Pins



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APPENDIX C

METHODS FOR DETAILED PIN CALCULATIONS

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C.1.0 Purpose

The purpose of this appendix is to document the methods, computer programs, and input data used in generating detailed results for individual pin sections for selected pins in MFF-3 and MFF-5for each operating cycle and specified decay times following discharge that were provided in the body of this report. The computer programs used in the process and the calculational sequence are described or referenced. Then, the input files for the major programs are discussed

C.2.0 Methods and Computer Programs Applied

The main computer programs employed are listed in Table C.1. Also given in this table is the function of each program and its references. Most of these programs have been classified as inactive since nuclear operations at the FFTF ended in 1992. Up to that time, they were normally run on a Hanford Cray®[2] computer or engineering workstations.

Programs used in the analysis of MFF-3 and MFF-5 were migrated to a desktop computer running under the Solaris[1] operating System or a desktop PC running under a Windows[3]-based operating system. All programs used were tested to verify that the options used in this work give accurate results or results consistent with results obtained when the programs were validated.

Processing of data to generate input files and extract data from output files was performed using spreadsheets.

Table C-1. Summary of Major Computer Programs Used

Program	Description	Reference
HEDPIN	Interpolates multigroup flux data to pin locations and calculates reaction rates	Cappiello 1976
ORIGEN2.2	Calculates burnup and decay of fuel	Ludwig 2002

[3] ® Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

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C.3.0 Computer Calculation Flow

Obtaining radionuclide inventories involved a number of steps. In summary, these steps are:

1. Identify and compile pin information
    a. Pins selected in each test assembly for detailed burnup calculations
    b. Irradiation history (irradiation and decay times) of each assembly
    c. Initial as-built compositions of the selected fuel pins
    d. Decay times selected following end of irradiation

2. Run HEDPIN on each layer of the 3DB flux files for each cycle to generate pin-wise total flux and appropriate cross sections for each irradiation cycle for each axial layer of each assembly.

3. Create ORIGEN2 inputs for each pin segment with as-built compositions, cycle fluxes, and cross sections to obtain radionuclide inventories for each fuel pin segment of each assembly at the beginning and end of each irradiation cycle and selected decay times following discharge, accounting for isotope buildup, depletion and radioactive decay.

These steps to obtain radionuclide inventories, summarized above, are described in more detail in the remainder of this section.

Power, flux and composition data were computed using the three dimensional FFTF computational methods described in Appendix A, the HEDPIN interpolation code, the ORIGEN2 burnup code, and spreadsheets for data processing. All related computer calculations were performed on a desktop computer running under the Solaris®[1] operating System, except for the ORIGEN2 code, which was run on a Windows®[3]-based operating system.

All programs used were tested to verify that the options used in this work give accurate results or results consistent with results obtained when the programs were formally validated.

