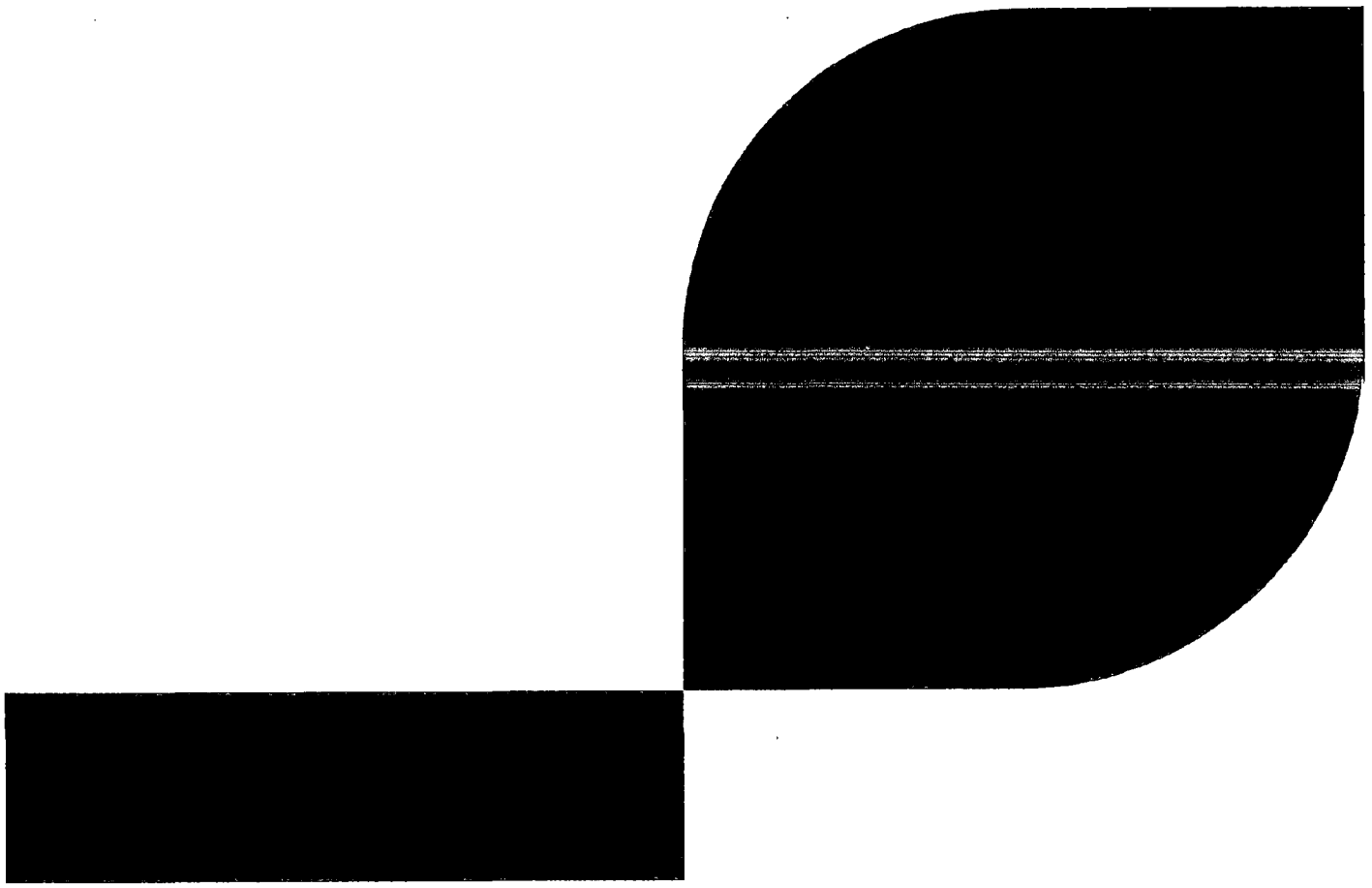
ANP-3013NP, Revision 0, *Brunswick Unit 1 Cycle 19 Fuel Cycle Design MELLLA+ Operating Domain*, May 2013



ANP-3013(NP)
Revision 0

Brunswick Unit 1 Cycle 19 Fuel Cycle Design
MELLLA+ Operating Domain

May 2013

AREVA NP Inc.

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Nature of Changes

Item	Page	Description and Justification
1.	All	This is the initial release.

Contents

Tables

Figures

Nomenclature

ACE	AREVA NP's advanced critical power correlation [ ]
APLHGR	average planar linear heat generation rate
BOC	beginning of cycle
BOL	beginning of life
BWR	boiling water reactor
CSDM	cold shutdown margin
EOC	end of cycle
EOFP	end of full power capability
EFW	extended flow window operating domain (e.g. MELLLA+)
FFTR	final feedwater temperature reduction
GWd/MTU	gigawatt days per metric ton of initial uranium
HEXR	hot excess reactivity
LHGR	linear heat generation rate
MCPR	minimum critical power ratio
MICROBURN-B2	AREVA NP advanced BWR core simulator methodology with PPR capability
MWd/MTU	megawatt days per metric ton of initial uranium
NRC	Nuclear Regulatory Commission, U.S.
PLFR	part length fuel rod
PPR	Pin Power Reconstruction. The PPR methodology accounts for variation in local rod power distributions due to neighboring assemblies and control state. The local rod power distributions are reconstructed based on the actual flux solution for each statepoint.
R Value	the larger of zero or the shutdown margin at BOC minus the minimum calculated shutdown margin in the cycle
SLC	standby liquid control
SPCB	AREVA NP (formerly Siemens Power Corporation) critical power correlation

1.0 Introduction

MELLLA+ is an EFW operating domain that allows the use of lower flow rates when compared to the MELLLA domain. Specifically, at rated conditions the MELLLA+ domain allows for operation at flows greater than or equal to 85% of the rated core flow.

AREVA NP Inc. (AREVA) has performed a fuel cycle design and fuel management calculations for the Cycle 19 operation of the Brunswick Unit 1 in the MELLLA+ operating domain. These analyses have been performed with the approved AREVA neutronics methodology (Reference 1). The CASMO-4 lattice depletion code was used to generate nuclear data including cross sections and local power peaking factors. The MICROBURN-B2 three dimensional core simulator code, combined with the application of the applicable critical power correlation, was used to model the core. The MICROBURN-B2 pin power reconstruction (PPR) model was used to determine the thermal margins presented in this report. The ACE critical power correlation (Reference 3) was utilized for the ATRIUM™ 10XM* fuel assemblies while the co-resident ATRIUM-10 fuel assemblies will continue to be monitored with the SPCB correlation (Reference 2). The following MICROBURN-B2 modeling features are included in this analysis:

- Control blade B-10 depletion
- Explicit neutronic treatment of the spacer grids
- Explicit modeling of the PLFR plenums
- Explicit modeling of the water rod flow

Design results for the Cycle 19 reactor core loading including projected control rod patterns and evaluations of thermal and reactivity margins are presented. The Cycle 19 results are based on Cycle 18 core operational history as summarized in Table 2.1

* ATRIUM is a trademark of AREVA NP.

2.0 Summary

The Cycle 19 fresh batch size (234 assemblies) and batch average enrichment [ ] were determined to meet the energy requirements provided by Progress Energy (References 5 through 8). For a complete description of the fresh reload assemblies, see Reference 4. The loading of the Cycle 19 fuel as described in this report results in a projected Cycle 19 full power energy capability (including FFTR) of 1,891±30 GWd (18,788±300 MWd/MTU). Beyond the full power capability, the cycle has been designed to achieve 38 GWd additional energy via Constant Pressure Power Coastdown operation.

In order to obtain optimum operating flexibility, the projected control rod patterns for Cycle 19 were developed to be consistent with a conservative margin to thermal limits. The cycle design calculations also demonstrate adequate hot excess reactivity and cold shutdown margin throughout the cycle. Key results from the design analysis are summarized in Table 2.1. Table 2.2 summarizes the assembly identification range by nuclear fuel type batch for the Cycle 19 design. Figures 2.1 and 2.2 provide a summary of the cycle design step-through projection.

Table 2.1 Brunswick Unit 1 Cycle 19 Energy and Key Results Summary

Cycle Energy, GWd (Cycle Exposure, MWd/MTU)	
Cycle 18	
• Core follow through April 19, 2011	1,020 (10,205)
• Best estimate depletion to Nominal EOC 18	1,903 (19,030)
• Short window EOC 18	1,859 (18,592)
• Long window EOC 18	1,953 (19,527)
Cycle 19	
• EOFP Energy (including FFTR)	1,891±30 (18,788±300)
• Constant Pressure Power Coastdown Energy	38 (378)
• EOC Energy	1,929±30 (19,166±300)

Key Results	
BOC CSDM, %Δk/k (based on short EOC 18)	1.29
Minimum CSDM, %Δk/k (based on short EOC 18)	1.29
Cycle Exposure of Minimum CSDM, MWd/MTU (short basis)	0
Cycle R Value, %Δk/k (short basis)	0.00
Minimum SLC SDM, %Δk/k (based on short EOC 18)	2.67
Cycle Exposure of Minimum SLC SDM, MWd/MTU (short basis)	0
BOC HEXR, %Δk/k (based on nominal EOC 18)	1.65
Maximum HEXR, %Δk/k (based on nominal EOC 18)	1.93
Cycle Exposure of Maximum HEXR, MWd/MTU (nominal basis)	14,000
Minimum MAPLHGR Margin, %	15.1
Exposure of Minimum MAPLHGR Margin, MWd/MTU	9,000
Minimum LHGR Margin, %	10.4
Exposure of Minimum LHGR Margin, MWd/MTU	9,300
Minimum CPR Margin, %	8.1
Exposure of Minimum CPR Margin, MWd/MTU	7,000

Table 2.2 Brunswick Unit 1 Cycle 19 Fuel Cycle Design Assembly ID Range by Nuclear Fuel Type

Nuclear Fuel Type	Number of Assemblies	Assembly ID Range
30	38	A17001-A17152
31	46	A17153-A17248
32	80	A18301-A18380
33	162	A18381-A18542
34	96	A19601-A19696
35	138	A19697-A19834

Table 2.3 Assumed MCPR Operating Limits

Cycle Exposure (GWd/MTU)	ATRIUM 10XM OLMCPR	ATRIUM-10 OLMCPR
0.0	1.39	1.48
16.7	1.41	1.54
18.225	1.42	1.55

Table 2.4 Assumed ATRIUM 10XM LHGR Limits

Peak Pellet Exposure (GWd/MTU)	LHGR kW/ft
0.0	14.1
18.9	14.1
74.4	7.4

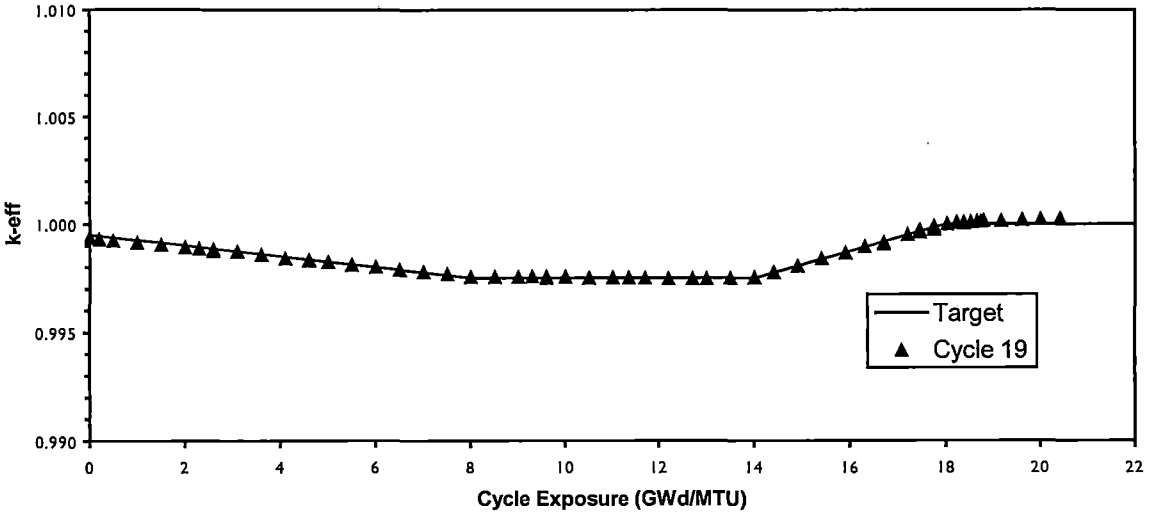


Figure 2.1 Brunswick Unit 1 Cycle 19 Design Step-Through k-eff versus Cycle Exposure

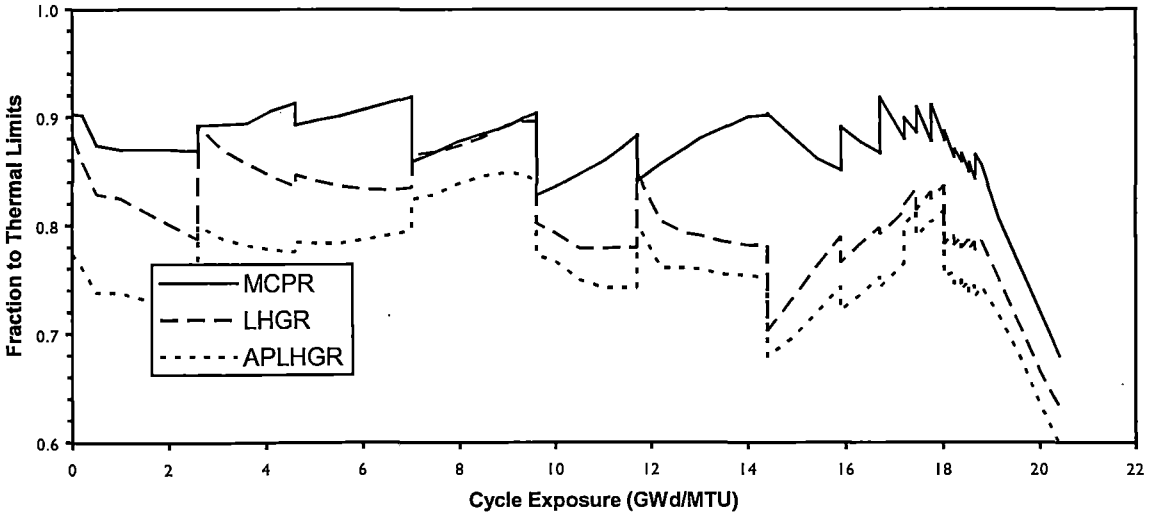


Figure 2.2 Brunswick Unit 1 Cycle 19 Design Margin to Thermal Limits versus Cycle Exposure

3.0 Cycle 19 Fuel Cycle Design

3.1 *General Description*

The assembly design for the Cycle 19 fresh reload fuel for Brunswick Unit 1 is described in detail in Reference 4. Elevation views of the fresh reload fuel design axial enrichment and gadolinia distributions are shown in Appendix B, Figures B.1 and B.2. The loading pattern maintains full symmetry within a scatter load fuel management scheme. This loading in conjunction with the control rod patterns presented in Appendix A shows acceptable power peaking and associated margins to limits for projected Cycle 19 operation. The analyses supporting this fuel cycle design were based on the core parameters shown in Table 3.1. Figures 3.1 through 3.5, along with Table 3.1 define the reference loading pattern used in the fuel cycle design. The specific core location of the fresh assemblies in Cycle 19 is provided in Appendix C. Key results for the cycle are summarized in Table 2.1.

Exposure limits have been checked on the long Cycle 18 energy window and the Cycle 19 operation to 703 EFPD. It has been confirmed that no full-length rod average exposure exceeds 60 GWd/MTU.

3.2 *Control Rod Patterns and Thermal Limits*

Projected control rod patterns for Cycle 19 and resultant key operating parameters including thermal margins are shown in Appendix A. The thermal margins presented in this report were determined using the MICROBURN-B2 3D core simulator PPR model to provide adequate margin to thermal limits. The thermal limit margins presented in this report are based on assumed thermal limits (See Table 2.3 and 2.4) and are subject to change pending the completion of the thermal-mechanical and safety analyses. A detailed summary of the core parameters resulting from the step-through projection analysis is provided in Tables A.1 and A.2. Limiting results from the step-through are summarized in Table 2.1 and in Figure 2.2. The hot operating target k-eff versus cycle exposure which was determined to be appropriate for Cycle 19 is shown in Table 3.2 (Reference 9). The k-eff and margin to limits results from the design cycle depletion are presented graphically in Figures 2.1 and 2.2. The k-eff values presented in Figure 2.1 and in Appendix A are not bias corrected. Selected exposure and radial power distributions from the design step-through are presented in Appendix D. The maximum core exit void for the design step-through was determined to be 88.8%.

3.3 *Hot Excess Reactivity and Cold Shutdown Margin*

The cycle design calculations demonstrate adequate hot excess reactivity, SLC shutdown margin, and cold shutdown margin throughout the cycle. Key shutdown margin and R-Value results are presented in Table 2.1. The shutdown margin for Cycle 19 is in conformance with the Technical Specification limit of R + 0.38 %Δk/k at BOC. The cold target k-eff versus exposure determined to be appropriate for calculation of cold shutdown margin in Cycle 19 is shown in Table 3.3 (Reference 9). The core hot excess reactivity was calculated at full power with all rods out, 77.0 Mlb/hr core flow, with equilibrium xenon. Table 3.4 summarizes the Cycle 19 reactivity margins versus cycle exposure, including the SLC shutdown margin for the cycle. The results in this table meet all applicable Reference 5 acceptance criteria.

BOC cold shutdown margin was evaluated to be 1.29 %Δk/k at a cold temperature of 55 °F. Calculations have been performed at temperatures above 68 °F to determine the shutdown margin at the most reactive temperature.

Table 3.1 Cycle 19 Core Composition and Design Parameters

Fuel Description	Cycle Loaded	Nuclear Fuel Type	Number of Assemblies
ATRIUM-10 [ ]	17	30	38
ATRIUM-10 [ ]	17	31	46
ATRIUM-10 [ ]	18	32	80
ATRIUM-10 [ ]	18	33	162
ATRIUM 10XM [ ]	19	34	96
ATRIUM 10XM [ ]	19	35	138

Number of Fuel Assemblies in Core	560
Total Number of Fresh Assemblies	234
Total Core Mass, MTU	100.66
Rated Thermal Power Level, MW_t	2,923
Rated Core Flow, Mlb/hr	77.0
Reference Pressure, psia	1,045*
Reference Inlet Subcooling, Btu/lbm	22.0†

* Value is representative of MICROBURN-B2 input for dome pressure at rated conditions and varies depending on core state point.

† Value is typically determined by MICROBURN-B2 using a heat balance method based on nominal feedwater temperature and other parameters identified in the cycle specific plant parameters document.

Table 3.2 Brunswick Unit 1 Cycle 19 Hot Operating Target k-eff versus Cycle Exposure

Cycle Exposure (MWd/MTU)	Hot Operating k-eff*
0.0	0.9995
8,000.0	0.9975
14,000.0	0.9975
18,000.0	1.0000
22,000.0	1.0000

Table 3.3 Brunswick Unit 1 Cycle 19 Cold Critical Target k-eff versus Cycle Exposure

Cycle Exposure (MWd/MTU)	Cold Critical k-eff*
0.0	0.9940
6,000.0	0.9900
22,000.0	0.9900

* Values are linearly interpolated between cycle exposure points.

Table 3.4 Brunswick Unit 1 Cycle 19 Reactivity Margin Summary

Cycle Exposure (MWd/MTU)	Cold Shutdown Margin* (% Δk/k)	SLC Cold Shutdown Margin† (% Δk/k)	Hot Excess Reactivity‡ (% Δk/k)
0	1.29§	2.67	1.65
200	1.58	2.92	1.61
1,000	1.92	3.20	1.42
2,300	2.18	3.44	1.41
3,600	2.28	3.61	1.40
5,500	2.34	3.75	1.44
7,500	2.36	3.87	1.59
9,000	2.41	3.92	1.69
10,000	2.42	3.95	1.75
11,000	2.34	3.98	1.80
12,200	2.16	3.94	1.87
13,000	2.03	3.92	1.92
14,000	**1.84**	3.92	1.93
15,400	**1.55**	4.12	1.65
16,700	**1.38**	4.57	1.03
18,225	**1.39**	5.27	-0.11
18,788	**1.42**	5.52	--
19,166	**1.49**	5.71	--
20,414	**1.79**	6.44	--

NOTE: Values are shown in **bold** if the most reactive temperature is greater then 68 °F.

* Based on short window EOC 18 and 68 °F.

† Based on short window EOC 18, calculated at 360.8 °F ARO conditions.

‡ Based on nominal EOC 18.

§ Evaluated at 55 °F which bounds values at 68 °F.

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									A17167	A17179	A17007	A17043	A17162
50								A17126	A18373	A18318	A18342	A18366	A18326
48					A17163	A17008	A17155	A18358	A18310	A19634	A18496	A19610	A19602
46				A17185	A17153	A18334	A18302	A19658	A19650	A19642	A19626	A19618	A18488
44			A17168	A17002	A18349	A19690	A18383	A19666	A19831	A18456	A19819	A18408	A19791
42			A17102	A18333	A19689	A18350	A19682	A19674	A18440	A19815	A18512	A19787	A18432
40			A17019	A18301	A18539	A19681	A19827	A18463	A19811	A18495	A19783	A18400	A19755
38		A17154	A18357	A19657	A19665	A19673	A18448	A19807	A18504	A19779	A18381	A19751	A18424
36	A17025	A18377	A18309	A19649	A19823	A18439	A19803	A18503	A19775	A18464	A19747	A18392	A19727
34	A17161	A18341	A19633	A19641	A18455	A19799	A18511	A19771	A18480	A19743	A18447	A19723	A18416
32	A17054	A18317	A18535	A19625	A19795	A18479	A19767	A18471	A19739	A18523	A19719	A18531	A19707
30	A17001	A18365	A19609	A19617	A18407	A19763	A18399	A19735	A18391	A19715	A18527	A19703	A18519
28	A17083	A18325	A19601	A18487	A19759	A18431	A19731	A18423	A19711	A18415	A19699	A18384	A18472
26	A17235	A18332	A19608	A18494	A19762	A18438	A19734	A18430	A19714	A18422	A19702	A18526	A19697
24	A17149	A18372	A19616	A19624	A18414	A19766	A18406	A19738	A18398	A19718	A18530	A19706	A18522
22	A17094	A18324	A18538	A19632	A19798	A18486	A19770	A18478	A19742	A18542	A19722	A18453	A19710
20	A17243	A18348	A19640	A19648	A18462	A19802	A18405	A19774	A18454	A19746	A18534	A19726	A18421
18	A17125	A18380	A18316	A19656	A19826	A18446	A19806	A18510	A19778	A18485	A19750	A18518	A19730
16		A17244	A18364	A19664	A19672	A19680	A18470	A19810	A18509	A19782	A18413	A19754	A18429
14			A17129	A18308	A18477	A19688	A19830	A18502	A19814	A18445	A19786	A18389	A19758
12			A17061	A18340	A19696	A18355	A19687	A19679	A18469	A19818	A18517	A19790	A18437
10			A17202	A17245	A18356	A19695	A18390	A19671	A19834	A18461	A19822	A18397	A19794
8				A17211	A17150	A18339	A18307	A19663	A19655	A19647	A19631	A19623	A18493
6					A17232	A17140	A17237	A18363	A18315	A19639	A18501	A19615	A19607
4								A17216	A18376	A18323	A18347	A18371	A18331
2									A17212	A17215	A17236	A17101	A17139

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	A17024	A17052	A17013	A17186	A17189								
50	A18327	A18367	A18343	A18319	A18374	A17157							
48	A19603	A19611	A18497	A19635	A18311	A18359	A17204	A17014	A17169				
46	A18489	A19619	A19627	A19643	A19651	A19659	A18303	A18335	A17004	A17190			
44	A19792	A18532	A19820	A18457	A19832	A19667	A18473	A19691	A18352	A17003	A17199		
42	A18433	A19788	A18514	A19816	A18441	A19675	A19683	A18351	A19692	A18336	A17156		
40	A19756	A18401	A19784	A18465	A19812	A18498	A19828	A19684	A18386	A18304	A17158		
38	A18425	A19752	A18513	A19780	A18505	A19808	A18449	A19676	A19668	A19660	A18360	A17178	
36	A19728	A18393	A19748	A18466	A19776	A18506	A19804	A18442	A19824	A19652	A18312	A18378	A17028
34	A18417	A19724	A18450	A19744	A18385	A19772	A18540	A19800	A18458	A19644	A19636	A18320	A17165
32	A19708	A18528	A19720	A18481	A19740	A18474	A19768	A18482	A19796	A19628	A18536	A18344	A17059
30	A18520	A19704	A18409	A19716	A18394	A19736	A18402	A19764	A18410	A19620	A19612	A18368	A17166
28	A19698	A18524	A19700	A18418	A19712	A18426	A19732	A18434	A19760	A18490	A19604	A18328	A17092
26	A18476	A18525	A19701	A18419	A19713	A18427	A19733	A18435	A19761	A18491	A19605	A18329	A17070
24	A18521	A19705	A18529	A19717	A18395	A19737	A18403	A19765	A18411	A19621	A19613	A18369	A17240
22	A19709	A18452	A19721	A18541	A19741	A18475	A19769	A18483	A19797	A19629	A18537	A18345	A17099
20	A18420	A19725	A18533	A19745	A18451	A19773	A18388	A19801	A18459	A19645	A19637	A18321	A17248
18	A19729	A18428	A19749	A18484	A19777	A18507	A19805	A18443	A19825	A19653	A18313	A18379	A17200
16	A18396	A19753	A18382	A19781	A18508	A19809	A18467	A19677	A19669	A19661	A18361	A17230	
14	A19757	A18404	A19785	A18468	A19813	A18499	A19829	A19685	A18387	A18305	A17213		
12	A18436	A19789	A18516	A19817	A18444	A19678	A19686	A18354	A19693	A18337	A17128		
10	A19793	A18412	A19821	A18460	A19833	A19670	A18515	A19694	A18353	A17152	A17233		
8	A18492	A19622	A19630	A19646	A19654	A19662	A18306	A18338	A17151	A17214			
6	A19606	A19614	A18500	A19638	A18314	A18362	A17246	A17145	A17203				
4	A18330	A18370	A18346	A18322	A18375	A17247							
2	A17239	A17110	A17146	A17222	A17134								

Figure 3.1 Brunswick Unit 1 Cycle 19 Reference Loading Pattern

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									31	31	30	30	31
									33.6	33.3	31.1	32.3	33.0
50	Nuclear Fuel Type							30	32	32	32	32	32
	BOC Exposure (GWd/MTU)							33.9	22.4	20.6	19.9	19.5	19.7
48					31	30	31	32	32	34	33	34	34
					36.8	33.9	32.3	23.0	21.1	0.0	23.7	0.0	0.0
46				31	31	32	32	34	34	34	34	34	33
				36.3	32.9	21.3	21.2	0.0	0.0	0.0	0.0	0.0	21.8
44			31	30	32	34	33	34	35	33	35	33	35
			38.8	30.9	17.9	0.0	23.8	0.0	0.0	23.0	0.0	23.2	0.0
42			30	32	34	32	34	34	33	35	33	35	33
			34.2	21.0	0.0	18.1	0.0	0.0	22.6	0.0	23.3	0.0	23.4
40			30	32	33	34	35	33	35	33	35	33	35
			32.5	20.7	23.3	0.0	0.0	22.4	0.0	22.2	0.0	23.4	0.0
38		31	32	34	34	34	33	35	33	35	33	35	33
		34.9	22.9	0.0	0.0	0.0	22.3	0.0	22.5	0.0	23.1	0.0	22.9
36	30	32	32	34	35	33	35	33	35	33	35	33	35
	33.8	22.1	20.7	0.0	0.0	22.1	0.0	22.0	0.0	22.9	0.0	23.1	0.0
34	31	32	34	34	33	35	33	35	33	35	33	35	33
	30.2	19.7	0.0	0.0	22.2	0.0	23.0	0.0	23.1	0.0	22.6	0.0	22.6
32	30	32	33	34	35	33	35	33	35	33	35	33	35
	32.6	20.3	23.5	0.0	0.0	22.5	0.0	22.0	0.0	23.2	0.0	22.6	0.0
30	30	32	34	34	33	35	33	35	33	35	33	35	33
	31.7	19.4	0.0	0.0	22.5	0.0	21.7	0.0	22.6	0.0	22.6	0.0	23.6
28	30	32	34	33	35	33	35	33	35	33	35	33	33
	32.8	19.5	0.0	21.4	0.0	22.6	0.0	22.2	0.0	23.1	0.0	23.7	23.4

Fuel Type	Description	Cycle Loaded	No. Per Quarter core
30	[ ]	17	11
31	[ ]	17	10
32	[ ]	18	20
33	[ ]	18	41
34	[ ]	19	24
35	[ ]	19	34

Figure 3.2 Brunswick Unit 1 Cycle 19 Upper Left Quarter Core Layout by Fuel Type

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	30	30	30	31	31								
	31.9	31.4	32.5	32.3	33.0								
50	32	32	32	32	32	31			Nuclear Fuel Type				
	20.0	19.8	20.2	20.8	22.7	34.7			BOC Exposure (GWd/MTU)				
48	34	34	33	34	32	32	31	30	31				
	0.0	0.0	24.0	0.0	21.2	23.3	32.4	31.7	39.0				
46	33	34	34	34	34	34	32	32	30	31			
	22.0	0.0	0.0	0.0	0.0	0.0	21.3	21.6	31.7	38.6			
44	35	33	35	33	35	34	33	34	32	30	31		
	0.0	23.0	0.0	23.3	0.0	0.0	23.8	0.0	18.2	31.1	39.2		
42	33	35	33	35	33	34	34	32	34	32	31		
	23.6	0.0	23.4	0.0	22.8	0.0	0.0	18.3	0.0	21.5	34.6		
40	35	33	35	33	35	33	35	34	33	32	31		
	0.0	23.5	0.0	23.1	0.0	22.7	0.0	0.0	24.0	21.1	32.6		
38	33	35	33	35	33	35	33	34	34	34	32	31	
	23.0	0.0	23.6	0.0	22.7	0.0	22.6	0.0	0.0	0.0	23.3	35.3	
36	35	33	35	33	35	33	35	33	35	34	32	32	30
	0.0	23.2	0.0	22.9	0.0	22.5	0.0	22.6	0.0	0.0	21.2	22.5	33.2
34	33	35	33	35	33	35	33	35	33	34	34	32	31
	22.7	0.0	22.9	0.0	23.8	0.0	23.7	0.0	22.6	0.0	0.0	20.8	32.5
32	35	33	35	33	35	33	35	33	35	34	33	32	30
	0.0	22.9	0.0	23.4	0.0	22.4	0.0	22.9	0.0	0.0	23.9	20.1	31.6
30	33	35	33	35	33	35	33	35	33	34	34	32	31
	23.7	0.0	23.2	0.0	23.0	0.0	22.2	0.0	22.9	0.0	0.0	19.7	29.6
28	35	33	35	33	35	33	35	33	35	33	34	32	30
	0.0	23.5	0.0	23.2	0.0	22.5	0.0	23.1	0.0	21.9	0.0	20.0	32.3

Fuel Type	Description	Cycle Loaded	No. Per Quarter core
30	[ ]	17	9
31	[ ]	17	12
32	[ ]	18	20
33	[ ]	18	40
34	[ ]	19	24
35	[ ]	19	35

Figure 3.3 Brunswick Unit 1 Cycle 19 Upper Right Quarter Core Layout by Fuel Type

	1	3	5	7	9	11	13	15	17	19	21	23	25
26	31	32	34	33	35	33	35	33	35	33	35	33	35
	32.1	19.7	0.0	21.5	0.0	22.6	0.0	22.0	0.0	22.8	0.0	23.2	0.0
24	30	32	34	34	33	35	33	35	33	35	33	35	33
	31.6	19.4	0.0	0.0	22.5	0.0	21.7	0.0	22.6	0.0	22.5	0.0	23.5
22	30	32	33	34	35	33	35	33	35	33	35	33	35
	32.5	20.4	23.5	0.0	0.0	22.4	0.0	22.0	0.0	23.2	0.0	22.3	0.0
20	31	32	34	34	33	35	33	35	33	35	33	35	33
	32.7	19.8	0.0	0.0	22.1	0.0	23.4	0.0	22.4	0.0	22.6	0.0	22.6
18	30	32	32	34	35	33	35	33	35	33	35	33	35
	33.4	22.2	20.7	0.0	0.0	22.1	0.0	22.0	0.0	23.1	0.0	23.0	0.0
16		31	32	34	34	34	33	35	33	35	33	35	33
		34.6	22.9	0.0	0.0	0.0	22.4	0.0	22.4	0.0	23.3	0.0	22.9
14			30	32	33	34	35	33	35	33	35	33	35
			32.3	20.7	23.5	0.0	0.0	22.2	0.0	22.7	0.0	23.8	0.0
12			30	32	34	32	34	34	33	35	33	35	33
			33.0	21.2	0.0	17.9	0.0	0.0	22.9	0.0	23.2	0.0	23.4
10			31	31	32	34	33	34	35	33	35	33	35
			39.8	32.4	18.0	0.0	23.7	0.0	0.0	23.1	0.0	23.1	0.0
8				31	30	32	32	34	34	34	34	34	33
				39.1	30.9	21.2	21.4	0.0	0.0	0.0	0.0	0.0	21.7
6					31	30	31	32	32	34	33	34	34
					38.9	33.8	34.5	22.9	21.2	0.0	23.7	0.0	0.0
4	Nuclear Fuel Type							31	32	32	32	32	32
	BOC Exposure (GWd/MTU)							36.8	22.3	20.6	19.8	19.4	19.7
2									31	31	31	30	30
									33.6	32.7	32.7	32.1	30.8

Fuel Type	Description	Cycle Loaded	No. Per Quarter core
30	[ ]	17	9
31	[ ]	17	12
32	[ ]	18	20
33	[ ]	18	40
34	[ ]	19	24
35	[ ]	19	35

Figure 3.4 Brunswick Unit 1 Cycle 19 Lower Left Quarter Core Layout by Fuel Type

	27	29	31	33	35	37	39	41	43	45	47	49	51
26	33	33	35	33	35	33	35	33	35	33	34	32	30
	23.9	23.5	0.0	23.3	0.0	22.6	0.0	23.0	0.0	21.7	0.0	19.8	32.1
24	33	35	33	35	33	35	33	35	33	34	34	32	31
	23.7	0.0	22.9	0.0	23.0	0.0	22.2	0.0	22.9	0.0	0.0	19.7	29.8
22	35	33	35	33	35	33	35	33	35	34	33	32	30
	0.0	22.7	0.0	23.6	0.0	22.4	0.0	22.8	0.0	0.0	23.9	19.9	31.6
20	33	35	33	35	33	35	33	35	33	34	34	32	31
	22.8	0.0	23.0	0.0	23.0	0.0	23.8	0.0	22.6	0.0	0.0	20.6	32.5
18	35	33	35	33	35	33	35	33	35	34	32	32	31
	0.0	23.1	0.0	23.5	0.0	22.3	0.0	22.5	0.0	0.0	21.1	22.4	34.4
16	33	35	33	35	33	35	33	34	34	34	32	31	
	23.2	0.0	23.2	0.0	22.8	0.0	22.8	0.0	0.0	0.0	23.2	35.6	
14	35	33	35	33	35	33	35	34	33	32	31		
	0.0	23.5	0.0	23.2	0.0	22.6	0.0	0.0	24.0	21.1	33.1		
12	33	35	33	35	33	34	34	32	34	32	30		
	23.6	0.0	23.7	0.0	22.8	0.0	0.0	18.3	0.0	21.3	33.6		
10	35	33	35	33	35	34	33	34	32	30	31		
	0.0	23.3	0.0	23.4	0.0	0.0	23.3	0.0	18.1	31.5	38.8		
8	33	34	34	34	34	34	32	32	30	31			
	22.0	0.0	0.0	0.0	0.0	0.0	21.4	21.6	30.7	38.8			
6	34	34	33	34	32	32	31	30	31				
	0.0	0.0	24.1	0.0	21.2	23.3	32.2	33.4	39.2				
4	32	32	32	32	32	31			Nuclear Fuel Type				
	20.0	19.7	20.2	20.8	22.7	34.5			BOC Exposure (GWd/MTU)				
2	31	30	30	31	30								
	32.5	31.7	30.7	32.6	32.3								

Fuel Type	Description	Cycle Loaded	No. Per Quarter core
30	[ ]	17	9
31	[ ]	17	12
32	[ ]	18	20
33	[ ]	18	41
34	[ ]	19	24
35	[ ]	19	34

Figure 3.5 Brunswick Unit 1 Cycle 19 Lower Right Quarter Core Layout by Fuel Type

4.0 Special Analyses

The following special analyses were performed at customer request.

4.1 *Hot Standby Boron Worth (HSBW)*

AREVA has calculated the Brunswick Unit 1 Equilibrium Cycle margin to criticality at hot standby conditions with the standby liquid control system engaged. The limiting result is presented in Table 4.1 for a moderator boron concentration of 522 ppm. The target k-eff is the average of the hot and cold target k-eff values. As shown, the shutdown margin is greater than 0.4 %Δk/k limit.

4.2 *Voiding in the Channel Bypass Region*

To demonstrate compliance with the NRC's requirement that there be less than 5% bypass voiding around the LPRMs (see Section 5.1.1.5.1 of Reference 10), the bypass void level has been evaluated throughout the equilibrium cycle. The maximum bypass void value applicable to the Cycle 19 design [

]

* [ ]

† [ ]

Table 4.1 Hot Standby Boron Worth Minimum Shutdown Margin

Operating Domain	Boron Concentration (ppm)	Cycle Exposure* (MWd/MTU)	k-eff	Target k-eff	Shutdown Margin (% Δk/k)
MELLLA+	522	14900	0.98868	0.99403	0.53
MELLLA	522	16700	0.99459	0.98581	0.88

Table 4.2 Maximum Bypass Voiding at LPRM Level D

Power (%), Flow (%) Condition	Cycle Exposure (GWd/MTU)	Bypass Void (%)
[		]

NOTE: There is no bypass voiding at LPRM levels A, B, or C.

* Cycle exposure at minimum SDM.

5.0 References

1. EMF-2158(P)(A) Revision 0, *Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2*, Siemens Power Corporation, October 1999.

2. EMF-2209(P)(A) Revision 3, *SPCB Critical Power Correlation,* AREVA NP, September 2009.

3. ANP-10298(P)(A) Revision 0, *ACE/ATRIUM-10XM Critical Power Correlation,* AREVA NP, March 2010.

4. ANP-3006(P) Revision 0, *Nuclear Fuel Design Report Brunswick Unit 1 Cycle 19 ATRIUM 10XM Fuel,* AREVA NP, June 2011.

5. Letter, E. J. Geyer (Progress Energy) to R. J. DeSteese (AREVA), "BRK1-19 Energy Utilization Plan Revision 1," NF11-016, January 25, 2011. (38-9153944-000)

6. Letter, E. J. Geyer (Progress Energy) to R. J. DeSteese (AREVA), "BRK1-19 Energy Utilization Plan Revision 3 (Control Blade Replacement)," NF11-129, May 4, 2011. (38-9161259-000)

7. Letter, E. J. Geyer (Progress Energy) to R. J. DeSteese (AREVA), "BRK1-19 Energy Utilization Plan Revision 4 (Conservative SIL320 Implementation)," NF11-137, May 17, 2011. (38-9161750-000)

8. 51-9152200-001, "Brunswick Unit 1 Cycle 19 Nuclear Design Basis Plan," AREVA NP, February 3, 2011.

9. 12-9151855-000, "Brunswick Unit 1 Cycle 19 Target K-effective Selection," AREVA NP, January 19, 2011.

10. Safety Evaluation by the Office of Nuclear Reactor Regulation Licensing Topical Report NEDC-33006P, *General Electric Boiling Water Reactor Maximum Extended Load Line Limit Analysis Plus,* General Electric Hitachi Nuclear Energy America, LLC, October 2008. (ADAMS Accession Number ML 081130008).

Appendix A Brunswick Unit 1 Cycle 19 Step-Through Depletion Summary, Control Rod Patterns and Core Average Axial Power and Exposure Distributions

Table A.1 Brunswick Unit 1 Cycle 19 Design Depletion Summary

Cycle Exposure (GWd/MT)	Calculated K-eff	Control Rod Density	Total Core Power MWt	Total Core Flow (Mlb/hr)	Ref. Pressure (psia)	Inlet Sub-Cooling (Btu/lb)	Void Fraction	Core Minimum CPR	Core Maximum LHGR (kW/ft)	Core Maximum APLHGR (kW/ft)
0.000	0.99937	6.42	2923.0	68.14	1044.53	24.46	0.538	1.614	12.43	9.64
0.200	0.99930	6.42	2923.0	68.53	1044.53	24.31	0.533	1.618	12.10	9.41
0.500	0.99922	6.42	2923.0	72.76	1044.59	22.74	0.517	1.656	11.69	9.09
1.000	0.99913	6.42	2923.0	73.92	1044.61	22.33	0.513	1.651	11.64	9.12
1.500	0.99903	6.42	2923.0	73.15	1044.60	22.59	0.512	1.643	11.47	9.06
2.000	0.99891	6.42	2923.0	72.50	1044.59	22.83	0.510	1.635	11.29	8.98
2.300	0.99884	6.42	2923.0	72.19	1044.58	22.94	0.509	1.632	11.19	8.94
2.600	0.99874	6.42	2923.0	71.88	1044.58	23.05	0.508	1.629	11.09	8.91
2.601	0.99881	5.66	2923.0	71.61	1044.58	23.14	0.522	1.583	12.58	9.95
3.100	0.99871	5.66	2923.0	70.84	1044.57	23.43	0.520	1.579	12.26	9.78
3.600	0.99856	5.66	2923.0	70.07	1044.55	23.71	0.519	1.576	12.08	9.72
4.100	0.99840	5.66	2923.0	69.30	1044.54	24.01	0.518	1.569	11.92	9.67
4.600	0.99830	5.66	2923.0	68.53	1044.53	24.31	0.517	1.560	11.78	9.67
4.601	0.99833	6.20	2923.0	75.27	1044.62	21.89	0.503	1.557	11.94	9.90
5.000	0.99824	6.20	2923.0	74.50	1044.62	22.13	0.504	1.555	11.88	9.90
5.500	0.99811	6.20	2923.0	73.34	1044.60	22.53	0.504	1.551	11.80	9.92
6.000	0.99800	6.20	2923.0	72.00	1044.58	23.00	0.505	1.544	11.76	9.97
6.500	0.99787	6.20	2923.0	70.46	1044.56	23.57	0.508	1.529	11.75	10.05
7.000	0.99778	6.20	2923.0	68.92	1044.54	24.16	0.510	1.516	11.77	10.17
7.001	0.99778	6.57	2923.0	76.23	1044.64	21.58	0.500	1.667	12.20	10.40
7.500	0.99768	6.57	2923.0	74.50	1044.62	22.13	0.503	1.646	12.24	10.53
8.000	0.99755	6.57	2923.0	72.96	1044.59	22.66	0.506	1.625	12.33	10.69
8.500	0.99755	6.57	2923.0	71.61	1044.58	23.14	0.509	1.607	12.40	10.78
9.000	0.99755	6.57	2923.0	70.26	1044.56	23.64	0.511	1.591	12.42	10.77
9.300	0.99756	6.57	2923.0	69.42	1044.55	23.97	0.512	1.578	12.38	10.77
9.600	0.99756	6.57	2923.0	68.65	1044.53	24.27	0.512	1.567	12.29	10.71
9.601	0.99750	8.12	2923.0	76.23	1044.64	21.58	0.481	1.689	11.18	9.94
10.000	0.99755	8.12	2923.0	75.00	1044.62	21.97	0.482	1.676	10.96	9.80
10.500	0.99751	8.12	2923.0	73.34	1044.60	22.53	0.482	1.656	10.58	9.51
11.000	0.99752	8.12	2923.0	71.61	1044.58	23.14	0.481	1.633	10.24	9.15
11.350	0.99752	8.12	2923.0	70.19	1044.56	23.67	0.481	1.614	10.21	9.13
11.700	0.99750	8.12	2923.0	68.72	1044.54	24.24	0.480	1.594	10.37	9.31
11.701	0.99750	7.30	2923.0	73.23	1044.60	22.58	0.494	1.652	11.34	9.97
12.200	0.99748	7.30	2923.0	71.69	1044.58	23.11	0.489	1.622	10.64	9.36
12.700	0.99748	7.30	2923.0	70.30	1044.56	23.63	0.484	1.595	10.17	9.01
13.000	0.99748	7.30	2923.0	69.49	1044.55	23.94	0.480	1.580	10.08	8.97
13.500	0.99751	7.30	2923.0	68.72	1044.54	24.24	0.473	1.564	9.91	9.00
14.000	0.99752	7.30	2923.0	68.26	1044.53	24.42	0.464	1.545	10.04	9.23
14.400	0.99776	7.30	2923.0	68.92	1044.54	24.16	0.455	1.541	10.25	9.37
14.401	0.99776	5.47	2923.0	68.14	1044.53	24.47	0.481	1.538	9.50	8.45
14.900	0.99805	5.47	2923.0	70.46	1044.56	23.58	0.464	1.575	9.90	8.74
15.400	0.99839	5.47	2923.0	73.92	1044.61	22.34	0.446	1.613	10.22	8.99
15.900	0.99867	5.47	2923.0	78.54	1044.67	20.86	0.426	1.634	10.49	9.22
15.901	0.99865	4.81	2923.0	69.30	1044.54	24.01	0.437	1.561	10.17	8.95
16.300	0.99895	4.81	2923.0	73.73	1044.60	22.40	0.419	1.585	10.31	9.07
16.700	0.99907	4.81	2923.0	79.12	1044.68	20.68	0.401	1.604	10.48	9.24
16.701	0.99914	3.59	2923.0	71.22	1044.57	23.27	0.424	1.560	10.39	9.14
17.200	0.99950	3.59	2923.0	79.69	1044.69	20.51	0.396	1.603	10.61	9.31
17.201	0.99950	3.41	2923.0	76.23	1044.64	21.56	0.401	1.588	10.82	9.91
17.450	0.99963	3.41	2923.0	80.31	1044.70	20.33	0.388	1.601	10.99	10.06
17.451	0.99972	2.19	2923.0	73.65	1044.61	22.41	0.408	1.555	10.50	9.63
17.750	0.99976	2.19	2923.0	79.89	1044.69	20.46	0.390	1.605	10.67	9.76
17.751	0.99988	1.03	2923.0	74.31	1044.61	22.19	0.408	1.568	10.54	9.66
18.025	1.00000	1.03	2923.0	80.08	1044.69	20.40	0.391	1.610	10.67	9.75
18.026	0.99998	0.00	2923.0	75.85	1044.64	21.68	0.408	1.602	10.08	9.22
18.225	1.00008	0.00	2923.0	80.46	1044.70	20.29	0.395	1.637	10.21	9.23
18.226	1.00007	0.00	2923.0	77.00	1044.30	24.32	0.392	1.633	10.03	9.10
18.375	1.00009	0.00	2923.0	80.39	1044.30	23.17	0.383	1.656	10.12	9.12
18.376	1.00004	0.00	2923.0	77.00	1044.30	27.11	0.380	1.652	9.96	8.99
18.525	1.00010	0.00	2923.0	80.46	1044.30	25.83	0.370	1.674	10.07	9.03