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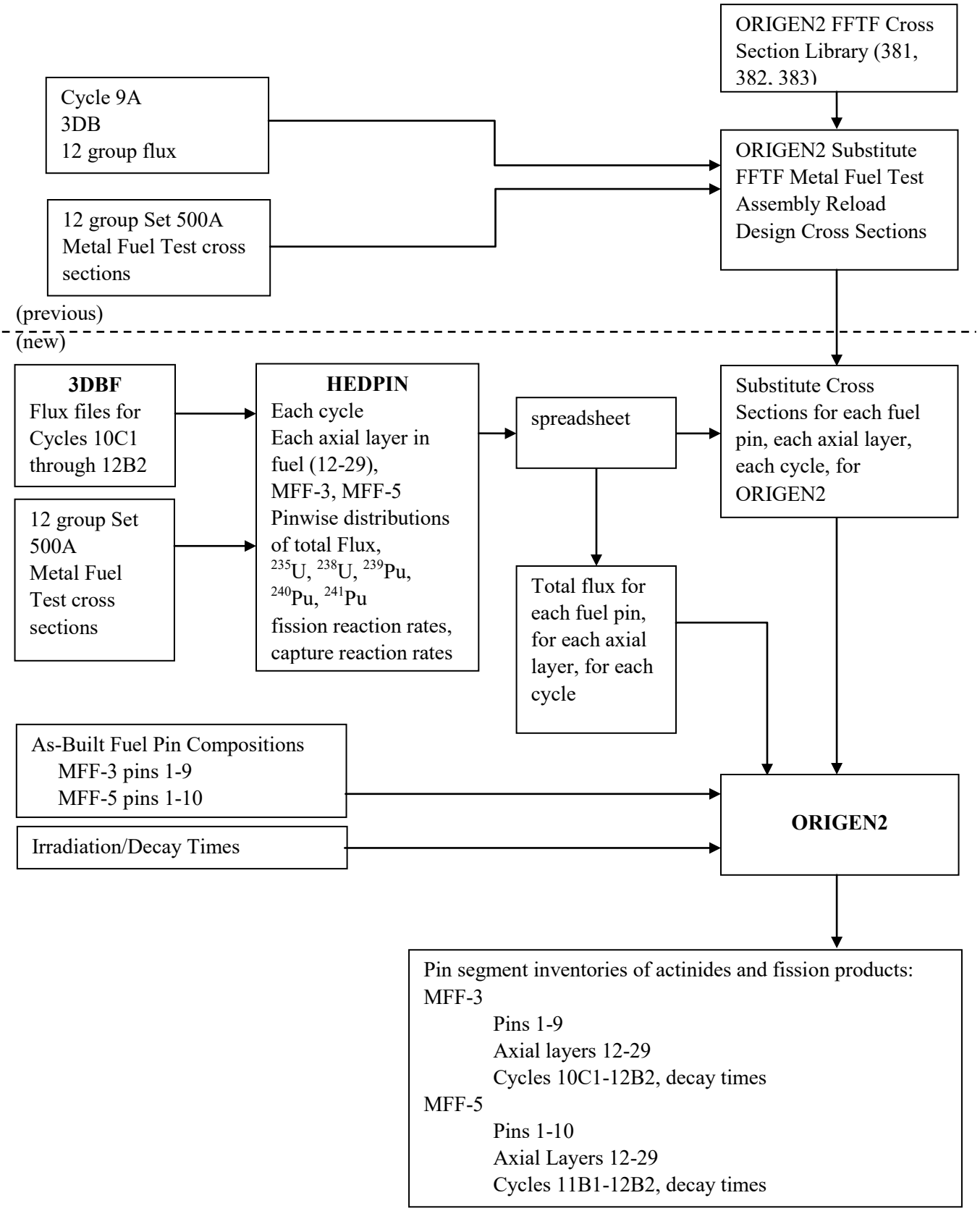
Figure C-1. Calculational Flow of MFF Cross Section Generation for MFF Pin Segments



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C4.0 Input Data

C.4.1 HEDPIN Input

For the detailed pin inventory calculational sequence, HEDPIN is used to compute pin-wise total flux and effective one group cross sections. The program reads the 3DBF-generated flux file and metal fuel cross sections. The spatial distributions of flux have six nodes per assembly in each X-Y plane of the three dimensional core model. HEDPIN reads these coarse distributions and performs a least squares polynomial fit to the data for each axial layer. The derived equations are used to estimate one group fission and capture reaction cross sections and total flux values at each axial layer for each pin location for input to ORIGEN2.

The 3DBF flux files used as input for HEDPIN were the same ones used for the assembly cycle burns described in Section 5.0 of the main body of this report. The control rods were representative of the mid-cycle position. Three separate HEDPIN runs were made for each cycle for each assembly, one to generate total flux, one to generate fission reaction rates, and one to generate capture reaction rates.

To generate total flux by pin segment, the HEDPIN code interpolated on the group fluxes and collapsed to one group.