18.526	1.00010	0.00	2923.0	77.08	1044.30	29.70	0.368	1.669	9.91	8.92
18.650	1.00011	0.00	2923.0	80.27	1044.30	28.40	0.360	1.690	10.00	8.95
18.651	1.00011	0.00	2923.0	77.19	1044.30	32.10	0.358	1.686	9.86	8.85
18.661	1.00012	0.00	2923.0	77.46	1044.30	31.98	0.358	1.688	9.86	8.85
18.730	1.00012	0.00	2923.0	79.04	1044.30	31.28	0.353	1.698	9.91	8.87
18.788	1.00016	0.00	2923.0	80.46	1044.30	30.68	0.349	1.706	9.96	8.89
19.166	1.00015	0.00	2722.7	80.46	1044.30	28.43	0.330	1.822	9.55	8.41
19.600	1.00018	0.00	2492.5	80.46	1044.30	25.83	0.308	1.958	9.02	7.94
20.000	1.00022	0.00	2266.5	80.46	1044.30	23.29	0.287	2.110	8.57	7.51
20.414	1.00025	0.00	2046.4	80.46	1044.30	20.81	0.265	2.286	8.16	7.11

Table A.2 Brunswick Unit 1 Cycle 19 Design Depletion Thermal Margin Summary

Cycle Exposure (GWd/MT)	Calculated K-eff	Control Rod Density	Core Limiting CPR	Fraction of Limiting CPR	Core Limiting LHGR (kW/ft)	Fraction of Limiting LHGR	Core Limiting APLHGR (kW/ft)	Fraction of Limiting APLHGR
0.000	0.99937	6.417	1.639	0.903	12.43	0.882	8.92	0.774
0.200	0.99930	6.417	1.641	0.902	12.10	0.858	8.75	0.761
0.500	0.99922	6.417	1.693	0.874	11.69	0.829	8.43	0.738
1.000	0.99913	6.417	1.701	0.870	11.64	0.825	8.37	0.738
1.500	0.99903	6.417	1.701	0.870	11.47	0.813	8.11	0.732
2.000	0.99891	6.417	1.700	0.870	11.29	0.801	8.02	0.730
2.300	0.99884	6.417	1.702	0.869	11.19	0.794	7.95	0.727
2.600	0.99874	6.417	1.704	0.869	11.09	0.787	7.90	0.726
2.601	0.99881	5.657	1.660	0.892	12.58	0.892	8.78	0.800
3.100	0.99871	5.657	1.657	0.893	12.26	0.870	8.56	0.788
3.600	0.99856	5.657	1.655	0.894	12.08	0.857	8.43	0.782
4.100	0.99840	5.657	1.633	0.906	11.92	0.845	8.32	0.778
4.600	0.99830	5.657	1.621	0.913	11.78	0.836	8.22	0.776
4.601	0.99833	6.204	1.557	0.893	11.94	0.847	8.32	0.785
5.000	0.99824	6.204	1.649	0.897	11.88	0.842	8.25	0.784
5.500	0.99811	6.204	1.642	0.901	11.80	0.837	8.18	0.784
6.000	0.99800	6.204	1.632	0.907	11.76	0.834	8.14	0.787
6.500	0.99787	6.204	1.620	0.913	11.75	0.833	8.11	0.791
7.000	0.99778	6.204	1.610	0.919	11.77	0.835	8.09	0.796
7.001	0.99778	6.569	1.722	0.859	12.20	0.865	8.64	0.824
7.500	0.99768	6.569	1.704	0.868	12.24	0.868	8.61	0.829
8.000	0.99755	6.569	1.686	0.878	12.33	0.874	8.64	0.839
8.500	0.99755	6.569	1.672	0.885	12.40	0.882	8.64	0.846
9.000	0.99755	6.569	1.658	0.892	12.42	0.893	8.58	0.849
9.300	0.99756	6.569	1.646	0.899	12.38	0.896	8.51	0.847
9.600	0.99756	6.569	1.637	0.904	12.29	0.896	8.40	0.841
9.601	0.99750	8.120	1.788	0.828	11.18	0.802	9.94	0.773
10.000	0.99755	8.120	1.771	0.836	10.96	0.793	9.80	0.767
10.500	0.99751	8.120	1.746	0.848	10.57	0.779	9.51	0.750
11.000	0.99752	8.120	1.721	0.860	7.83	0.779	7.05	0.743
11.350	0.99752	8.120	1.699	0.871	7.79	0.780	7.01	0.743
11.700	0.99750	8.120	1.677	0.883	7.74	0.780	6.97	0.743
11.701	0.99750	7.299	1.652	0.841	11.23	0.848	9.97	0.802
12.200	0.99748	7.299	1.622	0.857	10.63	0.804	7.31	0.761
12.700	0.99748	7.299	1.595	0.871	7.77	0.793	7.28	0.761
13.000	0.99748	7.299	1.580	0.880	8.00	0.791	7.23	0.760
13.500	0.99751	7.299	1.663	0.890	7.63	0.785	7.12	0.755
14.000	0.99752	7.299	1.645	0.900	7.59	0.782	6.94	0.754
14.400	0.99776	7.299	1.541	0.902	7.52	0.782	6.88	0.752
14.401	0.99776	5.474	1.538	0.903	6.73	0.703	6.45	0.679
14.900	0.99805	5.474	1.575	0.882	9.90	0.732	8.74	0.696
15.400	0.99839	5.474	1.613	0.862	10.22	0.762	8.99	0.720
15.900	0.99867	5.474	1.634	0.851	10.49	0.790	9.22	0.744
15.901	0.99865	4.805	1.661	0.891	10.17	0.766	8.95	0.722
16.300	0.99895	4.805	1.585	0.877	10.31	0.783	9.07	0.736
16.700	0.99907	4.805	1.604	0.867	10.44	0.798	7.35	0.753
16.701	0.99914	3.589	1.677	0.918	10.36	0.792	9.14	0.743
17.200	0.99950	3.589	1.750	0.880	10.59	0.812	7.29	0.765
17.201	0.99950	3.406	1.713	0.899	8.14	0.819	7.71	0.800
17.450	0.99963	3.406	1.739	0.886	8.24	0.833	7.80	0.813
17.451	0.99972	2.190	1.693	0.909	8.03	0.814	7.52	0.790
17.750	0.99976	2.190	1.605	0.878	8.15	0.831	7.61	0.804
17.751	0.99988	1.034	1.690	0.911	8.07	0.824	7.54	0.803
18.025	1.00000	1.034	1.751	0.879	8.16	0.837	7.60	0.814
18.026	0.99998	0.000	1.736	0.887	10.05	0.783	9.20	0.753
18.225	1.00008	0.000	1.784	0.863	10.13	0.793	9.22	0.757
18.226	1.00007	0.000	1.770	0.870	9.99	0.782	9.09	0.746
18.375	1.00009	0.000	1.805	0.859	10.05	0.789	7.09	0.752
18.376	1.00004	0.000	1.789	0.866	9.93	0.779	8.99	0.740

18.525	1.00010	0.000	1.823	0.850	10.01	0.787	7.04	0.749
18.526	1.00010	0.000	1.807	0.858	9.89	0.778	6.93	0.737
18.650	1.00011	0.000	1.839	0.843	9.95	0.785	6.99	0.745
18.651	1.00011	0.000	1.825	0.849	9.85	0.777	6.89	0.734
18.661	1.00012	0.000	1.688	0.865	9.85	0.778	6.89	0.735
18.730	1.00012	0.000	1.698	0.860	9.89	0.782	6.86	0.739
18.788	1.00016	0.000	1.706	0.856	9.93	0.786	6.89	0.744
19.166	1.00015	0.000	1.822	0.805	9.39	0.749	6.59	0.716
19.600	1.00018	0.000	1.958	0.761	9.02	0.706	6.20	0.678
20.000	1.00022	0.000	2.110	0.722	8.44	0.666	5.82	0.636
20.414	1.00025	0.000	2.286	0.680	8.10	0.632	5.43	0.598

```
Cycle:                                19
Exposure: MWd/MTU (GWd)              0.0 (    0.00 )
Delta E: MWd/MTU, (GWd)              0.0 (    0.00 )
Power: MWt                        2923.0 (100.00 %)
Core Pressure: psia               1044.5
Inlet Subcooling: Btu/lbm          -24.46
Flow: Mlb/hr                        68.14 ( 88.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --                51     :JR
   3           -- -- -- -- -- -- -- -- --       47
   5        -- -- -- 36 -- 26 -- 36 -- -- --    43
   7        -- -- -- -- -- -- -- -- -- -- --    39
   9 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
  11 -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13 -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
  15 -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
  19    -- -- -- -- -- -- -- -- -- -- --    15
  21    -- -- -- 36 -- 26 -- 36 -- -- --    11
  23       -- -- -- -- -- -- -- -- --        7
  25             -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.42

k-effective:                     0.99937
Void Fraction:                     0.538
Core Delta-P: psia                20.355
Core Plate Delta-P: psia          15.826
Coolant Temp: Deg-F                548.5
In Channel Flow: Mlb/hr            59.22
Total Bypass Flow (%):              13.1
Total Water Rod Flow (%):            3.3
Source Convergence               0.00035
```

Core Average Exposure: MWd/MTU 14498.2

	N(PRA)	Axial Profile Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.112	2.585	30	0.521	0.623	5	14
	24	0.360	7.941	31	0.482	0.616	47	40
	23	0.485	10.592	32	0.861	1.104	11	12
	22	0.577	11.873	33	1.131	1.260	15	26
	21	0.654	12.975	34	1.088	1.201	11	38
	20	0.718	13.763	35	1.171	1.284	15	24
	19	0.769	14.537					
	18	0.810	15.068					
	17	0.845	15.160					
	16	0.924	15.724					
	15	0.989	16.339					
	14	1.048	16.848					
	13	1.175	16.488					
	12	1.248	16.908					
	11	1.293	17.170					
	10	1.341	17.307					
	9	1.397	17.757					
	8	1.433	17.933					
	7	1.440	17.841					
	6	1.472	18.278*					
	5	1.528	18.277					
	4	1.535*	17.404					
	3	1.457	15.570					
	2	1.119	11.454					
Bottom	1	0.271	3.104					

```
                % AXIAL TILT -30.402 -10.313
          AVG BOT 8ft/12ft  1.1855  1.0671

Active Channel Flow: Mlb/hr        56.96
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.284	35	15	24	1.639	0.903	33	15	26	8.92	0.774	24.7	33	21	30	4	12.43	0.882	0.0	34	11	38	4
1.267	35	19	30	1.647	0.898	33	13	30	8.87	0.772	25.2	33	23	32	4	12.42	0.881	0.0	35	21	32	4
1.266	35	21	28	1.689	0.876	33	17	30	8.90	0.770	24.4	33	15	32	4	12.39	0.879	0.0	35	23	30	4
1.266	35	23	30	1.706	0.867	33	21	30	8.84	0.765	24.4	33	13	30	4	12.35	0.876	0.0	35	15	30	4
1.262	35	13	32	1.712	0.865	33	23	22	8.83	0.763	24.3	33	13	38	4	12.24	0.868	0.0	35	13	40	4
1.260	33	15	26	1.713	0.864	33	15	32	8.72	0.759	25.1	33	21	38	4	12.24	0.868	0.0	35	13	32	4
1.258	35	21	32	1.715	0.863	33	11	22	8.58	0.753	26.1	33	37	40	4	12.24	0.868	0.0	34	11	14	4
1.258	35	25	32	1.715	0.863	33	25	38	8.55	0.743	24.9	33	15	28	4	12.21	0.866	0.0	34	13	12	4
1.257	35	23	34	1.614	0.861	35	13	26	8.47	0.743	25.9	33	23	40	4	12.21	0.866	0.0	35	15	38	4
1.257	35	23	38	1.730	0.855	33	13	38	8.37	0.741	26.9	33	25	30	4	12.18	0.864	0.0	35	23	38	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.1 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 0.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)          200.0 (  20.13 )
Delta E: MWd/MTU, (GWd)          200.0 (  20.13 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm        -24.31
Flow: Mlb/hr                      68.53 ( 89.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.42

k-effective:                     0.99930
Void Fraction:                     0.533
Core Delta-P: psia                20.455
Core Plate Delta-P: psia          15.926
Coolant Temp: Deg-F               548.5
In Channel Flow: Mlb/hr           59.58   Active Channel Flow: Mlb/hr       57.32
Total Bypass Flow (%):             13.1   (of total core flow)
Total Water Rod Flow (%):           3.3   (of total core flow)
Source Convergence               0.00039
```

```
Core Average Exposure: MWd/MTU    14698.2

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
      Top 25  0.115   2.610     30  0.522 0.624    5 14
          24  0.369   8.017     31  0.483 0.617   47 40
          23  0.498  10.695     32  0.863 1.104   11 12
          22  0.592  11.997     33  1.133 1.264   15 26
          21  0.671  13.115     34  1.084 1.197   11 38
:JR       20  0.736  13.916     35  1.170 1.283   15 24
          19  0.787  14.701
          18  0.827  15.241
          17  0.861  15.341
          16  0.940  15.911
          15  1.003  16.539
          14  1.059  17.060
          13  1.184  16.712
          12  1.255  17.146
          11  1.297  17.415
          10  1.342  17.562
           9  1.395  18.023
           8  1.427  18.205
           7  1.429  18.115
           6  1.453  18.558
           5  1.500* 18.567*
           4  1.497  17.695
           3  1.414  15.847
           2  1.087  11.667
      Bottom  1  0.263   3.160

          % AXIAL TILT -28.969 -10.524
        AVG BOT 8ft/12ft  1.1780  1.0682
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.283	35	15	24	1.641	0.902	33	15	26	8.75	0.761	25.1 33	21	30	4	12.10	0.858	0.5 35	21	32	4
1.267	35	19	30	1.650	0.897	33	13	30	8.70	0.760	25.6 33	23	32	4	12.08	0.856	0.5 35	23	30	4
1.266	35	21	28	1.692	0.874	33	17	30	8.71	0.757	24.8 33	15	32	4	12.06	0.855	0.5 34	11	38	4
1.265	35	23	30	1.709	0.866	33	21	30	8.66	0.751	24.8 33	13	30	4	12.02	0.852	0.5 35	15	30	4
1.264	33	15	26	1.715	0.863	33	23	22	8.62	0.748	24.6 33	13	38	4	11.91	0.845	0.5 35	13	32	4
1.261	35	13	32	1.716	0.862	33	15	32	8.54	0.745	25.5 33	21	38	4	11.88	0.842	0.5 35	13	40	4
1.258	35	21	32	1.719	0.861	33	11	22	8.38	0.738	26.5 33	37	40	4	11.86	0.841	0.5 34	11	14	4
1.258	35	25	32	1.719	0.861	33	25	38	8.31	0.735	26.9 33	19	26	9	11.86	0.841	0.5 35	15	38	4
1.256	35	23	34	1.618	0.859	35	13	26	8.16	0.734	28.8 33	11	18	8	11.85	0.840	0.5 35	23	38	4
1.255	35	23	38	1.738	0.852	33	13	38	8.37	0.730	25.3 33	15	28	4	11.83	0.839	0.5 34	13	12	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.2 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 200.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)          500.0 (  50.33 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.74
Flow: Mlb/hr                     72.76 ( 94.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- 36 -- 26 -- 36 -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
  11 -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13 -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
  15 -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
  19    -- -- -- -- -- -- -- -- -- -- --     15
  21    -- -- -- 36 -- 26 -- 36 -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            6.42

k-effective:                   0.99922
Void Fraction:                   0.517
Core Delta-P: psia              22.100
Core Plate Delta-P: psia        17.569
Coolant Temp: Deg-F             548.5
In Channel Flow: Mlb/hr         63.43
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence             0.00045
```

Core Average Exposure: MWd/MTU 14998.3

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.121	2.648	30	0.520	0.622	5	14
	24	0.390	8.135	31	0.481	0.614	47	40
	23	0.527	10.853	32	0.863	1.107	11	12
	22	0.625	12.186	33	1.135	1.266	15	26
	21	0.706	13.330	34	1.082	1.196	11	38
	20	0.770	14.152	35	1.169	1.282	15	24
	19	0.819	14.953					
	18	0.857	15.505					
	17	0.887	15.616					
	16	0.964	16.195					
	15	1.023	16.843					
	14	1.075	17.380					
	13	1.197	17.050					
	12	1.264	17.503					
	11	1.302	17.785					
	10	1.344	17.944					
	9	1.392	18.421					
	8	1.416	18.612					
	7	1.408	18.522					
	6	1.421	18.972					
	5	1.451*	18.995*					
	4	1.430	18.122					
	3	1.337	16.250					
	2	1.024	11.977					
Bottom	1	0.249	3.240					

% AXIAL TILT -26.355 -10.801
AVG BOT 8ft/12ft 1.1635 1.0697

Active Channel Flow: Mlb/hr 61.08
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.282	35	15	24	1.693	0.874	33	15	26	8.43	0.738	25.7	33	21	30	4	11.69	0.829	1.3	34	11	38	5
1.266	33	15	26	1.701	0.870	33	13	30	8.38	0.736	26.1	33	23	32	4	11.64	0.826	1.3	35	21	32	4
1.265	35	19	30	1.749	0.846	33	17	30	8.26	0.734	27.5	33	19	26	9	11.61	0.824	1.3	35	23	30	4
1.264	35	21	28	1.761	0.841	33	21	30	8.40	0.733	25.4	33	15	32	4	11.56	0.820	1.3	35	15	30	4
1.262	35	23	30	1.656	0.839	35	13	26	8.09	0.731	29.3	33	11	36	8	11.49	0.815	1.3	34	11	14	5
1.260	35	13	32	1.770	0.836	33	15	22	8.25	0.729	26.8	33	13	38	5	11.46	0.812	1.3	34	13	12	5
1.255	35	21	32	1.770	0.836	33	11	22	8.35	0.728	25.4	33	13	30	4	11.45	0.812	1.3	35	13	32	4
1.255	35	25	32	1.773	0.835	33	23	22	8.23	0.727	26.8	33	25	34	9	11.45	0.812	1.3	34	37	12	5
1.254	33	13	30	1.774	0.834	33	25	38	8.06	0.722	28.3	33	37	40	5	11.42	0.810	1.3	35	13	40	4
1.254	35	23	34	1.680	0.828	35	15	24	8.22	0.722	26.1	33	21	38	4	11.39	0.808	1.2	35	15	38	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.3 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         1000.0 ( 100.66 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.33
Flow: Mlb/hr                     73.92 ( 96.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           6.42

k-effective:                  0.99913
Void Fraction:                  0.513
Core Delta-P: psia             22.576
Core Plate Delta-P: psia       18.045
Coolant Temp: Deg-F             548.5
In Channel Flow: Mlb/hr         64.47
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence            0.00046
```

Core Average Exposure: MWd/MTU 15498.2

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.123	2.715	30	0.515	0.617	5	14
	24	0.394	8.341	31	0.476	0.608	13	48
	23	0.531	11.132	32	0.859	1.106	11	12
	22	0.629	12.519	33	1.134	1.266	15	26
	21	0.710	13.706	34	1.084	1.202	11	38
	20	0.773	14.562	35	1.175	1.290	15	24
	19	0.823	15.390					
	18	0.861	15.962					
	17	0.891	16.089					
	16	0.969	16.681					
	15	1.030	17.359					
	14	1.082	17.922					
	13	1.202	17.619					
	12	1.268	18.105					
	11	1.304	18.404					
	10	1.343	18.583					
	9	1.388	19.083					
	8	1.410	19.286					
	7	1.401	19.192					
	6	1.413	19.647					
	5	1.442*	19.684*					
	4	1.420	18.802					
	3	1.326	16.885					
	2	1.018	12.464					
Bottom	1	0.250	3.366					

% AXIAL TILT -25.916 -11.153
AVG BOT 8ft/12ft 1.1616 1.0715

Active Channel Flow: Mlb/hr 62.10
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.290	35	15	24	1.701	0.870	33	15	26	8.37	0.738	26.6	33	21	30	4	11.64	0.825	2.5	34	11	38	5
1.271	35	19	30	1.712	0.865	33	13	30	8.32	0.736	27.1	33	23	32	4	11.61	0.823	2.5	35	21	32	4
1.269	35	21	28	1.651	0.842	35	13	26	8.21	0.735	28.4	33	19	26	9	11.57	0.820	2.5	35	23	30	4
1.268	35	13	32	1.760	0.841	33	17	30	8.34	0.734	26.3	33	15	32	4	11.53	0.818	2.5	35	15	30	4
1.266	35	23	30	1.779	0.832	33	21	30	8.19	0.730	27.7	33	13	38	5	11.44	0.811	2.5	34	11	14	5
1.266	33	15	26	1.781	0.831	33	11	22	8.00	0.729	30.2	33	11	18	8	11.42	0.810	2.4	35	13	32	4
1.262	35	13	26	1.781	0.831	33	15	22	8.28	0.728	26.3	33	13	30	4	11.40	0.808	2.5	34	13	12	5
1.261	35	21	32	1.676	0.829	35	15	24	8.18	0.728	27.7	33	25	34	9	11.40	0.808	2.5	34	37	12	5
1.260	35	23	38	1.785	0.829	33	25	38	8.16	0.722	27.0	33	21	38	4	11.38	0.807	2.5	35	13	40	4
1.260	35	23	34	1.787	0.828	33	23	22	8.00	0.722	29.2	33	37	40	5	11.36	0.806	2.4	35	15	38	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.4 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 1,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         1500.0 ( 150.99 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.59
Flow: Mlb/hr                     73.15 ( 95.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.42

k-effective:                     0.99903
Void Fraction:                     0.512
Core Delta-P: psia                22.216
Core Plate Delta-P: psia          17.685
Coolant Temp: Deg-F               548.5
In Channel Flow: Mlb/hr           63.80
Total Bypass Flow (%):             12.8
Total Water Rod Flow (%):           3.2
Source Convergence               0.00038
```

Core Average Exposure: MWd/MTU 15998.2

	N(PRA)	Axial Profile Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.125	2.783	30	0.511	0.612	5	14
	24	0.400	8.550	31	0.472	0.604	13	48
	23	0.540	11.413	32	0.854	1.104	11	12
	22	0.641	12.855	33	1.132	1.262	15	26
	21	0.723	14.084	34	1.086	1.205	11	38
	20	0.788	14.975	35	1.181	1.295	15	24
	19	0.837	15.829					
	18	0.876	16.421					
	17	0.905	16.564					
	16	0.983	17.170					
	15	1.041	17.878					
	14	1.090	18.468					
	13	1.206	18.191					
	12	1.268	18.707					
	11	1.300	19.024					
	10	1.336	19.222					
	9	1.379	19.743					
	8	1.398	19.956					
	7	1.387	19.858					
	6	1.396	20.319					
	5	1.422*	20.369*					
	4	1.398	19.476					
	3	1.305	17.515					
	2	1.007	12.947					
Bottom	1	0.250	3.493					

% AXIAL TILT -24.783 -11.470
AVG BOT 8ft/12ft 1.1557 1.0732

Active Channel Flow: Mlb/hr 61.45
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR K	Value	Margin	Exp.	FT	IR JR K
1.295	35	15	24	1.701	0.870	33	15 26	8.11	0.732	29.3	33	19 26 9	11.47	0.813	3.8	34	11 38 5
1.275	35	19	30	1.713	0.864	33	13 30	8.21	0.730	27.5	33	21 30 4	11.43	0.811	3.7	35	21 32 4
1.273	35	13	22	1.643	0.846	35	13 26	8.16	0.729	28.0	33	23 32 4	11.39	0.808	3.7	35	23 30 4
1.272	35	21	28	1.761	0.841	33	17 30	8.19	0.726	27.2	33	15 32 4	11.37	0.806	3.7	35	15 30 4
1.268	35	23	30	1.772	0.835	33	21 30	7.90	0.726	31.1	33	11 18 8	11.28	0.800	3.7	34	11 14 5
1.267	35	13	26	1.666	0.834	35	15 24	8.08	0.725	28.6	33	25 20 9	11.26	0.799	3.6	35	13 32 4
1.265	35	23	38	1.779	0.832	33	15 22	8.06	0.724	28.6	33	13 38 5	11.24	0.797	3.7	34	37 12 5
1.265	35	21	32	1.781	0.831	33	11 22	8.13	0.721	27.2	33	13 30 4	11.24	0.797	3.7	34	13 12 5
1.264	35	23	34	1.782	0.830	33	23 22	7.87	0.716	30.1	33	37 40 5	11.22	0.796	3.6	35	13 40 5
1.263	35	25	22	1.783	0.830	33	25 38	8.02	0.716	27.8	33	21 38 4	11.20	0.794	3.6	35	15 38 4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.5 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 1,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         2000.0 ( 201.32 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.83
Flow: Mlb/hr                     72.50 ( 94.15 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11 -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13 -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15 -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17 -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19    -- -- -- -- -- -- -- -- -- -- --     15
 21    -- -- -- 36 -- 26 -- 36 -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %          6.42

k-effective:                 0.99891
Void Fraction:                 0.510
Core Delta-P: psia            21.902
Core Plate Delta-P: psia      17.372
Coolant Temp: Deg-F           548.4
In Channel Flow: Mlb/hr       63.23
Total Bypass Flow (%):         12.8
Total Water Rod Flow (%):       3.2
Source Convergence          0.00042
```

Core Average Exposure: MWd/MTU 16498.2

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.129	2.853	30	0.507	0.607	5	14
	24	0.409	8.761	31	0.468	0.599	13	48
	23	0.552	11.699	32	0.850	1.101	11	12
	22	0.655	13.196	33	1.130	1.260	15	26
	21	0.738	14.470	34	1.087	1.209	11	38
	20	0.803	15.395	35	1.187	1.301	15	24
	19	0.853	16.275					
	18	0.890	16.888					
	17	0.919	17.047					
	16	0.995	17.666					
	15	1.051	18.403					
	14	1.097	19.018					
	13	1.209	18.764					
	12	1.267	19.310					
	11	1.296	19.643					
	10	1.330	19.857					
	9	1.370	20.399					
	8	1.386	20.620					
	7	1.372	20.517					
	6	1.378	20.982					
	5	1.401*	21.045*					
	4	1.375	20.140					
	3	1.283	18.135					
	2	0.994	13.425					
Bottom	1	0.248	3.620					

% AXIAL TILT -23.583 -11.732
AVG BOT 8ft/12ft 1.1491 1.0746

Active Channel Flow: Mlb/hr 60.90
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.301	35	15	24	1.700	0.870	33	15	26	8.02	0.730	30.1	33	19	26	9	11.29	0.801	5.0	34	11	38	5
1.281	35	19	30	1.713	0.864	33	13	30	7.99	0.723	29.4	33	25	20	9	11.26	0.799	4.9	35	21	32	4
1.279	35	13	22	1.635	0.850	35	13	26	7.80	0.723	32.0	33	11	18	8	11.20	0.795	4.9	35	23	30	4
1.277	35	21	28	1.762	0.840	33	17	30	8.06	0.722	28.4	33	21	30	4	11.20	0.794	4.8	35	15	30	4
1.274	35	13	26	1.763	0.840	33	21	30	8.01	0.721	28.9	33	23	32	4	11.10	0.788	4.8	34	11	14	5
1.272	35	23	30	1.657	0.839	35	15	24	8.04	0.719	28.1	33	15	32	4	11.10	0.787	4.8	35	13	32	4
1.271	35	23	38	1.772	0.835	33	23	22	7.93	0.717	29.5	33	13	38	5	11.07	0.785	4.9	34	37	12	5
1.270	35	21	32	1.669	0.833	35	13	32	7.98	0.713	28.1	33	13	30	4	11.07	0.785	4.8	34	13	12	5
1.270	35	23	34	1.778	0.833	33	15	22	7.62	0.710	32.8	33	15	40	5	11.07	0.785	4.8	35	13	40	5
1.268	35	25	22	1.782	0.830	33	25	38	7.61	0.710	32.8	33	17	42	8	11.04	0.783	4.8	35	15	38	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.6 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 2,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         2300.0 ( 231.51 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.94
Flow: Mlb/hr                     72.19 ( 93.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            6.42

k-effective:                   0.99884
Void Fraction:                   0.509
Core Delta-P: psia              21.748
Core Plate Delta-P: psia        17.218
Coolant Temp: Deg-F             548.4
In Channel Flow: Mlb/hr         62.96
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence             0.00050
```

```
Core Average Exposure: MWd/MTU    16798.2

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone  Avg.  Max.   IR JR
Top 25    0.131   2.895    30   0.505 0.605    5 14
    24    0.416   8.891    31   0.465 0.597   13 48
    23    0.561  11.875    32   0.847 1.099   11 12
    22    0.665  13.406    33   1.129 1.258   15 26
    21    0.749  14.706    34   1.088 1.212   11 38
:JR 20    0.814  15.652    35   1.190 1.305   15 24
    19    0.863  16.548
    18    0.899  17.173
    17    0.927  17.341
    16    1.002  17.967
    15    1.057  18.721
    14    1.100  19.349
    13    1.210  19.109
    12    1.265  19.672
    11    1.293  20.013
    10    1.324  20.237
     9    1.363  20.789
     8    1.378  21.016
     7    1.363  20.909
     6    1.368  21.376
     5   1.389*  21.444*
     4    1.362  20.532
     3    1.271  18.501
     2    0.985  13.709
Bottom 1  0.247   3.696

          % AXIAL TILT -22.799 -11.860
AVG BOT 8ft/12ft  1.1446  1.0753

Active Channel Flow: Mlb/hr       60.65
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.305	35	15	24	1.702	0.869	33	15	26	7.95	0.727	30.7	33	19	26	9	11.19	0.794	5.7	34	11	38	5
1.285	35	19	30	1.715	0.863	33	13	30	7.74	0.720	32.5	33	11	18	8	11.16	0.791	5.6	35	21	32	4
1.283	35	13	22	1.632	0.852	35	13	26	7.92	0.720	30.0	33	25	20	9	11.10	0.788	5.5	35	15	30	4
1.279	35	21	28	1.758	0.842	33	21	30	7.97	0.718	29.0	33	21	30	4	11.10	0.787	5.6	35	23	30	4
1.278	35	13	26	1.653	0.841	35	15	24	7.92	0.716	29.4	33	23	32	4	11.01	0.781	5.5	35	13	32	4
1.275	35	23	38	1.763	0.839	33	17	24	7.96	0.715	28.7	33	15	32	4	11.01	0.781	5.5	34	11	14	5
1.274	35	23	30	1.767	0.838	33	23	22	7.85	0.714	30.0	33	13	38	5	10.98	0.779	5.5	35	13	40	5
1.273	35	21	32	1.665	0.835	35	13	32	7.90	0.709	28.6	33	13	30	4	10.97	0.778	5.5	34	13	12	5
1.273	35	23	34	1.779	0.832	33	15	22	7.55	0.708	33.3	33	17	42	8	10.97	0.778	5.6	34	37	12	5
1.271	35	25	22	1.784	0.830	33	11	22	7.55	0.707	33.3	33	15	40	5	10.94	0.776	5.5	35	15	38	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.7 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 2,300.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         2600.0 ( 261.71 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.05
Flow: Mlb/hr                     71.88 ( 93.35 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 -- 34 -- 10 -- 34 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 -- 12 -- 34 -- 12 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           6.42

k-effective:                  0.99874
Void Fraction:                  0.508
Core Delta-P: psia             21.598
Core Plate Delta-P: psia       17.068
Coolant Temp: Deg-F             548.4
In Channel Flow: Mlb/hr         62.70
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence            0.00036
```

```
Core Average Exposure: MWd/MTU    17098.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
      Top 25  0.133    2.939     30   0.502  0.602    5 14
          24  0.421    9.023     31   0.463  0.594   13 48
          23  0.569   12.053     32   0.844  1.097   11 12
          22  0.674   13.618     33   1.128  1.257   15 26
          21  0.758   14.945     34   1.089  1.214   11 38
          20  0.823   15.912     35   1.194  1.309   15 24
          19  0.871   16.824
          18  0.907   17.460
          17  0.934   17.637
          16  1.009   18.270
          15  1.063   19.041
          14  1.104   19.682
          13  1.211   19.454
          12  1.264   20.033
          11  1.290   20.381
          10  1.320   20.614
           9  1.357   21.178
           8  1.370   21.409
           7  1.355   21.297
           6  1.358   21.766
           5  1.378*  21.840*
           4  1.350   20.921
           3  1.259   18.863
           2  0.977   13.989
      Bottom  1  0.246    3.771

          % AXIAL TILT -22.099 -11.970
      AVG BOT 8ft/12ft  1.1407  1.0759

Active Channel Flow: Mlb/hr       60.39
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.309	35	15	24	1.704	0.869	33	15 26	7.90	0.726	31.2 33	19 26	9	11.09	0.787	6.4 34	11 38	5
1.288	35	19	30	1.716	0.862	33	13 30	7.87	0.719	30.5 33	25 20	9	11.06	0.785	6.3 35	21 32	4
1.287	35	13	22	1.629	0.854	35	13 26	7.69	0.718	33.0 33	11 18	8	11.01	0.781	6.2 35	15 30	4
1.283	35	21	28	1.754	0.844	33	21 30	7.89	0.714	29.5 33	21 30	4	11.00	0.780	6.2 35	23 30	4
1.282	35	13	26	1.757	0.842	33	17 24	7.84	0.712	29.9 33	23 32	4	10.92	0.774	6.2 35	13 32	4
1.279	35	23	38	1.650	0.842	35	15 24	7.88	0.711	29.2 33	15 32	4	10.91	0.774	6.2 34	11 14	5
1.277	35	23	30	1.762	0.840	33	23 22	7.78	0.711	30.5 33	13 38	5	10.90	0.773	6.2 35	13 40	5
1.277	35	23	34	1.662	0.836	35	13 32	7.50	0.706	33.7 33	17 42	8	10.88	0.771	6.2 34	13 12	5
1.277	35	21	32	1.777	0.833	33	15 22	7.82	0.705	29.1 33	13 30	4	10.88	0.771	6.3 34	37 12	5
1.274	35	25	22	1.785	0.829	33	11 22	7.49	0.705	33.8 33	15 40	5	10.86	0.770	6.1 35	15 38	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.8 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 2,600.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         2601.0 ( 261.81 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.14
Flow: Mlb/hr                     71.61 ( 93.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- 34 -- 34 -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 35
  11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13  -- -- -- 14 -- 36 -- 36 -- 14 -- -- -- 27
  15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- 34 -- 34 -- -- -- --     11
  23        -- -- -- -- -- -- -- --           7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              5.66

k-effective:                     0.99881
Void Fraction:                     0.522
Core Delta-P: psia                21.618
Core Plate Delta-P: psia          17.088
Coolant Temp: Deg-F               548.6
In Channel Flow: Mlb/hr           62.40
Total Bypass Flow (%):            12.9
Total Water Rod Flow (%):          3.2
Source Convergence               0.00048
```

Core Average Exposure: MWd/MTU 17099.1

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.133	2.939	30	0.502	0.600	5	14
24	0.420	9.024	31	0.463	0.600	13	48
23	0.567	12.054	32	0.846	1.095	11	12
22	0.671	13.619	33	1.126	1.291	25	28
21	0.754	14.946	34	1.101	1.230	15	42
20	0.819	15.913	35	1.187	1.345	25	26
19	0.868	16.825					
18	0.902	17.461					
17	0.907	17.638					
16	0.962	18.271					
15	0.999	19.042					
14	1.027	19.684					
13	1.118	19.455					
12	1.163	20.034					
11	1.187	20.383					
10	1.220	20.616					
9	1.268	21.179					
8	1.306	21.410					
7	1.336	21.299					
6	1.408	21.767					
5	1.493	21.841*					
4	1.523*	20.922					
3	1.472	18.864					
2	1.174	13.990					
Bottom 1	0.301	3.771					

% AXIAL TILT -24.375 -11.971
AVG BOT 8ft/12ft 1.1436 1.0759

Active Channel Flow: Mlb/hr 60.08
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR	K	Value	Margin	Exp.	FT	IR JR	K
1.345	35	25	26	1.660	0.892	33	25 28	8.78	0.800	30.3	33	9 30	4	12.58	0.892	5.8	34	45 30	4
1.306	35	23	30	1.583	0.878	35	25 26	8.68	0.777	28.3	33	9 34	4	12.34	0.875	3.4	35	9 28	4
1.291	33	25	28	1.702	0.870	33	25 24	8.30	0.772	32.4	33	7 28	4	12.30	0.872	5.6	35	9 32	4
1.287	35	19	24	1.747	0.847	33	21 30	8.30	0.772	32.5	33	15 40	4	12.30	0.872	5.6	34	45 22	4
1.270	35	25	22	1.763	0.839	33	19 28	8.43	0.771	30.7	33	11 32	4	12.23	0.867	5.6	35	11 30	4
1.265	35	17	40	1.679	0.828	35	23 24	8.38	0.760	29.8	33	11 28	4	12.20	0.865	6.2	34	37 12	4
1.257	35	17	22	1.788	0.828	33	23 28	9.95	0.759	3.0	35	9 28	4	12.00	0.851	5.6	34	5 26	4
1.257	33	25	30	1.685	0.825	35	25 22	8.21	0.757	31.5	33	17 42	4	11.98	0.850	6.2	34	13 12	4
1.246	35	25	40	1.809	0.818	33	19 22	8.17	0.751	31.3	33	17 38	4	11.97	0.849	4.9	34	45 20	4
1.244	35	19	38	1.699	0.818	35	19 24	9.82	0.750	4.3	35	9 32	4	11.93	0.846	3.5	35	11 34	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.9 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 2,601.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         3100.0 ( 312.04 )
Delta E: MWd/MTU, (GWd)          499.0 (  50.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.43
Flow: Mlb/hr                     70.84 ( 92.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 34 -- 34 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- -- 14 -- 36 -- 36 -- 14 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 34 -- 34 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           5.66