To generate fission rate by pin segment, the HEDPIN code interpolated on the group fluxes, multiplied by the multigroup fission cross section, and collapsed to one group.

To generate capture rate by pin segment, the HEDPIN code interpolated on the group fluxes, multiplied by the multigroup absorption (capture plus fission) cross section, and collapsed to one group; the capture rate was then calculated by subtracting the fission rate from the absorption rate.

The fission and capture cross sections were calculated by dividing the fission and capture reaction rates by the total flux.

The fission and capture cross sections for each segment for each cycle were then substituted into the assembly average ORIGEN2 cross sections specific to the metal fuel tests.

These steps were repeated for each axial layer for each cycle for each assembly.

The processing of the cross sections and total flux was done by spreadsheets.

C.4.2 ORIGEN2 Input

For the detailed pin inventory calculational sequence, ORIGEN2 is used to compute compositions of each axial pin segment based on the irradiation and decay history. The

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ORIGEN2 input file for each fuel pin segment was constructed using the as-built initial fuel pin compositions and the total flux and effective cross sections based on the 3DBF calculations for each cycle.

The process for generating cross sections for the ORIGEN2 calculations is shown in Figure C-1. One-group cross sections are spectrum dependent and can vary significantly with reactor and fuel type. The ORIGEN2 code includes a complete library of actinide, fission product, and activation product one-group neutron reaction cross sections specifically for FFTF. More specific assembly type and row dependent one-group FFTF actinide cross section libraries, including cross section libraries for metal fuel tests, were originally generated for use with the ORIGEN code (Gilbert 1990) in FFTF reload design and shutdown reactivity monitoring analyses. ORIGEN was certified with that library for FFTF applications (Gilbert 1990, and Ombrellaro and Gilbert 1990). Multi-group neutron reaction cross sections (Set 500A) were developed to support FFTF core reload design and related nuclear analyses during cycles 9 through 12 (Wootan 1986). The neutron reaction cross section data for the reload design ORIGEN calculations were previously generated by combining multi-group cross sections with the calculated multi-group neutron spectra from three-dimensional core calculations and averaging over specific assembly types and row locations. The ORIGEN one-group assembly type and row dependent cross sections were based on the same Set 500A 12-group cross section library used in the Reload Design Report calculations from which neutron flux values were obtained. The Set 500A cross sections are the same ones used for the three dimensional cycle burnup calculations described in the main body of this report. These ORIGEN cross sections were then reformatted for use in ORIGEN2. The same metal fuel neutron reaction cross sections developed for the ORIGEN code and used to support FFTF core reload design and related nuclear analyses during Cycles 9 through 12 were used as the starting point in the ORIGEN2 calculations for the MFF-3 and MFF-5 metal fuel pins. These cross sections are listed in Table C-2.

The one group neutron reaction cross sections for the metal fuel test actinide isotopes shown in Table C-2 were modified with the substitute fission and capture cross sections specific to each fuel segment for each cycle and used to replace the fuel cross sections in the standard FFTF ORIGEN2 library of cross sections. All other actinide cross sections and decay libraries used in the fuel segment ORIGEN2 calculations were the standard ORIGEN2 libraries for FFTF.

For the MFF-3 and MFF-5 assemblies, the effective one-group fission and capture cross sections for ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, and ^{241}Pu were calculated for each of the selected pins in each assembly, each axial layer, and each operating cycle. These were calculated by running HEDPIN on each axial layer of the fuel region (layers 12 through 29) of the 12-group 3DB flux file for each cycle and calculating effective isotopic fission rates and absorption rates. These one-group fission and capture rates were divided by the corresponding total flux to generate effective one group fission and capture cross sections for ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, and ^{241}Pu that were substituted into the ORIGEN2 FFTF cross section library.