k-effective:                  0.99871
Void Fraction:                  0.520
Core Delta-P: psia             21.247
Core Plate Delta-P: psia       16.719
Coolant Temp: Deg-F             548.5
In Channel Flow: Mlb/hr         61.73
Total Bypass Flow (%):           12.9
Total Water Rod Flow (%):         3.2
Source Convergence            0.00047
```

Core Average Exposure: MWd/MTU 17598.2

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.137	3.012	30	0.498	0.596	5	14
24	0.432	9.246	31	0.459	0.596	13	48
23	0.582	12.353	32	0.842	1.092	11	12
22	0.688	13.976	33	1.124	1.282	25	28
21	0.773	15.347	34	1.103	1.234	15	42
20	0.837	16.349	35	1.193	1.343	25	26
19	0.886	17.287					
18	0.919	17.941					
17	0.923	18.121					
16	0.977	18.756					
15	1.012	19.545					
14	1.037	20.201					
13	1.124	19.986					
12	1.165	20.586					
11	1.186	20.946					
10	1.216	21.195					
9	1.261	21.781					
8	1.296	22.030					
7	1.322	21.933					
6	1.389	22.435					
5	1.468	22.549*					
4	1.491*	21.644					
3	1.437	19.562					
2	1.145	14.547					
Bottom 1	0.295	3.924					

:JR

% AXIAL TILT -22.891 -12.191
AVG BOT 8ft/12ft 1.1355 1.0768

Active Channel Flow: Mlb/hr 59.44
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.343	35	25	26	1.657	0.893	33	25	28	8.56	0.788	31.3 33	9	30	4	12.26	0.870	7.1 34	45	30	4
1.308	35	23	30	1.672	0.885	33	25	30	8.47	0.764	29.2 33	9	34	4	12.05	0.854	6.9 35	9	32	4
1.292	35	19	24	1.579	0.880	35	25	26	8.13	0.763	33.4 33	15	40	4	12.04	0.854	4.7 35	9	28	4
1.282	33	25	28	1.735	0.853	33	21	30	8.24	0.760	31.6 33	11	32	4	12.01	0.852	6.9 34	45	22	4
1.273	35	25	22	1.749	0.846	33	19	28	8.08	0.758	33.3 33	7	28	4	11.97	0.849	6.8 35	11	30	4
1.271	35	17	40	1.660	0.837	35	23	24	9.78	0.747	4.1 35	9	28	4	11.93	0.846	7.5 34	37	12	4
1.264	35	17	22	1.668	0.834	35	25	22	8.16	0.747	30.8 33	11	28	4	11.74	0.832	7.4 34	13	12	4
1.252	35	25	40	1.778	0.833	33	23	28	8.02	0.746	32.4 33	17	42	4	11.70	0.830	6.2 34	45	20	4
1.250	35	19	38	1.678	0.829	35	19	24	8.00	0.742	32.2 33	17	38	4	11.69	0.829	6.8 34	5	26	4
1.250	33	25	30	1.791	0.826	33	19	22	9.70	0.740	5.3 35	9	32	4	11.68	0.829	7.4 35	13	40	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.10 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 3,100.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)          3600.0 ( 362.37 )
Delta E: MWd/MTU, (GWd)           500.0 (  50.33 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.6
Inlet Subcooling: Btu/lbm         -23.71
Flow: Mlb/hr                       70.07 ( 91.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- 34 -- 34 -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 35
  11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13  -- -- -- 14 -- 36 -- 36 -- 14 -- -- -- 27
  15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- 34 -- 34 -- -- -- --     11
  23        -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              5.66

k-effective:                     0.99856
Void Fraction:                     0.519
Core Delta-P: psia                20.895
Core Plate Delta-P: psia          16.367
Coolant Temp: Deg-F               548.5
In Channel Flow: Mlb/hr           61.06
Total Bypass Flow (%):             12.9
Total Water Rod Flow (%):           3.2
Source Convergence              0.00042
```

```
Core Average Exposure: MWd/MTU    18098.1

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
Top 25    0.141   3.088    30  0.494 0.592   5 14
    24    0.443   9.474    31  0.456 0.592  13 48
    23    0.596  12.661    32  0.838 1.090  11 12
    22    0.703  14.343    33  1.123 1.273  25 28
    21    0.788  15.759    34  1.104 1.238  15 42
    20    0.852  16.795    35  1.198 1.342  25 26
    19    0.900  17.759
    18    0.933  18.432
    17    0.935  18.613
    16    0.987  19.249
    15    1.020  20.056
    14    1.042  20.724
    13    1.125  20.520
    12    1.162  21.140
    11    1.181  21.510
    10    1.209  21.773
     9    1.252  22.381
     8    1.285  22.646
     7    1.309  22.561
     6    1.375  23.096
     5    1.451  23.246*
     4   1.473*  22.352
     3    1.417  20.245
     2    1.129  15.091
Bottom   1    0.292   4.073

          % AXIAL TILT -21.758 -12.358
AVG BOT 8ft/12ft  1.1289  1.0775

Active Channel Flow: Mlb/hr       58.79
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.342	35	25	26	1.655	0.894	33	25 28	8.43	0.782	32.2 33	9 30	4	12.08	0.857	8.4 34	45 30	4
1.311	35	23	30	1.666	0.888	33	25 30	8.34	0.759	30.2 33	9 34	4	11.90	0.844	8.1 35	9 32	4
1.298	35	19	24	1.576	0.882	35	25 26	8.02	0.759	34.3 33	15 40	4	11.87	0.842	5.6 35	9 28	4
1.277	35	25	22	1.689	0.876	33	21 24	8.13	0.756	32.5 33	11 32	4	11.84	0.840	8.2 34	45 22	4
1.277	35	17	40	1.700	0.870	33	19 26	7.94	0.750	34.2 33	7 28	4	11.83	0.839	8.0 35	11 30	4
1.273	33	25	28	1.728	0.857	33	23 28	9.72	0.742	5.1 35	9 28	4	11.78	0.835	8.7 34	37 12	4
1.270	35	17	22	1.644	0.845	35	23 24	7.91	0.741	33.3 33	17 42	4	11.59	0.822	8.6 34	13 12	4
1.258	35	25	40	1.760	0.841	33	19 32	8.02	0.740	31.7 33	11 28	4	11.55	0.819	8.7 35	13 40	4
1.256	35	19	38	1.653	0.841	35	25 22	9.67	0.738	6.3 35	9 32	4	11.54	0.818	7.4 34	45 20	4
1.251	35	21	22	1.659	0.838	35	19 24	7.89	0.737	33.0 33	17 38	4	11.53	0.818	5.9 35	11 34	4

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.11 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 3,600.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         4100.0 ( 412.70 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm        -24.01
Flow: Mlb/hr                     69.30 ( 90.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 34 -- 34 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 26 -- 14 -- 14 -- 26 -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- 14 -- 36 -- 36 -- 14 -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- 26 -- 14 -- 14 -- 26 -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 34 -- 34 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              5.66

k-effective:                     0.99840
Void Fraction:                     0.518
Core Delta-P: psia                20.551
Core Plate Delta-P: psia          16.023
Coolant Temp: Deg-F                548.5
In Channel Flow: Mlb/hr            60.38
Total Bypass Flow (%):              12.9
Total Water Rod Flow (%):            3.2
Source Convergence               0.00046
```

Core Average Exposure: MWd/MTU 18598.2

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.145	3.167	30	0.491	0.588	5	14
24	0.452	9.709	31	0.452	0.588	13	48
23	0.608	12.977	32	0.833	1.087	11	12
22	0.716	14.718	33	1.121	1.265	25	28
21	0.801	16.180	34	1.106	1.242	15	42
20	0.865	17.249	35	1.204	1.342	25	26
19	0.913	18.239					
18	0.944	18.929					
17	0.945	19.111					
16	0.996	19.747					
15	1.027	20.570					
14	1.046	21.249					
13	1.125	21.055					
12	1.159	21.692					
11	1.175	22.071					
10	1.202	22.348					
9	1.243	22.976					
8	1.275	23.257					
7	1.299	23.183					
6	1.363	23.750					
5	1.438	23.936*					
4	1.458*	23.052					
3	1.401	20.918					
2	1.114	15.627					
Bottom 1	0.290	4.222					

% AXIAL TILT -20.777 -12.485
AVG BOT 8ft/12ft 1.1232 1.0779

Active Channel Flow: Mlb/hr 58.14
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.342	35	25	26	1.633	0.906	33	27	26	8.32	0.778	33.1 33	9	30	4	11.92	0.845	9.7 34	45	30	4
1.315	35	23	30	1.660	0.892	33	25	30	7.93	0.756	35.2 33	15	40	4	11.77	0.835	9.3 35	9	32	4
1.304	35	19	24	1.569	0.886	35	25	26	8.23	0.755	31.1 33	9	34	4	11.73	0.832	6.8 35	9	28	4
1.283	35	17	40	1.678	0.882	33	21	24	8.02	0.753	33.4 33	11	32	4	11.71	0.831	9.2 35	11	30	4
1.282	35	25	22	1.688	0.877	33	19	26	7.81	0.744	35.1 33	7	28	4	11.70	0.829	9.4 34	45	22	4
1.276	35	17	22	1.719	0.861	33	23	26	9.67	0.738	6.1 35	9	28	4	11.64	0.826	10.0 34	37	12	4
1.265	33	25	28	1.724	0.858	33	17	24	7.81	0.738	34.2 33	17	42	4	11.47	0.813	9.9 34	13	12	4
1.264	35	25	14	1.630	0.853	35	23	24	9.65	0.737	7.3 35	9	32	4	11.46	0.813	9.8 35	13	40	4
1.263	35	19	38	1.640	0.848	35	25	22	7.90	0.735	32.5 33	11	26	4	11.41	0.810	6.7 35	11	34	4
1.258	35	21	22	1.747	0.847	33	23	22	7.80	0.735	33.9 33	17	38	4	11.41	0.809	8.9 34	7	34	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.12 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 4,100.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         4600.0 ( 463.03 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.31
Flow: Mlb/hr                     68.53 ( 89.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 34 -- 34 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- -- 14 -- 36 -- 36 -- 14 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 26 -- 14 -- 14 -- 26 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 34 -- 34 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            5.66

k-effective:                   0.99830
Void Fraction:                   0.517
Core Delta-P: psia              20.214
Core Plate Delta-P: psia        15.687
Coolant Temp: Deg-F             548.4
In Channel Flow: Mlb/hr         59.70
Total Bypass Flow (%):           12.9
Total Water Rod Flow (%):         3.2
Source Convergence             0.00048
```

```
Core Average Exposure: MWd/MTU    19098.2

                 Axial Profile    Edit   Radial Power
      N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
Top 25 0.149   3.247   30  0.486 0.583   5 14
   24  0.460   9.948   31  0.448 0.583  13 48
   23  0.618  13.299   32  0.828 1.083  11 12
   22  0.727  15.100   33  1.119 1.257  25 28
   21  0.813  16.607   34  1.108 1.246  15 42
:JR20  0.876  17.711   35  1.211 1.344  25 26
   19  0.924  18.726
   18  0.954  19.432
   17  0.954  19.615
   16  1.005  20.249
   15  1.034  21.088
   14  1.050  21.777
   13  1.125  21.590
   12  1.156  22.243
   11  1.170  22.630
   10  1.194  22.919
    9  1.234  23.567
    8  1.266  23.863
    7  1.289  23.801
    6  1.353  24.398
    5  1.427  24.619*
    4  1.445* 23.744
    3  1.387  21.583
    2  1.102  16.156
Bottom 1  0.287   4.369

      % AXIAL TILT -19.886 -12.579
AVG BOT 8ft/12ft  1.1181  1.0782

Active Channel Flow: Mlb/hr       57.48
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.344	35	25	26	1.621	0.913	33	25	28	8.22	0.776	34.1 33	9	30	4	11.78	0.836	11.0 34	45	30	4
1.319	35	23	30	1.653	0.895	33	25	30	7.85	0.755	36.1 33	15	40	4	11.68	0.828	10.5 35	9	32	4
1.311	35	19	24	1.560	0.891	35	25	26	8.14	0.753	32.0 33	9	34	4	11.62	0.824	8.0 35	9	28	4
1.290	35	17	40	1.667	0.888	33	21	24	7.94	0.751	34.3 33	11	32	4	11.62	0.824	10.4 35	11	30	4
1.287	35	25	22	1.677	0.883	33	19	26	7.69	0.740	36.0 33	7	28	4	11.58	0.821	10.6 34	45	22	4
1.284	35	17	22	1.709	0.866	33	23	26	9.67	0.738	8.3 35	9	32	4	11.52	0.817	11.2 34	37	12	4
1.271	35	25	14	1.711	0.865	33	17	24	9.65	0.737	7.1 35	9	28	4	11.40	0.808	11.0 35	13	40	4
1.270	35	19	38	1.615	0.861	35	23	24	7.73	0.736	35.0 33	17	42	4	11.36	0.806	11.0 34	13	12	4
1.264	35	21	22	1.626	0.855	35	19	24	7.71	0.733	34.8 33	17	38	4	11.34	0.804	7.9 35	11	34	4
1.263	35	21	40	1.626	0.855	35	25	22	7.80	0.731	33.4 33	11	28	4	11.32	0.803	10.0 34	7	34	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.13 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 4,600.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         4601.0 ( 463.13 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -21.89
Flow: Mlb/hr                     75.27 ( 97.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- 36 -- 14 -- 14 -- 36 -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.20

k-effective:                    0.99833
Void Fraction:                    0.503
Core Delta-P: psia               23.008
Core Plate Delta-P: psia         18.477
Coolant Temp: Deg-F              548.6
In Channel Flow: Mlb/hr          65.75
Total Bypass Flow (%):           12.6
Total Water Rod Flow (%):         3.2
Source Convergence             0.00049

                                Core Average Exposure: MWd/MTU    19099.1

                                    Axial Profile    Edit   Radial Power
                              N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
                          Top   25  0.154   3.247    30  0.487 0.586   5 14
                                24  0.478   9.948    31  0.448 0.581  13 48
                                23  0.642  13.299    32  0.832 1.080  11 12
                                22  0.751  15.101    33  1.117 1.278  25 28
                                21  0.832  16.607    34  1.114 1.232  11 16
                                20  0.888  17.712    35  1.206 1.360  25 26
                                19  0.923  18.727
                                18  0.936  19.433
                                17  0.929  19.616
                                16  0.975  20.250
                                15  1.002  21.090
                                14  1.019  21.778
                                13  1.098  21.591
                                12  1.137  22.244
                                11  1.164  22.631
                                10  1.184  22.920
                                 9  1.227  23.568
                                 8  1.268  23.864
                                 7  1.309  23.802
                                 6  1.377  24.399
                                 5  1.450  24.620*
                                 4  1.463* 23.746
                                 3  1.398  21.585
                                 2  1.107  16.158
                          Bottom 1  0.289   4.369

                          % AXIAL TILT -20.268 -12.579
                        AVG BOT 8ft/12ft  1.1149  1.0782

Active Channel Flow: Mlb/hr      63.37
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.360	35	25	26	1.557	0.893	35	25	26	8.32	0.785	34.1	33	9	30 4	11.94	0.847	8.0	35	9	28 4
1.323	35	21	26	1.675	0.884	33	25	28	8.36	0.777	32.4	33	23	44 4	11.94	0.847	11.0	34	45	30 4
1.320	35	25	22	1.691	0.875	33	23	26	8.20	0.769	33.4	33	11	26 4	11.93	0.846	9.5	34	29	46 4
1.303	35	19	20	1.696	0.873	33	25	30	8.33	0.767	31.5	33	25	42 4	11.90	0.844	7.0	35	25	44 4
1.298	35	17	18	1.611	0.863	35	21	26	8.28	0.767	32.0	33	9	34 4	11.82	0.838	10.5	35	9	32 4
1.297	35	23	20	1.615	0.861	35	25	22	8.20	0.755	31.5	33	19	44 4	11.82	0.838	7.6	35	21	44 4
1.295	35	19	24	1.731	0.855	33	25	20	9.90	0.755	7.1	35	9	28 4	11.75	0.833	9.3	34	21	46 4
1.279	35	17	26	1.743	0.849	33	19	26	7.85	0.755	36.0	33	7	28 4	11.74	0.833	10.6	34	45	22 4
1.278	33	25	28	1.663	0.836	35	23	20	9.81	0.749	6.2	35	25	44 4	11.67	0.828	10.4	35	11	30 4
1.274	35	25	18	1.777	0.833	33	21	20	7.83	0.747	35.1	33	25	46 4	11.66	0.827	7.6	35	23	42 4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.14 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 4,601.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         5000.0 ( 503.29 )
Delta E: MWd/MTU, (GWd)          399.0 (  40.16 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.13
Flow: Mlb/hr                     74.50 ( 96.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- 36 -- 14 -- 14 -- 36 -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           6.20

k-effective:                  0.99824
Void Fraction:                  0.504
Core Delta-P: psia             22.660
Core Plate Delta-P: psia       18.130
Coolant Temp: Deg-F             548.6
In Channel Flow: Mlb/hr         65.07
Total Bypass Flow (%):           12.7
Total Water Rod Flow (%):         3.2
Source Convergence            0.00048
```

```
Core Average Exposure: MWd/MTU    19498.2

                    Axial Profile     Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
Top 25    0.157   3.315    30  0.483 0.582   5 14
    24    0.485  10.150    31  0.445 0.578  13 48
    23    0.650  13.570    32  0.828 1.077  11 12
    22    0.759  15.420    33  1.116 1.272  25 28
    21    0.840  16.961    34  1.115 1.235  11 16
:JR 20    0.896  18.090    35  1.211 1.363  25 26
    19    0.931  19.120
    18    0.944  19.832
    17    0.936  20.012
    16    0.981  20.643
    15    1.007  21.493
    14    1.022  22.188
    13    1.097  22.008
    12    1.134  22.676
    11    1.159  23.072
    10    1.179  23.370
     9    1.220  24.033
     8    1.261  24.346
     7    1.302  24.299
     6    1.369  24.921
     5    1.442  25.170*
     4   1.455*  24.300
     3    1.389  22.115
     2    1.099  16.577
Bottom 1  0.287   4.486

          % AXIAL TILT -19.610 -12.641
      AVG BOT 8ft/12ft  1.1111  1.0782

Active Channel Flow: Mlb/hr        62.71
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.363	35	25	26	1.649	0.897	33	25	28	8.25	0.784	34.8	33	9	30	4	11.88	0.842	9.0	35	9	28	4
1.329	35	21	26	1.555	0.894	35	25	26	8.26	0.773	33.1	33	23	44	4	11.84	0.840	12.0	34	45	30	4
1.326	35	25	22	1.683	0.879	33	23	26	8.13	0.768	34.1	33	11	26	4	11.80	0.837	10.5	34	29	46	4
1.308	35	19	20	1.689	0.876	33	25	30	8.22	0.766	32.7	33	9	34	4	11.79	0.836	8.0	35	25	44	4
1.303	35	23	20	1.605	0.866	35	21	26	8.23	0.763	32.2	33	25	42	4	11.77	0.835	11.4	35	9	32	4
1.303	35	17	18	1.609	0.864	35	25	22	9.90	0.756	7.9	35	9	28	4	11.72	0.831	8.5	35	21	44	4
1.302	35	19	24	1.720	0.861	33	25	20	8.12	0.753	32.2	33	19	44	4	11.66	0.827	11.6	34	45	22	4
1.285	35	17	26	1.731	0.855	33	19	26	7.77	0.752	36.6	33	7	28	4	11.64	0.825	10.3	34	21	46	4
1.280	35	25	18	1.652	0.841	35	23	20	9.79	0.747	9.1	35	9	32	4	11.62	0.824	11.4	35	11	30	4
1.272	33	25	28	1.759	0.841	33	21	34	9.78	0.746	7.0	35	25	44	4	11.56	0.820	8.6	35	23	42	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.15 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 5,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         5500.0 ( 553.62 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.53
Flow: Mlb/hr                     73.34 ( 95.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- 36 -- 14 -- 14 -- 36 -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.20