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Table C-2. Base Set of Assembly Average FFTF Metal Fuel Test Cross Sections

Library ID	Isotope ID	n,gamma	n,2n	n,3n	n,fission	n,gamma*	n,2n*
382	922340	4.790E-01	1.760E-04	3.300E-06	4.200E-01	0.000E+00	0.000E+00
382	922350	4.290E-01	1.340E-03	3.500E-06	1.660E 00	0.000E+00	0.000E+00
382	922360	4.590E-01	1.070E-03	5.400E-06	1.340E-01	0.000E+00	0.000E+00
382	922370	3.410E-01	3.350E-03	5.062E-05	6.310E-01	0.000E+00	0.000E+00
382	922380	2.210E-01	2.270E-03	1.120E-05	5.610E-02	0.000E+00	0.000E+00
382	922390	4.290E-01	2.750E-04	0.000E+00	1.660E+00	0.000E+00	0.000E+00
382	932360	4.540E-02	3.460E-03	0.000E+00	2.930E-01	0.000E+00	0.000E+00
382	932370	1.270E 00	1.930E-04	7.100E-07	4.320E-01	0.000E+00	1.930E-04
382	932380	4.540E-02	3.460E-03	0.000E+00	2.930E-01	0.000E+00	0.000E+00
382	932390	1.270E+00	1.470E-04	0.000E+00	4.330E-01	4.714E-02	0.000E+00
382	942360	3.580E-01	5.924E-04	1.073E-05	1.580E 00	0.000E+00	0.000E+00
382	942370	3.520E-01	2.750E-04	4.350E-06	1.740E 00	0.000E+00	0.000E+00
382	942380	5.780E-01	7.000E-05	2.250E-06	1.180E 00	0.000E+00	0.000E+00
382	942390	3.520E-01	2.750E-04	4.350E-06	1.740E 00	0.000E+00	0.000E+00
382	942400	3.700E-01	7.070E-04	2.620E-06	4.640E-01	0.000E+00	0.000E+00
382	942410	3.630E-01	2.870E-03	5.900E-06	2.310E 00	0.000E+00	0.000E+00
382	942420	3.700E-01	1.020E-03	5.500E-06	4.640E-01	0.000E+00	0.000E+00
382	942430	3.630E-01	7.400E-03	8.036E-05	2.310E+00	0.000E+00	0.000E+00
382	942440	1.460E-01	2.900E-03	2.894E-05	1.820E-01	0.000E+00	0.000E+00
382	952410	1.419E 00	1.470E-04	3.750E-07	3.540E-01	3.114E-01	0.000E+00
382	952421	2.800E-01	3.460E-03	1.430E-05	3.420E 00	0.000E+00	0.000E+00
382	952420	6.840E-02	3.460E-03	1.430E-05	4.320E-01	0.000E+00	0.000E+00
382	952430	7.002E-02	9.390E-05	2.042E-06	2.800E-01	7.080E-01	0.000E+00
382	952441	4.540E-02	3.460E-03	0.000E+00	2.930E-01	0.000E+00	0.000E+00
382	952440	4.540E-02	3.460E-03	0.000E+00	2.930E-01	0.000E+00	0.000E+00
382	962420	2.200E-01	5.680E-03	1.760E-06	2.160E-01	0.000E+00	0.000E+00
382	962430	1.790E-01	2.890E-03	3.076E-06	2.340E+00	0.000E+00	0.000E+00
382	962440	6.710E-01	5.680E-04	1.693E-05	5.320E-01	0.000E+00	0.000E+00
382	962450	1.790E-01	2.890E-03	1.989E-05	2.340E+00	0.000E+00	0.000E+00
382	962460	6.710E-01	5.680E-04	4.538E-05	5.320E-01	0.000E+00	0.000E+00
382	962470	1.790E-01	4.490E-03	3.838E-05	2.340E+00	0.000E+00	0.000E+00
382	962480	6.710E-01	1.170E-03	4.720E-05	5.320E-01	0.000E+00	0.000E+00

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