k-effective:                    0.99811
Void Fraction:                    0.504
Core Delta-P: psia               22.149
Core Plate Delta-P: psia         17.619
Coolant Temp: Deg-F              548.5
In Channel Flow: Mlb/hr          64.04
Total Bypass Flow (%):            12.7
Total Water Rod Flow (%):          3.2
Source Convergence              0.00049
```

Core Average Exposure: MWd/MTU 19998.2

	N(PRA)	Axial Profile Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.160	3.402	30	0.479	0.578	5	14
	24	0.492	10.407	31	0.441	0.574	13	48
	23	0.659	13.914	32	0.823	1.073	11	12
	22	0.769	15.825	33	1.114	1.264	25	28
	21	0.851	17.409	34	1.117	1.240	11	16
:JR	20	0.907	18.568	35	1.218	1.365	25	26
	19	0.941	19.616					
	18	0.953	20.335					
	17	0.945	20.511					
	16	0.989	21.138					
	15	1.013	22.001					
	14	1.025	22.703					
	13	1.096	22.529					
	12	1.130	23.215					
	11	1.152	23.623					
	10	1.170	23.930					
	9	1.210	24.613					
	8	1.251	24.945					
	7	1.291	24.918					
	6	1.359	25.572					
	5	1.433	25.855*					
	4	1.447*	24.991					
	3	1.381	22.775					
	2	1.091	17.099					
Bottom	1	0.286	4.632					

% AXIAL TILT -18.809 -12.697
AVG BOT 8ft/12ft 1.1064 1.0782

Active Channel Flow: Mlb/hr 61.72
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.365	35	25	26	1.642	0.901	33	25 28	8.18	0.784	35.7 33	9 30	4	11.80	0.837	10.3 35	9 28	4
1.335	35	21	26	1.551	0.896	35	25 26	8.17	0.771	34.0 33	23 44	4	11.74	0.833	13.2 34	45 30	4
1.333	35	25	22	1.671	0.886	33	23 26	8.16	0.767	33.6 33	9 34	4	11.73	0.832	12.6 35	9 32	4
1.315	35	19	20	1.678	0.882	33	25 30	8.05	0.766	35.0 33	11 26	4	11.69	0.829	9.2 35	25 44	4
1.311	35	23	20	1.597	0.871	35	21 26	8.13	0.761	33.1 33	25 42	4	11.68	0.828	11.7 34	29 46	4
1.310	35	17	18	1.598	0.870	35	25 22	9.92	0.757	8.9 35	9 28	4	11.64	0.825	9.7 35	21 44	4
1.310	35	19	24	1.703	0.869	33	25 20	8.05	0.753	33.1 33	19 44	4	11.57	0.821	12.8 34	45 22	4
1.292	35	17	26	1.715	0.863	33	19 26	9.84	0.751	10.1 35	9 32	4	11.56	0.820	12.6 35	11 30	4
1.287	35	25	18	1.729	0.856	33	21 20	7.69	0.750	37.5 33	7 28	4	11.53	0.818	11.5 34	21 46	4
1.278	35	13	18	1.636	0.850	35	23 20	9.77	0.746	8.0 35	25 44	4	11.51	0.816	10.1 35	11 34	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.16 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 5,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         6000.0 ( 603.95 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.00
Flow: Mlb/hr                     72.00 ( 93.50 %)

       1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- -- 35
  11 -- -- -- 12 -- 28 -- 28 -- 12 -- -- -- 31
  13 -- -- -- -- -- -- -- -- -- -- -- -- -- 27
  15 -- -- -- 12 -- 28 -- 28 -- 12 -- -- -- 23
  17 -- -- -- -- -- -- -- -- -- -- -- -- -- 19
  19    -- -- 36 -- 14 -- 14 -- 36 -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25             -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.20

k-effective:                    0.99800
Void Fraction:                    0.505
Core Delta-P: psia               21.568
Core Plate Delta-P: psia         17.039
Coolant Temp: Deg-F              548.5
In Channel Flow: Mlb/hr          62.84
Total Bypass Flow (%):           12.7
Total Water Rod Flow (%):         3.2
Source Convergence              0.00048
```

```
Core Average Exposure: MWd/MTU    20498.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone  Avg.   Max.   IR JR
      Top 25  0.163   3.491      30  0.475 0.573   5 14
          24  0.499  10.668      31  0.437 0.569  13 48
          23  0.668  14.263      32  0.818 1.069  11 12
          22  0.778  16.235      33  1.112 1.257  25 28
          21  0.860  17.863      34  1.118 1.244  11 16
          20  0.916  19.051      35  1.224 1.369  25 26
          19  0.950  20.118
          18  0.961  20.843
          17  0.953  21.015
          16  0.996  21.637
          15  1.018  22.512
          14  1.027  23.220
          13  1.094  23.051
          12  1.124  23.753
          11  1.144  24.171
          10  1.160  24.486
           9  1.199  25.189
           8  1.239  25.540
           7  1.281  25.532
           6  1.349  26.218
           5  1.426  26.535*
           4  1.442* 25.679
           3  1.378  23.431
           2  1.088  17.618
      Bottom  1  0.286   4.777

          % AXIAL TILT -18.111 -12.731
        AVG BOT 8ft/12ft  1.1023  1.0780

Active Channel Flow: Mlb/hr       60.55
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.369	35	25 26	1.632	0.907	33	25 28	8.14	0.787	36.6 33	9 30	4	11.76	0.834	11.5 35	9 28	4
1.342	35	21 26	1.544	0.900	35	25 26	8.10	0.771	34.9 33	23 44	4	11.72	0.831	13.9 35	9 32	4
1.340	35	25 22	1.656	0.894	33	23 26	8.12	0.769	34.5 33	9 34	4	11.66	0.827	14.4 34	45 30	4
1.323	35	19 20	1.663	0.890	33	25 24	7.99	0.768	35.9 33	11 26	4	11.64	0.825	10.5 35	25 44	4
1.318	35	23 20	1.581	0.879	35	21 26	9.97	0.761	10.0 35	9 28	4	11.59	0.822	10.9 35	21 44	4
1.318	35	19 24	1.684	0.879	33	25 20	8.06	0.761	34.0 33	25 42	4	11.58	0.822	12.9 34	29 46	4
1.317	35	17 18	1.582	0.879	35	25 22	9.93	0.758	11.1 35	9 32	4	11.55	0.819	13.7 35	11 30	4
1.299	35	17 26	1.696	0.873	33	19 26	8.00	0.755	34.0 33	19 44	4	11.51	0.816	14.0 34	45 22	4
1.295	35	25 18	1.710	0.865	33	21 20	7.62	0.750	38.3 33	7 28	4	11.49	0.815	11.3 35	11 34	4
1.284	35	13 18	1.617	0.859	35	23 20	9.80	0.748	9.1 35	25 44	4	8.92	0.813	40.3 33	9 24	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.17 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 6,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)          6500.0 ( 654.28 )
Delta E: MWd/MTU, (GWd)           500.0 (  50.33 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.6
Inlet Subcooling: Btu/lbm         -23.57
Flow: Mlb/hr                       70.46 ( 91.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- 36 -- 14 -- 14 -- 36 -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.20

k-effective:                     0.99787
Void Fraction:                     0.508
Core Delta-P: psia                20.920
Core Plate Delta-P: psia          16.393
Coolant Temp: Deg-F               548.4
In Channel Flow: Mlb/hr           61.47
Total Bypass Flow (%):             12.8
Total Water Rod Flow (%):           3.2
Source Convergence               0.00050
```

```
Core Average Exposure: MWd/MTU    20998.2

                  Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure    Zone  Avg.  Max.   IR JR
Top 25    0.166   3.581    30   0.471 0.569    5 14
    24    0.506  10.932    31   0.433 0.565   13 48
    23    0.676  14.617    32   0.812 1.065   11 12
    22    0.786  16.650    33   1.110 1.250   25 28
    21    0.868  18.321    34   1.120 1.248   11 16
:JR 20    0.924  19.539    35   1.231 1.372   25 26
    19    0.958  20.624
    18    0.969  21.356
    17    0.960  21.523
    16    1.002  22.139
    15    1.022  23.025
    14    1.028  23.738
    13    1.090  23.571
    12    1.117  24.287
    11    1.134  24.715
    10    1.149  25.038
     9    1.187  25.759
     8    1.227  26.129
     7    1.270  26.141
     6    1.341  26.860
     5    1.421  27.213*
     4   1.442*  26.364
     3    1.381  24.085
     2    1.090  18.135
Bottom   1    0.288   4.923

          % AXIAL TILT -17.501 -12.746
AVG BOT 8ft/12ft  1.0986  1.0778

Active Channel Flow: Mlb/hr        59.21
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.372	35	25	26	1.620	0.913	33	25	28	8.11	0.791	37.5 33	9	30	4	11.75	0.833	12.7 35	9	28	4
1.350	35	21	26	1.529	0.909	35	25	26	8.06	0.774	35.8 33	23	44	4	11.74	0.833	15.1 35	9	32	4
1.348	35	25	22	1.639	0.903	33	23	26	8.09	0.774	35.4 33	9	34	4	11.62	0.824	15.7 34	45	30	4
1.331	35	19	20	1.645	0.899	33	25	24	7.95	0.770	36.8 33	11	26	4	11.61	0.823	11.7 35	25	44	4
1.326	35	19	24	1.663	0.890	33	25	20	10.05	0.768	11.0 35	9	28	4	11.58	0.821	12.1 35	21	44	4
1.326	35	23	20	1.563	0.890	35	21	26	10.04	0.766	12.2 35	9	32	4	11.56	0.820	14.9 35	11	30	4
1.324	35	17	18	1.563	0.889	35	25	22	8.02	0.763	34.9 33	25	42	4	8.88	0.817	41.2 33	9	24	4
1.307	35	17	26	1.675	0.883	33	19	26	7.97	0.758	34.8 33	19	44	4	11.52	0.817	14.2 34	29	46	4
1.303	35	25	18	1.689	0.876	33	21	20	9.86	0.753	10.1 35	25	44	4	11.50	0.816	12.4 35	11	34	4
1.291	35	13	18	1.596	0.871	35	23	20	7.58	0.752	39.2 33	7	28	4	11.48	0.814	15.2 34	45	22	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.18 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 6,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         7000.0 ( 704.61 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm        -24.16
Flow: Mlb/hr                      68.92 ( 89.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- 36 -- 14 -- 14 -- 36 -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- -- 12 -- 28 -- 28 -- 12 -- -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- 36 -- 14 -- 14 -- 36 -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            6.20

k-effective:                   0.99778
Void Fraction:                   0.510
Core Delta-P: psia              20.289
Core Plate Delta-P: psia        15.763
Coolant Temp: Deg-F             548.4
In Channel Flow: Mlb/hr         60.09
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence            0.00045
```

```
Core Average Exposure: MWd/MTU    21498.1

                  Axial Profile    Edit   Radial Power
          N(PRA)  Power Exposure   Zone   Avg.   Max.   IR JR
Top 25    0.168    3.673    30   0.466 0.564    5 14
    24    0.510   11.200    31   0.429 0.561   13 48
    23    0.680   14.974    32   0.807 1.060   11 12
    22    0.791   17.069    33   1.107 1.243   25 28
    21    0.873   18.784    34   1.122 1.253   11 16
    20    0.929   20.032    35   1.238 1.376   25 26
    19    0.963   21.135
    18    0.974   21.872
    17    0.965   22.034
    16    1.006   22.644
    15    1.025   23.541
    14    1.028   24.256
    13    1.086   24.089
    12    1.110   24.818
    11    1.125   25.254
    10    1.139   25.584
     9    1.176   26.323
     8    1.217   26.713
     7    1.261   26.744
     6    1.335   27.497
     5    1.420   27.888*
     4    1.446*  27.049
     3    1.388   24.741
     2    1.095   18.653
Bottom   1    0.290    5.069

          % AXIAL TILT -17.102 -12.746
     AVG BOT 8ft/12ft  1.0962  1.0775

Active Channel Flow: Mlb/hr       57.87
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.376	35	25	26	1.610	0.919	33	25	28	8.09	0.796	38.4	33	9	30	4	11.77	0.835	13.9	35	9	28	4
1.356	35	21	26	1.516	0.917	35	25	26	8.09	0.780	36.3	33	9	34	4	11.77	0.835	16.3	35	9	32	4
1.355	35	25	22	1.624	0.911	33	23	26	8.04	0.778	36.7	33	23	44	4	11.61	0.824	12.9	35	25	44	4
1.339	35	19	20	1.630	0.908	33	25	24	10.17	0.776	13.2	35	9	32	4	8.86	0.823	42.2	33	9	24	4
1.334	35	19	24	1.644	0.900	33	25	20	10.16	0.776	12.0	35	9	28	4	11.61	0.823	13.3	35	21	44	4
1.334	35	23	20	1.545	0.899	35	21	26	7.94	0.775	37.6	33	11	26	4	11.60	0.823	16.9	34	45	30	4
1.331	35	17	18	1.546	0.899	35	25	22	7.99	0.767	35.8	33	25	42	4	11.59	0.822	16.1	35	11	30	4
1.314	35	17	26	1.657	0.893	33	19	26	7.97	0.764	35.7	33	19	44	4	11.54	0.818	13.6	35	11	34	4
1.311	35	25	18	1.669	0.887	33	21	20	9.95	0.760	11.1	35	25	44	4	11.49	0.815	15.4	34	29	46	4
1.297	35	13	18	1.576	0.882	35	23	20	7.55	0.755	40.0	33	7	28	4	11.48	0.814	16.4	34	45	22	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.19 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 7,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         7001.0 ( 704.71 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm        -21.58
Flow: Mlb/hr                     76.23 ( 99.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- 14 --  8 -- 14 -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19    -- -- -- 14 --  8 -- 14 -- -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.57

k-effective:                    0.99778
Void Fraction:                    0.500
Core Delta-P: psia               23.447
Core Plate Delta-P: psia         18.915
Coolant Temp: Deg-F              548.6
In Channel Flow: Mlb/hr          66.62
Total Bypass Flow (%):            12.6
Total Water Rod Flow (%):          3.1
Source Convergence             0.00047
```

```
Core Average Exposure: MWd/MTU    21499.2

                 Axial Profile    Edit   Radial Power
N(PRA)  Power  Exposure  Zone   Avg.   Max.   IR JR
Top 25  0.167    3.673    30   0.471  0.579   5 14
    24  0.509   11.200    31   0.431  0.569  47 40
    23  0.678   14.975    32   0.817  1.077  11 12
    22  0.783   17.070    33   1.100  1.251  13 24
    21  0.854   18.785    34   1.136  1.304  11 16
    20  0.895   20.033    35   1.229  1.387  13 26
    19  0.917   21.136
    18  0.920   21.873
    17  0.905   22.036
    16  0.943   22.645
    15  0.962   23.542
    14  0.971   24.257
    13  1.039   24.090
    12  1.079   24.819
    11  1.119   25.255
    10  1.168   25.585
     9  1.231   26.324
     8  1.286   26.714
     7  1.335   26.746
     6  1.402   27.498
     5  1.482   27.889*
     4  1.499*  27.050
     3  1.431   24.742
     2  1.127   18.654
Bottom 1  0.298    5.069

% AXIAL TILT -20.666 -12.746
AVG BOT 8ft/12ft  1.1097  1.0775

Active Channel Flow: Mlb/hr        64.22
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.387	35	13 26	1.722	0.859	33	13 24	8.64	0.824	35.1 33	13 38	4	12.20	0.865	13.6 35	13 40	4
1.364	35	13 22	1.765	0.838	33	25 28	8.30	0.804	36.7 33	23 44	4	12.15	0.862	15.9 34	11 38	4
1.364	35	25 26	1.768	0.837	33	23 26	8.10	0.800	38.8 33	11 36	4	12.03	0.853	14.7 35	13 18	4
1.353	35	11 20	1.770	0.836	33	11 28	10.40	0.794	11.5 35	13 36	4	12.01	0.851	13.3 35	21 44	4
1.351	35	13 18	1.667	0.834	35	13 26	8.03	0.786	37.8 33	15 36	4	11.96	0.849	13.3 35	15 38	4
1.351	35	23 24	1.667	0.834	35	25 26	8.18	0.785	35.7 33	19 44	4	9.51	0.846	37.9 33	13 38	4
1.347	35	9 26	1.783	0.830	33	15 26	8.06	0.783	37.0 33	13 20	4	11.92	0.845	15.3 34	11 40	4
1.329	35	21 26	1.676	0.829	35	9 26	10.23	0.781	11.6 35	13 40	4	11.88	0.842	13.3 35	23 42	4
1.327	35	15 20	1.791	0.826	33	23 22	10.20	0.779	11.3 35	21 44	4	11.85	0.841	13.3 35	9 36	4
1.322	35	15 24	1.792	0.826	33	13 20	10.14	0.774	11.1 35	25 44	4	11.83	0.839	15.4 34	29 46	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.20 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 7,001.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         7500.0 ( 754.94 )
Delta E: MWd/MTU, (GWd)          499.0 (  50.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.13
Flow: Mlb/hr                     74.50 ( 96.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- 14 --  8 -- 14 -- -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- -- 14 --  8 -- 14 -- -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            6.57

k-effective:                   0.99768
Void Fraction:                   0.503
Core Delta-P: psia              22.699
Core Plate Delta-P: psia        18.168
Coolant Temp: Deg-F             548.6
In Channel Flow: Mlb/hr         65.07
Total Bypass Flow (%):           12.7
Total Water Rod Flow (%):         3.2
Source Convergence             0.00038
```

```
Core Average Exposure: MWd/MTU    21998.1

                 Axial Profile    Edit   Radial Power
N(PRA)  Power  Exposure  Zone   Avg.   Max.   IR JR
Top 25  0.169    3.765    30   0.467  0.574    5 14
    24  0.514   11.469    31   0.427  0.564   47 40
    23  0.684   15.333    32   0.812  1.072   11 12
    22  0.789   17.487    33   1.098  1.246   13 24
    21  0.860   19.239    34   1.139  1.309   11 16
    20  0.901   20.509    35   1.236  1.392   13 26
    19  0.923   21.624
    18  0.926   22.363
    17  0.910   22.517
    16  0.947   23.120
    15  0.965   24.026
    14  0.971   24.746
    13  1.034   24.583
    12  1.071   25.331
    11  1.108   25.786
    10  1.155   26.139
     9  1.217   26.908
     8  1.273   27.324
     7  1.324   27.379
     6  1.395   28.164
     5  1.482   28.592*
     4  1.506*  27.761
     3  1.442   25.421
     2  1.135   19.188
Bottom 1  0.301    5.221

          % AXIAL TILT -20.229 -12.820
      AVG BOT 8ft/12ft  1.1069  1.0774

Active Channel Flow: Mlb/hr       62.71
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.392	35	13	26	1.704	0.868	33	13 24	8.61	0.829	36.1 33	13 38	4	12.24	0.868	14.9 35	13 40	4
1.370	35	13	22	1.751	0.845	33	23 26	8.30	0.811	37.6 33	23 44	4	12.19	0.864	16.7 34	11 38	4
1.365	35	25	26	1.753	0.844	33	25 28	8.10	0.807	39.7 33	11 36	4	12.10	0.858	15.9 35	13 18	4
1.359	35	11	20	1.646	0.844	35	13 26	10.53	0.804	12.6 35	13 36	4	12.07	0.856	14.5 35	21 44	4
1.358	35	13	18	1.755	0.844	33	11 28	8.20	0.793	36.6 33	19 44	4	9.48	0.852	38.9 33	13 38	4
1.355	35	23	24	1.653	0.841	35	25 26	8.02	0.792	38.7 33	15 36	4	12.00	0.851	14.5 35	15 38	4
1.351	35	9	26	1.763	0.839	33	15 26	10.37	0.791	12.7 35	13 40	4	11.96	0.848	16.6 34	11 40	4
1.334	35	15	20	1.771	0.836	33	23 22	10.36	0.791	12.3 35	21 44	4	11.93	0.846	14.5 35	23 42	4
1.334	35	21	26	1.663	0.836	35	9 26	8.05	0.788	37.9 33	13 20	4	11.92	0.846	14.6 35	9 36	4
1.328	35	15	24	1.771	0.836	33	13 20	10.28	0.784	12.1 35	25 44	4	8.94	0.842	43.4 33	11 18	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.21 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 7,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         8000.0 ( 805.27 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.66
Flow: Mlb/hr                     72.96 ( 94.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- 14 --  8 -- 14 -- -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- -- 14 --  8 -- 14 -- -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %            6.57

k-effective:                   0.99755
Void Fraction:                   0.506
Core Delta-P: psia              22.045
Core Plate Delta-P: psia        17.515
Coolant Temp: Deg-F             548.5
In Channel Flow: Mlb/hr         63.68
Total Bypass Flow (%):           12.7
Total Water Rod Flow (%):         3.2
Source Convergence             0.00044
```

```
Core Average Exposure: MWd/MTU    22498.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone  Avg.  Max.   IR JR
      Top 25  0.172   3.859      30  0.462 0.570    5 14
          24  0.520  11.741      31  0.423 0.560   47 40
          23  0.691  15.695      32  0.806 1.069   11 12
          22  0.796  17.907      33  1.095 1.242   13 24
          21  0.867  19.698      34  1.141 1.315   11 16
          20  0.908  20.990      35  1.242 1.398   13 26
          19  0.929  22.116
          18  0.930  22.856
          17  0.914  23.003
          16  0.949  23.598
          15  0.964  24.513
          14  0.967  25.236
          13  1.025  25.075
          12  1.058  25.840
          11  1.093  26.313
          10  1.138  26.689
           9  1.200  27.487
           8  1.257  27.929
           7  1.312  28.008
           6  1.389  28.827
           5  1.484  29.296*
           4  1.518* 28.476
           3  1.460  26.106
           2  1.152  19.727
      Bottom  1  0.306   5.373

          % AXIAL TILT -19.856 -12.880
      AVG BOT 8ft/12ft  1.1040  1.0773

Active Channel Flow: Mlb/hr       61.36
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.398	35	13	26	1.686	0.878	33	13 24	8.64	0.839	37.0 33	13	38	4	12.33	0.874	16.1 35	13	40	4
1.376	35	13	22	1.625	0.855	35	13 26	8.32	0.820	38.5 33	23	44	4	12.31	0.873	17.9 34	11	38	4
1.367	35	25	26	1.736	0.852	33	23 26	8.13	0.818	40.6 33	11	36	4	12.20	0.865	17.1 35	13	18	4
1.366	35	11	20	1.736	0.852	33	11 26	10.69	0.816	13.7 35	13	36	4	9.51	0.864	40.0 33	13	38	4
1.366	35	13	18	1.742	0.849	33	25 28	10.55	0.805	13.8 35	13	40	4	12.16	0.862	15.8 35	21	44	4
1.360	35	23	24	1.744	0.849	33	15 26	10.54	0.805	13.4 35	21	44	4	12.08	0.857	15.8 35	15	38	4
1.356	35	9	26	1.641	0.847	35	25 26	8.25	0.805	37.5 33	19	44	4	12.06	0.856	17.8 34	11	40	4
1.341	35	15	20	1.751	0.845	33	13 20	8.04	0.800	39.6 33	15	36	4	12.03	0.853	15.8 35	9	36	4
1.339	35	21	26	1.752	0.845	33	23 22	8.06	0.796	38.8 33	13	20	4	8.96	0.853	44.4 33	11	18	4
1.335	35	15	24	1.650	0.842	35	9 26	10.43	0.796	13.2 35	25	44	4	11.99	0.851	15.8 35	23	42	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.22 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 8,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)          8500.0 ( 855.60 )
Delta E: MWd/MTU, (GWd)           500.0 (  50.33 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.6
Inlet Subcooling: Btu/lbm         -23.14
Flow: Mlb/hr                      71.61 ( 93.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- 14 --  8 -- 14 -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19    -- -- -- 14 --  8 -- 14 -- -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25             -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.57

k-effective:                     0.99755
Void Fraction:                     0.509
Core Delta-P: psia                21.478
Core Plate Delta-P: psia          16.950
Coolant Temp: Deg-F               548.5
In Channel Flow: Mlb/hr           62.48
Total Bypass Flow (%):            12.8
Total Water Rod Flow (%):          3.2
Source Convergence               0.00048
```

```
Core Average Exposure: MWd/MTU    22998.1

                 Axial Profile    Edit   Radial Power
N(PRA)  Power  Exposure  Zone   Avg.   Max.   IR JR
Top 25  0.174    3.954    30   0.458  0.566    5 14
    24  0.526   12.016    31   0.420  0.556   47 40
    23  0.698   16.061    32   0.802  1.065   11 12
    22  0.802   18.331    33   1.093  1.237   13 24
    21  0.873   20.160    34   1.145  1.322   11 16
    20  0.914   21.474    35   1.248  1.403   13 26
    19  0.934   22.612
    18  0.935   23.353
    17  0.918   23.490
    16  0.951   24.076
    15  0.964   24.999
    14  0.964   25.724
    13  1.018   25.562
    12  1.048   26.343
    11  1.080   26.832
    10  1.124   27.230
     9  1.185   28.057
     8  1.244   28.527
     7  1.302   28.632
     6  1.384   29.487
     5  1.485   30.001*
     4  1.526*  29.197
     3  1.475   26.799
     2  1.165   20.274
Bottom  1  0.310   5.529

% AXIAL TILT -19.486 -12.929
AVG BOT 8ft/12ft  1.1012  1.0771

Active Channel Flow: Mlb/hr       60.19
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.403	35	13 26	1.672	0.885	33	13 24	8.64	0.846	38.0 33	13 38	4	12.40	0.882	19.2 34	11 38	4
1.382	35	13 22	1.607	0.865	35	13 26	8.32	0.828	39.4 33	23 44	4	12.38	0.878	17.4 35	13 40	4
1.373	35	11 20	1.723	0.859	33	11 26	8.14	0.826	41.5 33	11 36	4	9.51	0.873	41.0 33	13 38	4
1.372	35	13 18	1.725	0.858	33	23 26	10.78	0.823	14.8 35	13 36	4	12.23	0.867	18.4 35	13 18	4
1.368	35	25 26	1.729	0.856	33	15 26	10.69	0.816	14.5 35	21 44	4	12.22	0.866	17.0 35	21 44	4
1.363	35	23 24	1.735	0.853	33	13 20	10.69	0.816	14.8 35	13 40	4	12.14	0.862	19.0 34	11 40	4
1.360	35	9 26	1.735	0.853	33	25 28	8.28	0.815	38.4 33	19 44	4	8.96	0.861	45.4 33	11 18	4
1.348	35	15 20	1.631	0.852	35	25 26	10.53	0.808	15.6 34	11 38	4	12.10	0.858	17.0 35	15 38	4
1.343	35	21 26	1.738	0.852	33	23 22	8.01	0.805	40.4 33	15 36	4	12.10	0.858	17.0 35	9 36	4
1.340	35	15 24	1.634	0.850	35	13 22	10.54	0.805	14.3 35	25 44	4	12.03	0.853	18.6 34	29 46	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.23 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 8,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         9000.0 ( 905.93 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.64
Flow: Mlb/hr                     70.26 ( 91.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- 14 --  8 -- 14 -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- 14 --  8 -- 14 -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           6.57

k-effective:                  0.99755
Void Fraction:                  0.511
Core Delta-P: psia             20.919
Core Plate Delta-P: psia       16.391
Coolant Temp: Deg-F             548.5
In Channel Flow: Mlb/hr         61.27
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence            0.00029
```

Core Average Exposure: MWd/MTU 23498.1

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.176	4.050	30	0.455	0.562	5	14
	24	0.529	12.295	31	0.416	0.552	47	40
	23	0.702	16.431	32	0.797	1.062	11	12
	22	0.806	18.759	33	1.090	1.232	13	24
	21	0.876	20.626	34	1.149	1.328	11	16
:JR	20	0.917	21.961	35	1.253	1.406	13	26
	19	0.938	23.110					
	18	0.939	23.851					
	17	0.921	23.979					
	16	0.955	24.556					
	15	0.966	25.485					
	14	0.964	26.210					
	13	1.015	26.046					
	12	1.042	26.841					
	11	1.073	27.346					
	10	1.117	27.764					
	9	1.178	28.621					
	8	1.237	29.119					
	7	1.296	29.251					
	6	1.380	30.145					
	5	1.483	30.706*					
	4	1.527*	29.922					
	3	1.480	27.500					
	2	1.170	20.827					
Bottom	1	0.312	5.686					

```
                % AXIAL TILT -19.203 -12.969
          AVG BOT 8ft/12ft  1.0995  1.0769
Active Channel Flow: Mlb/hr       59.02
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.406	35	13	26	1.658	0.892	33	13	24	8.58	0.849	38.9	33	13	38	4	12.42	0.893	20.5	34	11	38	4
1.386	35	13	22	1.591	0.874	35	13	26	8.29	0.831	40.4	33	23	44	4	9.46	0.877	42.0	33	13	38	4
1.379	35	11	20	1.711	0.865	33	11	26	8.10	0.830	42.4	33	11	36	4	12.34	0.875	18.7	35	13	40	4
1.378	35	13	18	1.715	0.863	33	23	26	10.77	0.828	15.9	35	13	36	4	12.18	0.873	20.2	34	41	40	4
1.369	35	25	26	1.717	0.862	33	15	26	10.75	0.827	15.9	35	13	40	4	12.17	0.868	19.6	35	39	36	4
1.367	35	23	24	1.720	0.861	33	13	20	10.76	0.825	15.6	35	21	44	4	12.23	0.867	17.4	35	21	44	3
1.364	35	9	26	1.618	0.859	35	13	22	10.63	0.822	16.7	34	11	38	4	8.91	0.866	46.4	33	11	18	4
1.353	35	15	20	1.725	0.858	33	23	22	8.27	0.822	39.3	33	19	44	4	12.09	0.864	19.8	34	29	46	4
1.347	35	21	26	1.621	0.857	35	25	26	10.58	0.810	15.4	35	25	44	4	12.02	0.861	20.0	34	9	38	4
1.345	35	15	24	1.729	0.856	33	25	28	7.93	0.804	41.3	33	15	36	4	12.10	0.858	18.3	35	9	36	4

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.24 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 9,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         9300.0 ( 936.12 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm        -23.97
Flow: Mlb/hr                      69.42 ( 90.15 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- 14 --  8 -- 14 -- -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- -- 14 --  8 -- 14 -- -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.57

k-effective:                     0.99756
Void Fraction:                     0.512
Core Delta-P: psia                20.556
Core Plate Delta-P: psia          16.029
Coolant Temp: Deg-F               548.4
In Channel Flow: Mlb/hr           60.52
Total Bypass Flow (%):             12.8
Total Water Rod Flow (%):           3.2
Source Convergence               0.00048
```

Core Average Exposure: MWd/MTU 23798.2

	N(PRA)	Axial Profile Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.179	4.109	30	0.453	0.560	5	14
	24	0.536	12.463	31	0.414	0.550	47	40
	23	0.710	16.654	32	0.795	1.060	11	12
	22	0.814	19.017	33	1.088	1.230	13	24
	21	0.885	20.906	34	1.151	1.332	11	16
	20	0.925	22.254	35	1.256	1.408	13	26
	19	0.946	23.410					
	18	0.946	24.151					
	17	0.927	24.274					
	16	0.959	24.845					
	15	0.970	25.778					
	14	0.965	26.502					
	13	1.013	26.336					
	12	1.038	27.139					
	11	1.067	27.652					
	10	1.110	28.083					
	9	1.170	28.957					
	8	1.230	29.472					
	7	1.289	29.621					
	6	1.373	30.539					
	5	1.475	31.129*					
	4	1.520*	30.358					
	3	1.476	27.922					
	2	1.168	21.161					
Bottom	1	0.311	5.781					

```
                % AXIAL TILT -18.611 -12.988
          AVG BOT 8ft/12ft  1.0958  1.0768
Active Channel Flow: Mlb/hr       58.29
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.408	35	13	26	1.646	0.899	33	13 24	8.51	0.847	39.5 33	13 38	4	12.38	0.896	21.3 34	11 38	4
1.388	35	13	22	1.578	0.881	35	13 26	8.22	0.829	40.9 33	23 44	4	12.14	0.876	21.0 34	41 40	4
1.382	35	11	20	1.700	0.870	33	11 26	10.71	0.828	16.6 35	13 40	4	9.38	0.876	42.6 33	13 38	4
1.381	35	13	18	1.704	0.869	33	23 26	8.04	0.828	42.9 33	11 36	4	12.25	0.873	19.5 35	13 40	4
1.370	35	25	26	1.705	0.868	33	15 26	10.64	0.827	17.3 34	11 38	4	12.06	0.868	20.6 34	29 46	4
1.369	35	23	24	1.707	0.867	33	13 20	10.72	0.827	16.3 35	21 44	4	12.06	0.866	20.4 35	39 36	4
1.367	35	9	26	1.604	0.866	35	13 22	10.69	0.826	16.6 35	13 36	4	8.84	0.865	46.9 33	11 18	4
1.355	35	15	20	1.712	0.865	33	23 22	8.23	0.822	39.9 33	19 44	4	12.19	0.864	18.2 35	21 44	3
1.349	35	21	26	1.611	0.863	35	25 26	10.53	0.811	16.0 35	25 44	4	11.99	0.864	20.8 34	9 38	4
1.347	35	15	24	1.612	0.862	35	15 24	7.83	0.798	41.8 33	15 36	4	11.97	0.858	20.1 34	21 46	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.25 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 9,300.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         9600.0 ( 966.32 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.27
Flow: Mlb/hr                     68.65 ( 89.15 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- 14 --  8 -- 14 -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- -- 35
  11 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- -- 31
  13 -- -- -- -- -- -- -- -- -- -- -- -- -- 27
  15 -- -- 36 -- 12 -- 36 -- 12 -- 36 -- -- 23
  17 -- -- -- -- -- -- -- -- -- -- -- -- -- 19
  19    -- -- -- 14 --  8 -- 14 -- -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25             -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              6.57

k-effective:                    0.99756
Void Fraction:                    0.512
Core Delta-P: psia               20.229
Core Plate Delta-P: psia         15.703
Coolant Temp: Deg-F              548.4
In Channel Flow: Mlb/hr          59.84
Total Bypass Flow (%):           12.8
Total Water Rod Flow (%):         3.2
Source Convergence             0.00041
```

Core Average Exposure: MWd/MTU 24098.2

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.180	4.168	30	0.451	0.559	5	14
	24	0.539	12.633	31	0.413	0.549	47	40
	23	0.714	16.879	32	0.793	1.058	11	12
	22	0.818	19.278	33	1.087	1.227	13	24
	21	0.889	21.189	34	1.154	1.335	11	16
	20	0.930	22.550	35	1.259	1.410	13	26
	19	0.951	23.713					
	18	0.951	24.454					
	17	0.933	24.571					
	16	0.965	25.135					
	15	0.974	26.071					
	14	0.969	26.794					
	13	1.015	26.625					
	12	1.038	27.435					
	11	1.067	27.956					
	10	1.108	28.399					
	9	1.168	29.291					
	8	1.227	29.823					
	7	1.285	29.988					
	6	1.367	30.930					
	5	1.466	31.549*					
	4	1.508*	30.791					
	3	1.465	28.343					
	2	1.161	21.494					
Bottom	1	0.310	5.876					

% AXIAL TILT -18.168 -12.999
AVG BOT 8ft/12ft 1.0935 1.0766

Active Channel Flow: Mlb/hr 57.63
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.410	35	13	26	1.637	0.904	33	13	24	8.40	0.841	40.1	33	13	38	4	12.29	0.896	22.1	34	11	38	4
1.390	35	13	22	1.567	0.887	35	13	26	10.61	0.829	18.0	34	11	38	4	12.07	0.877	21.7	34	41	40	4
1.385	35	11	20	1.691	0.875	33	11	26	10.65	0.828	17.2	35	39	40	4	9.27	0.871	43.2	33	13	38	4
1.383	35	13	18	1.695	0.873	33	23	26	10.65	0.826	16.9	35	21	44	4	12.00	0.869	21.4	34	29	46	4
1.371	35	23	24	1.696	0.873	33	15	26	8.13	0.825	41.4	33	23	44	4	12.11	0.869	20.2	35	13	40	4
1.370	35	25	26	1.594	0.872	35	13	22	7.95	0.823	43.4	33	11	36	4	11.94	0.865	21.4	34	43	38	4
1.370	35	9	26	1.697	0.872	33	13	20	10.56	0.821	17.2	35	13	36	4	8.75	0.861	47.5	33	11	18	4
1.357	35	15	20	1.702	0.870	33	23	22	8.17	0.820	40.4	33	19	44	4	11.91	0.861	21.1	35	39	36	4
1.351	35	21	26	1.602	0.868	35	15	24	10.44	0.808	16.7	35	25	44	4	11.92	0.859	20.8	34	21	46	4
1.349	35	15	24	1.604	0.867	35	25	26	10.35	0.799	16.4	35	17	44	4	12.00	0.857	19.8	35	21	44	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.26 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 9,600.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         9601.0 ( 966.42 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -21.58
Flow: Mlb/hr                     76.23 ( 99.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 --  6 --  8 --  6 -- 36 -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- 26 --  8 -- 26 --  8 -- 26 -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- 36 --  6 --  8 --  6 -- 36 -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              8.12

k-effective:                    0.99750
Void Fraction:                    0.481
Core Delta-P: psia               23.195
Core Plate Delta-P: psia         18.663
Coolant Temp: Deg-F              548.4
In Channel Flow: Mlb/hr          66.72
Total Bypass Flow (%):           12.5
Total Water Rod Flow (%):         3.1
Source Convergence              0.00046
```

```
Core Average Exposure: MWd/MTU    24099.1

                Axial Profile     Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
        Top 25  0.179   4.168     30   0.464  0.566    5 14
           24   0.540  12.633     31   0.426  0.560   13 48
           23   0.715  16.880     32   0.817  1.104   11 12
           22   0.813  19.278     33   1.073  1.202   13 24
           21   0.872  21.190     34   1.179  1.342   11 16
           20   0.911  22.551     35   1.235  1.376   13 22
           19   0.949  23.714
           18   0.986  24.455
           17   1.008  24.572
           16   1.074  25.136
           15   1.106  26.072
           14   1.107  26.795
           13   1.155  26.626
           12   1.163  27.436
           11   1.156  27.957
           10   1.168  28.401
            9   1.202  29.292
            8   1.231  29.824
            7   1.252  29.989
            6   1.290  30.932
            5   1.340* 31.551*
            4   1.330  30.792
            3   1.245  28.344
            2   0.957  21.495
     Bottom  1   0.251   5.876

          % AXIAL TILT -13.945 -12.999
      AVG BOT 8ft/12ft  1.0894  1.0766

Active Channel Flow: Mlb/hr       64.36
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.376	35	13	22	1.788	0.828	33	13	24	9.94	0.773	17.3	35	13	40	4	11.18	0.802	20.2	35	13	40	4
1.364	35	13	18	1.689	0.823	35	9	22	7.55	0.765	41.4	33	13	38	5	8.50	0.798	43.1	33	13	38	5
1.359	35	11	24	1.695	0.820	35	11	24	7.30	0.762	44.1	33	15	40	5	8.11	0.795	47.1	33	15	40	5
1.355	35	13	14	1.821	0.813	33	11	22	9.66	0.749	17.0	35	15	38	4	10.96	0.793	21.2	34	11	14	4
1.354	35	15	16	1.831	0.808	33	15	14	7.16	0.737	42.9	33	11	18	8	10.88	0.793	22.1	34	11	38	4
1.353	35	17	14	1.721	0.807	35	13	32	7.31	0.729	39.7	33	15	32	4	10.95	0.792	21.1	34	13	12	4
1.346	35	9	22	1.833	0.807	33	19	40	9.40	0.729	16.9	35	13	32	4	10.95	0.782	19.6	35	15	38	4
1.345	35	21	14	1.722	0.807	35	13	14	9.38	0.727	16.9	35	15	30	4	10.66	0.773	21.5	34	37	12	4
1.342	34	11	16	1.838	0.805	33	13	38	7.27	0.726	39.8	33	13	30	4	7.96	0.772	46.1	33	11	18	8
1.336	35	13	26	1.840	0.804	33	13	20	7.00	0.723	43.2	33	17	42	8	7.79	0.758	46.5	33	17	42	8

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.27 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 9,601.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        10000.0 (1006.60 )
Delta E: MWd/MTU, (GWd)          399.0 (  40.16 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -21.97
Flow: Mlb/hr                     75.00 ( 97.40 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- 36 -- 26 -- 36 -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9 -- -- 36 --  6 --  8 --  6 -- 36 -- --  35
  11 -- -- -- -- -- -- -- -- -- -- -- -- --  31
  13 -- -- 26 --  8 -- 26 --  8 -- 26 -- --  27
  15 -- -- -- -- -- -- -- -- -- -- -- -- --  23
  17 -- -- 36 --  6 --  8 --  6 -- 36 -- --  19
  19    -- -- -- -- -- -- -- -- -- -- --     15
  21    -- -- -- 36 -- 26 -- 36 -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %           8.12

k-effective:                  0.99755
Void Fraction:                  0.482
Core Delta-P: psia             22.646
Core Plate Delta-P: psia       18.115
Coolant Temp: Deg-F             548.4
In Channel Flow: Mlb/hr         65.62
Total Bypass Flow (%):          12.5
Total Water Rod Flow (%):        3.1
Source Convergence           0.00042
```

Core Average Exposure: MWd/MTU 24498.1

	Axial Profile N(PRA)	Power	Exposure
Top	25	0.181	4.248
	24	0.545	12.861
	23	0.721	17.182
	22	0.819	19.624
	21	0.879	21.561
	20	0.918	22.939
	19	0.956	24.117
	18	0.994	24.875
	17	1.017	25.001
	16	1.083	25.569
	15	1.114	26.517
	14	1.113	27.241
	13	1.159	27.064
	12	1.164	27.877
	11	1.156	28.396
	10	1.167	28.844
	9	1.200	29.748
	8	1.228	30.291
	7	1.248	30.464
	6	1.283	31.421
	5	1.326*	32.059*
	4	1.311	31.296
	3	1.226	28.816
	2	0.944	21.858
Bottom	1	0.248	5.978

Edit Zone	Radial Power Avg.	Max.	IR	JR
30	0.461	0.563	5	14
31	0.423	0.557	13	48
32	0.814	1.101	11	12
33	1.071	1.198	13	24
34	1.183	1.347	11	16
35	1.238	1.378	13	22

% AXIAL TILT -13.263 -12.936
AVG BOT 8ft/12ft 1.0861 1.0762

Active Channel Flow: Mlb/hr 63.29
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.378	35	13	22	1.771	0.836	33	13	24	9.80	0.767	18.1	35	13	40	4	10.96	0.793	21.2	35	13	40	4
1.368	35	13	18	1.676	0.829	35	9	22	7.44	0.759	42.0	33	13	38	5	8.37	0.792	43.8	33	13	38	5
1.363	35	11	24	1.683	0.826	35	11	24	7.19	0.755	44.8	33	15	40	5	10.84	0.791	22.1	34	11	14	4
1.359	35	13	14	1.805	0.820	33	11	22	7.13	0.739	43.5	33	11	18	8	10.84	0.790	22.0	34	13	12	4
1.357	35	15	16	1.813	0.816	33	15	14	9.45	0.738	17.8	35	15	38	4	7.98	0.789	47.8	33	15	40	5
1.356	35	17	14	1.818	0.814	33	19	40	6.96	0.724	43.8	33	17	42	8	10.73	0.789	23.0	34	11	38	4
1.351	35	9	22	1.708	0.814	35	13	14	7.09	0.721	41.7	33	9	20	8	7.92	0.774	46.7	33	11	18	8
1.348	35	21	14	1.710	0.813	35	13	32	9.19	0.721	18.4	34	11	40	4	10.56	0.772	22.4	34	37	12	4
1.347	34	11	16	1.821	0.813	33	13	38	9.15	0.717	18.3	34	13	42	4	10.69	0.769	20.5	35	15	38	4
1.338	35	13	26	1.822	0.812	33	13	20	9.17	0.715	17.7	35	13	32	4	7.74	0.760	47.1	33	17	42	8

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.28 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 10,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        10500.0 (1056.90 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.53
Flow: Mlb/hr                     73.34 ( 95.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 --  8 -- 26 --  8 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              8.12

k-effective:                     0.99751
Void Fraction:                     0.482
Core Delta-P: psia                21.904
Core Plate Delta-P: psia          17.374
Coolant Temp: Deg-F               548.3
In Channel Flow: Mlb/hr           64.15   Active Channel Flow: Mlb/hr       61.86
Total Bypass Flow (%):            12.5    (of total core flow)
Total Water Rod Flow (%):          3.1    (of total core flow)
Source Convergence              0.00045

                                Core Average Exposure: MWd/MTU    24998.1

                                    Axial Profile    Edit   Radial Power
                              N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
                            Top 25  0.185   4.348    30  0.458 0.560   5 14
                                24  0.554  13.150    31  0.421 0.554  13 48
                                23  0.732  17.564    32  0.810 1.098  11 12
                                22  0.830  20.061    33  1.068 1.194  13 24
                                21  0.890  22.030    34  1.188 1.352  11 16
                          :JR   20  0.931  23.428    35  1.242 1.380  13 22
                                19  0.970  24.627
                                18  1.009  25.405
                                17  1.032  25.543
                                16  1.099  26.115
                                15  1.129  27.079
                                14  1.126  27.802
                                13  1.167  27.615
                                12  1.169  28.430
                                11  1.158  28.945
                                10  1.168  29.399
                                 9  1.200  30.319
                                 8  1.225  30.875
                                 7  1.241  31.058
                                 6  1.269  32.031
                                 5  1.298* 32.689*
                                 4  1.274  31.919
                                 3  1.188  29.398
                                 2  0.916  22.306
                            Bottom  1  0.241   6.104
                                % AXIAL TILT -12.002 -12.846
                              AVG BOT 8ft/12ft  1.0801  1.0758
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.380	35	13	22	1.746	0.848	33	13	24	9.51	0.750	19.1	35	39	40	4	10.57	0.779	23.3	34	11	14	4
1.371	35	13	18	1.656	0.839	35	9	22	7.24	0.745	42.8	33	13	38	5	10.58	0.778	23.1	34	13	12	4
1.367	35	11	24	1.664	0.835	35	11	24	7.00	0.742	45.6	33	15	40	5	8.14	0.778	44.7	33	13	38	5
1.362	35	13	14	1.781	0.831	33	11	22	7.08	0.741	44.3	33	11	18	8	7.87	0.776	47.6	33	11	18	8
1.359	35	15	16	1.787	0.828	33	13	16	6.92	0.725	44.6	33	17	42	8	7.77	0.775	48.7	33	15	40	5
1.359	35	17	14	1.788	0.828	33	15	14	7.05	0.723	42.5	33	9	20	8	10.45	0.774	23.8	34	11	38	5
1.356	35	9	22	1.791	0.826	33	13	34	9.09	0.715	18.8	35	15	38	4	10.57	0.772	22.3	35	13	40	4
1.352	34	11	16	1.794	0.825	33	19	40	9.00	0.712	19.3	34	41	40	4	10.34	0.762	23.3	34	37	12	5
1.350	35	21	14	1.687	0.824	35	13	32	8.97	0.709	19.3	34	13	42	4	7.69	0.762	48.0	33	17	42	8
1.342	35	13	26	1.688	0.824	35	13	14	6.82	0.702	42.9	33	19	44	8	7.79	0.747	45.1	33	9	34	8

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.29 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 10,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        11000.0 (1107.20 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.14
Flow: Mlb/hr                     71.61 ( 93.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 --  6 --  8 --  6 -- 36 -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- 26 --  8 -- 26 --  8 -- 26 -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- 36 --  6 --  8 --  6 -- 36 -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %           8.12

k-effective:                  0.99752
Void Fraction:                  0.481
Core Delta-P: psia             21.135
Core Plate Delta-P: psia       16.607
Coolant Temp: Deg-F             548.2
In Channel Flow: Mlb/hr         62.62
Total Bypass Flow (%):           12.6
Total Water Rod Flow (%):         3.1
Source Convergence            0.00049
```

Core Average Exposure: MWd/MTU 25498.2

	Axial Profile N(PRA)	Power	Exposure
Top	25	0.188	4.450
	24	0.562	13.443
	23	0.742	17.951
	22	0.841	20.504
	21	0.902	22.504
	20	0.944	23.924
	19	0.985	25.144
	18	1.026	25.942
	17	1.051	26.093
	16	1.120	26.670
	15	1.150	27.649
	14	1.144	28.370
	13	1.181	28.170
	12	1.180	28.986
	11	1.166	29.496
	10	1.174	29.954
	9	1.202	30.889
	8	1.224	31.457
	7	1.233	31.648
	6	1.251	32.634
	5	1.263*	33.306*
	4	1.227	32.524
	3	1.138	29.963
	2	0.879	22.741
Bottom	1	0.231	6.226

Edit Zone	Radial Power Avg.	Max.	IR	JR
30	0.456	0.558	5	14
31	0.418	0.552	13	48
32	0.807	1.094	11	12
33	1.065	1.190	13	24
34	1.192	1.357	11	16
35	1.245	1.382	13	22

% AXIAL TILT -10.556 -12.735
AVG BOT 8ft/12ft 1.0737 1.0752

Active Channel Flow: Mlb/hr 60.38
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.382	35	13	22	1.721	0.860	33	13	24	7.05	0.743	45.1	33	11	18	8	7.83	0.779	48.4	33	11	18	8
1.374	35	13	18	1.633	0.851	35	9	22	6.89	0.728	45.4	33	17	42	8	7.66	0.765	48.8	33	17	42	8
1.371	35	11	24	1.642	0.846	35	11	24	9.15	0.727	20.0	35	39	40	4	7.87	0.759	45.6	33	13	38	5
1.365	35	13	14	1.751	0.845	33	13	16	7.00	0.726	43.6	33	13	38	5	10.24	0.759	24.0	34	11	14	5
1.362	35	17	14	1.755	0.843	33	11	22	7.01	0.725	43.3	33	9	20	8	10.24	0.759	23.9	34	13	12	5
1.362	35	9	22	1.759	0.841	33	13	34	6.90	0.724	44.7	33	37	40	5	10.15	0.758	24.9	34	11	38	5
1.361	35	15	16	1.760	0.841	33	15	14	6.79	0.705	43.6	33	19	44	8	7.52	0.757	49.5	33	15	40	5
1.357	34	11	16	1.768	0.837	33	19	40	8.78	0.698	20.0	34	41	40	5	10.21	0.750	23.0	35	13	40	5
1.353	35	21	14	1.663	0.836	35	13	32	8.75	0.695	19.9	34	13	42	5	10.07	0.749	24.4	34	37	12	5
1.345	35	13	26	1.665	0.835	35	13	14	8.77	0.693	19.4	35	15	38	5	7.74	0.749	45.9	33	9	34	8

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.30 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 11,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        11350.0 (1142.50 )
Delta E: MWd/MTU, (GWd)          350.0 (  35.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.67
Flow: Mlb/hr                     70.19 ( 91.15 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- 36 -- 26 -- 36 -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- 26 --  8 -- 26 --  8 -- 26 -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- 36 -- 26 -- 36 -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           8.12

k-effective:                  0.99752
Void Fraction:                  0.481
Core Delta-P: psia             20.515
Core Plate Delta-P: psia       15.987
Coolant Temp: Deg-F             548.1
In Channel Flow: Mlb/hr         61.36
Total Bypass Flow (%):           12.6
Total Water Rod Flow (%):         3.1
Source Convergence            0.00048
```

Core Average Exposure: MWd/MTU 25848.1

	N(PRA)	Axial Profile Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.190	4.523	30	0.454	0.557	5	14
	24	0.567	13.651	31	0.417	0.551	13	48
	23	0.749	18.226	32	0.805	1.092	11	12
	22	0.849	20.818	33	1.064	1.187	13	24
	21	0.911	22.841	34	1.195	1.359	11	16
:JR	20	0.955	24.277	35	1.247	1.384	13	22
	19	0.997	25.511					
	18	1.040	26.325					
	17	1.066	26.485					
	16	1.137	27.065					
	15	1.167	28.055					
	14	1.159	28.774					
	13	1.193	28.563					
	12	1.189	29.379					
	11	1.173	29.884					
	10	1.178	30.345					
	9	1.205	31.289					
	8	1.222	31.864					
	7	1.225	32.058					
	6	1.234*	33.050					
	5	1.234	33.726*					
	4	1.189	32.932					
	3	1.098	30.341					
	2	0.849	23.034					
Bottom	1	0.223	6.308					
% AXIAL TILT		-9.379	-12.640					
AVG BOT 8ft/12ft		1.0686	1.0747					

Active Channel Flow: Mlb/hr 59.15
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.384	35	13	22	1.699	0.871	33	13	24	7.01	0.743	45.7	33	11	18	8	7.79	0.780	49.0	33	11	18	8
1.375	35	13	18	1.614	0.861	35	9	22	6.87	0.730	45.9	33	17	42	8	7.63	0.767	49.4	33	17	42	8
1.374	35	11	24	1.622	0.857	35	11	24	6.97	0.725	43.8	33	9	20	8	7.69	0.750	46.5	33	9	34	8
1.366	35	13	14	1.729	0.856	33	13	16	8.93	0.712	20.3	35	39	40	5	9.99	0.746	24.8	34	11	14	5
1.365	35	9	22	1.731	0.855	33	9	24	6.81	0.711	44.2	33	13	38	5	10.00	0.746	24.6	34	13	12	5
1.364	35	17	14	1.735	0.853	33	11	22	6.66	0.710	46.2	33	15	40	6	9.89	0.744	25.6	34	11	38	5
1.362	35	15	16	1.736	0.852	33	13	34	6.77	0.706	44.1	33	19	44	8	7.55	0.744	47.6	33	13	38	5
1.359	34	11	16	1.738	0.852	33	15	14	9.13	0.703	16.0	35	9	26	15	7.31	0.742	50.1	33	15	40	5
1.355	35	21	14	1.639	0.848	34	11	38	7.07	0.703	39.3	33	11	26	14	7.56	0.738	46.6	33	19	44	8
1.347	35	13	26	1.745	0.848	33	19	14	8.60	0.688	20.7	34	41	40	5	9.84	0.737	25.1	34	37	12	5

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.31 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 11,350.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         11700.0 (1177.70 )
Delta E: MWd/MTU, (GWd)           350.0 (  35.23 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.5
Inlet Subcooling: Btu/lbm        -24.24
Flow: Mlb/hr                      68.72 ( 89.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- 36 -- 26 -- 36 -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 35
  11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13  -- -- 26 --  8 -- 26 --  8 -- 26 -- -- 27
  15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17  -- -- 36 --  6 --  8 --  6 -- 36 -- -- 19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- 36 -- 26 -- 36 -- -- --     11
  23        -- -- -- -- -- -- -- -- --        7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              8.12

k-effective:                    0.99750
Void Fraction:                    0.480
Core Delta-P: psia               19.886
Core Plate Delta-P: psia         15.359
Coolant Temp: Deg-F              548.0
In Channel Flow: Mlb/hr          60.07
Total Bypass Flow (%):           12.6
Total Water Rod Flow (%):         3.1
Source Convergence              0.00033
```

```
Core Average Exposure: MWd/MTU    26198.1

                    Axial Profile    Edit   Radial Power
          N(PRA)  Power Exposure    Zone   Avg.   Max.   IR JR
Top 25    0.193   4.596    30   0.453 0.555    5 14
    24    0.573  13.861    31   0.416 0.549   13 48
    23    0.756  18.504    32   0.803 1.089   11 12
    22    0.857  21.134    33   1.062 1.185   11 22
    21    0.922  23.181    34   1.197 1.361   11 16
    20    0.966  24.633    35   1.250 1.385   13 22
    19    1.011  25.884
    18    1.056  26.713
    17    1.084  26.883
    16    1.156  27.466
    15    1.186  28.467
    14    1.176  29.183
    13    1.207  28.960
    12    1.200  29.775
    11    1.182  30.275
    10    1.184  30.737
     9    1.207  31.690
     8    1.219* 32.271
     7    1.216  32.466
     6    1.216  33.461
     5    1.202  34.136*
     4    1.147  33.327
     3    1.055  30.706
     2    0.816  23.316
Bottom   1    0.214   6.388

          % AXIAL TILT  -8.079 -12.532
AVG BOT 8ft/12ft  1.0631  1.0742

Active Channel Flow: Mlb/hr       57.90
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.385	35	13	22	1.677	0.883	33	13	24	6.97	0.743	46.2	33	11	18	8	7.74	0.780	49.6	33	11	18	8
1.377	35	13	18	1.594	0.872	35	9	22	6.83	0.730	46.4	33	17	42	8	7.59	0.768	49.9	33	17	42	8
1.376	35	11	24	1.600	0.869	35	11	24	6.93	0.724	44.3	33	9	20	8	7.64	0.749	47.1	33	9	34	8
1.368	35	9	22	1.705	0.868	33	9	24	9.31	0.720	16.6	35	9	26	15	10.37	0.738	19.4	35	9	26	15
1.367	35	13	14	1.706	0.868	33	13	16	7.15	0.714	39.9	33	11	26	14	7.52	0.738	47.2	33	19	44	8
1.366	35	17	14	1.713	0.864	33	11	22	6.74	0.707	44.6	33	19	44	8	7.74	0.732	43.8	33	11	28	13
1.363	35	15	16	1.713	0.864	33	13	34	6.52	0.700	46.9	33	13	16	6	7.41	0.732	47.7	33	13	38	6
1.361	34	11	16	1.715	0.863	33	15	14	6.53	0.700	46.7	33	15	40	6	9.74	0.731	25.3	34	13	12	5
1.358	35	21	14	1.612	0.862	34	11	38	8.69	0.696	21.0	35	39	40	5	9.72	0.731	25.5	34	11	14	5
1.349	35	13	26	1.720	0.860	33	19	14	8.88	0.682	15.8	35	25	10	15	7.22	0.730	49.9	33	15	40	6

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.32 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 11,700.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        11701.0 (1177.80 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.58
Flow: Mlb/hr                     73.23 ( 95.10 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --                51     :JR
  3        -- -- -- -- -- -- -- -- --          47
  5     -- -- -- -- 36 -- 36 -- -- -- --       43
  7     -- -- -- -- -- -- -- -- -- -- --       39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- -- --    15
 21     -- -- -- -- 36 -- 36 -- -- -- -- --    11
 23        -- -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --                 3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              7.30

k-effective:                    0.99750
Void Fraction:                    0.494
Core Delta-P: psia               22.062
Core Plate Delta-P: psia         17.532
Coolant Temp: Deg-F              548.4
In Channel Flow: Mlb/hr          63.97
Total Bypass Flow (%):           12.6
Total Water Rod Flow (%):         3.2
Source Convergence              0.00035
```

Core Average Exposure: MWd/MTU 26199.1

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.175	4.597	30	0.443	0.532	5	14
	24	0.522	13.862	31	0.407	0.551	13	48
	23	0.690	18.505	32	0.793	1.067	11	12
	22	0.784	21.135	33	1.065	1.194	25	12
	21	0.846	23.182	34	1.196	1.370	15	12
	20	0.894	24.634	35	1.258	1.408	19	12
	19	0.930	25.885					
	18	0.954	26.715					
	17	0.967	26.884					
	16	1.025	27.468					
	15	1.050	28.468					
	14	1.048	29.184					
	13	1.091	28.961					
	12	1.111	29.776					
	11	1.137	30.276					
	10	1.175	30.738					
	9	1.230	31.691					
	8	1.276	32.272					
	7	1.310	32.467					
	6	1.355	33.462					
	5	1.391*	34.137*					
	4	1.382	33.328					
	3	1.322	30.707					
	2	1.053	23.317					
Bottom	1	0.282	6.388					

% AXIAL TILT -17.320 -12.531
AVG BOT 8ft/12ft 1.1020 1.0742

Active Channel Flow: Mlb/hr 61.66
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.408	35	19	12	1.652	0.841	35	25	10	9.97	0.802	21.4	34	37	42	4	11.23	0.848	26.0	34	37	12	4
1.400	35	17	14	1.771	0.836	33	19	40	9.97	0.794	20.2	35	43	22	4	11.34	0.847	24.8	34	45	20	4
1.394	35	25	14	1.684	0.826	35	17	14	7.71	0.794	42.8	33	43	20	4	11.26	0.846	25.4	34	45	30	4
1.388	35	25	10	1.797	0.824	33	25	12	7.46	0.786	45.1	33	17	12	5	11.24	0.840	24.8	34	45	22	4
1.384	35	21	14	1.688	0.824	35	23	12	9.97	0.786	19.0	35	43	36	4	11.16	0.836	25.1	34	15	10	4
1.370	34	15	12	1.797	0.824	33	23	14	9.74	0.783	21.3	35	39	40	4	11.10	0.836	25.7	34	13	12	4
1.358	35	25	26	1.688	0.823	35	19	12	9.78	0.782	20.6	34	45	22	4	11.05	0.824	24.6	35	43	32	4
1.354	35	23	24	1.698	0.819	35	25	14	9.90	0.779	18.8	35	17	10	4	11.13	0.823	23.7	34	45	36	4
1.349	35	17	10	1.704	0.816	35	17	10	7.47	0.779	44.1	33	43	24	4	8.46	0.822	46.3	33	43	20	4
1.349	35	19	16	1.818	0.814	33	17	12	7.43	0.778	44.6	33	37	40	4	11.30	0.821	21.7	35	17	44	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.33 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 11,701.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        12200.0 (1228.00 )
Delta E: MWd/MTU, (GWd)          499.0 (  50.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.11
Flow: Mlb/hr                     71.69 ( 93.10 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 36 -- 36 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 36 -- 36 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           7.30

k-effective:                  0.99748
Void Fraction:                  0.489
Core Delta-P: psia             21.309
Core Plate Delta-P: psia       16.781
Coolant Temp: Deg-F            548.3
In Channel Flow: Mlb/hr        62.64   Active Channel Flow: Mlb/hr       60.37
Total Bypass Flow (%):          12.6   (of total core flow)
Total Water Rod Flow (%):        3.2   (of total core flow)
Source Convergence            0.00041
```

```
Core Average Exposure: MWd/MTU    26698.1

                    Axial Profile     Edit   Radial Power
              N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
          Top 25  0.181   4.693      30   0.442  0.531    5 14
              24  0.538  14.138      31   0.406  0.550   13 48
              23  0.711  18.869      32   0.792  1.065   11 12
              22  0.808  21.553      33   1.063  1.192   25 12
              21  0.872  23.632      34   1.198  1.371   15 12
              20  0.924  25.110      35   1.261  1.411   19 12
              19  0.962  26.379
              18  0.989  27.222
              17  1.003  27.399
              16  1.063  27.983
              15  1.088  28.997
              14  1.081  29.712
              13  1.120  29.479
              12  1.135  30.303
              11  1.155  30.815
              10  1.188  31.296
               9  1.234  32.275
               8  1.269  32.878
               7  1.288  33.088
               6  1.314  34.106
               5  1.323* 34.797*
               4  1.294  33.984
               3  1.225  31.334
               2  0.975  23.816
       Bottom  1  0.261   6.531

          % AXIAL TILT -14.412 -12.532
      AVG BOT 8ft/12ft  1.0886  1.0741
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.411	35	19	12	1.622	0.857	35	25	10	7.31	0.761	44.0	33	23	10	8	10.63	0.804	26.2	34	37	12	4
1.401	35	17	14	1.736	0.853	33	19	14	7.12	0.761	46.5	33	21	42	8	10.64	0.804	26.0	34	45	20	4
1.398	35	25	14	1.651	0.842	35	23	12	9.36	0.759	22.4	34	37	42	4	10.51	0.798	26.6	34	45	30	4
1.394	35	25	10	1.760	0.841	33	23	14	7.09	0.754	45.9	33	17	12	5	10.51	0.793	26.0	34	45	22	4
1.388	35	21	14	1.654	0.841	35	17	14	9.31	0.748	21.3	35	43	22	4	7.85	0.793	49.8	33	21	12	8
1.371	34	15	12	1.763	0.840	33	25	12	7.20	0.748	43.7	33	43	20	4	8.13	0.792	46.4	33	29	44	8
1.356	35	25	26	1.657	0.839	35	19	12	9.36	0.744	20.0	35	43	18	4	10.45	0.791	26.3	34	15	10	4
1.354	35	23	24	1.666	0.834	35	25	14	6.94	0.743	46.6	33	37	40	5	10.38	0.789	26.8	34	13	12	4
1.353	35	17	10	1.780	0.831	33	19	10	9.34	0.741	19.8	35	17	10	4	7.63	0.784	51.2	33	35	12	5
1.352	35	19	16	1.673	0.831	35	17	10	9.20	0.741	21.6	34	45	22	4	10.48	0.783	24.8	34	45	36	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.34 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 12,200.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        12700.0 (1278.40 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.63
Flow: Mlb/hr                     70.30 ( 91.30 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 36 -- 36 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 36 -- 36 -- -- -- --     11
 23        -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              7.30

k-effective:                    0.99748
Void Fraction:                    0.484
Core Delta-P: psia               20.639
Core Plate Delta-P: psia         16.112
Coolant Temp: Deg-F              548.2
In Channel Flow: Mlb/hr          61.44
Total Bypass Flow (%):            12.6
Total Water Rod Flow (%):          3.2
Source Convergence              0.00043
```

Core Average Exposure: MWd/MTU 27198.1

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.186	4.793	30	0.441	0.530	5	14
	24	0.552	14.423	31	0.405	0.549	13	48
	23	0.729	19.245	32	0.790	1.063	11	12
	22	0.829	21.983	33	1.061	1.191	25	12
	21	0.897	24.098	34	1.201	1.373	15	12
	20	0.952	25.602	35	1.263	1.414	19	12
	19	0.994	26.893					
	18	1.023	27.749					
	17	1.039	27.934					
	16	1.101	28.519					
	15	1.125	29.545					
	14	1.115	30.257					
	13	1.150	30.011					
	12	1.159	30.843					
	11	1.174	31.364					
	10	1.200	31.860					
	9	1.239	32.862					
	8	1.261	33.481					
	7	1.265	33.701					
	6	1.272*	34.730					
	5	1.256	35.426*					
	4	1.208	34.598					
	3	1.133	31.916					
	2	0.901	24.279					
Bottom	1	0.241	6.663					

% AXIAL TILT -11.595 -12.478
AVG BOT 8ft/12ft 1.0759 1.0737

Active Channel Flow: Mlb/hr 59.22
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.414	35	19	12	1.595	0.871	35	25	10	7.28	0.761	44.3	33	29	44	8	7.77	0.793	50.6	33	21	12	8
1.402	35	17	14	1.704	0.868	33	19	14	7.05	0.760	47.3	33	21	42	8	8.06	0.792	47.3	33	29	44	8
1.402	35	25	14	1.618	0.859	35	23	12	6.93	0.728	44.8	33	27	42	8	9.99	0.763	27.3	34	37	12	5
1.400	35	25	10	1.728	0.856	33	23	14	6.74	0.722	46.7	33	17	12	5	9.95	0.759	27.1	34	45	20	4
1.393	35	21	14	1.626	0.855	35	19	12	8.76	0.716	23.4	34	37	42	4	7.25	0.752	52.0	33	35	12	5
1.373	34	15	12	1.732	0.855	33	25	12	6.68	0.710	45.9	33	43	34	5	9.79	0.751	27.7	34	45	30	4
1.359	35	23	12	1.627	0.854	35	17	14	6.58	0.710	47.3	33	37	40	5	9.88	0.749	26.3	34	37	44	4
1.356	35	17	10	1.636	0.849	35	25	14	9.01	0.710	18.9	35	23	42	8	9.81	0.748	27.1	34	45	22	4
1.354	35	19	16	1.745	0.848	33	19	10	6.76	0.709	44.7	33	23	26	9	10.17	0.745	22.7	35	23	42	8
1.352	35	25	26	1.751	0.845	33	17	12	8.92	0.707	19.7	35	21	10	8	9.69	0.744	27.9	34	13	12	4

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.35 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 12,700.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        13000.0 (1308.60 )
Delta E: MWd/MTU, (GWd)          300.0 (  30.20 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm        -23.94
Flow: Mlb/hr                      69.49 ( 90.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- 36 -- 36 -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9 -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
  11 -- -- -- -- -- -- -- -- -- -- -- -- -- 31
  13 -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
  15 -- -- -- -- -- -- -- -- -- -- -- -- -- 23
  17 -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
  19    -- -- -- -- -- -- -- -- -- -- --     15
  21    -- -- -- -- 36 -- 36 -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %          7.30

k-effective:                 0.99748
Void Fraction:                 0.480
Core Delta-P: psia            20.250
Core Plate Delta-P: psia      15.723
Coolant Temp: Deg-F           548.1
In Channel Flow: Mlb/hr       60.74
Total Bypass Flow (%):         12.6
Total Water Rod Flow (%):       3.1
Source Convergence          0.00043
```

Core Average Exposure: MWd/MTU 27498.1

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.189	4.855	30	0.440	0.529	5	14
24	0.561	14.598	31	0.405	0.548	13	48
23	0.740	19.477	32	0.790	1.062	11	12
22	0.843	22.249	33	1.060	1.190	25	12
21	0.914	24.385	34	1.202	1.373	15	12
:JR 20	0.971	25.907	35	1.264	1.415	19	12
19	1.014	27.211					
18	1.044	28.076					
17	1.062	28.266					
16	1.124	28.853					
15	1.148	29.886					
14	1.136	30.594					
13	1.167	30.339					
12	1.174	31.174					
11	1.185	31.699					
10	1.207	32.203					
9	1.239	33.215					
8	1.254*	33.841					
7	1.249	34.062					
6	1.244	35.093					
5	1.214	35.784*					
4	1.157	34.943					
3	1.078	32.239					
2	0.856	24.536					
Bottom 1	0.229	6.737					

% AXIAL TILT -9.817 -12.416
AVG BOT 8ft/12ft 1.0678 1.0734

Active Channel Flow: Mlb/hr 58.55
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.415	35	19	12	1.580	0.880	35	25	10	7.23	0.760	44.8	33	29	44	8	8.00	0.791	47.8	33	29	44	8
1.404	35	25	14	1.686	0.878	33	19	14	6.99	0.757	47.8	33	21	42	8	7.69	0.790	51.1	33	21	12	8
1.403	35	25	10	1.598	0.870	35	23	12	6.89	0.727	45.2	33	27	42	8	10.08	0.743	23.3	35	23	42	8
1.403	35	17	14	1.710	0.865	33	23	14	8.97	0.709	19.4	35	23	42	8	9.66	0.743	27.9	34	37	12	5
1.395	35	21	14	1.607	0.865	35	19	12	6.71	0.707	45.1	33	23	26	9	7.47	0.743	48.4	33	27	12	8
1.373	34	15	12	1.714	0.864	33	25	12	8.87	0.707	20.2	35	21	10	8	9.99	0.740	23.9	35	21	44	8
1.364	35	23	12	1.611	0.863	35	17	14	6.58	0.705	46.5	33	19	44	8	7.26	0.735	49.9	33	19	44	8
1.357	35	17	10	1.619	0.859	35	25	14	6.44	0.703	48.4	33	17	42	6	7.33	0.733	48.9	33	23	40	8
1.356	35	19	16	1.725	0.858	33	19	10	6.67	0.702	45.0	33	23	40	8	7.38	0.732	48.1	33	23	26	9
1.349	35	25	26	1.733	0.854	33	17	12	8.48	0.695	23.7	34	37	42	5	9.54	0.732	27.7	34	45	20	4

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.36 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 13,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        13500.0 (1358.90 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.24
Flow: Mlb/hr                     68.72 ( 89.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 36 -- 36 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 36 -- 36 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              7.30

k-effective:                    0.99751
Void Fraction:                    0.473
Core Delta-P: psia               19.835
Core Plate Delta-P: psia         15.309
Coolant Temp: Deg-F              547.9
In Channel Flow: Mlb/hr          60.09
Total Bypass Flow (%):            12.6
Total Water Rod Flow (%):          3.1
Source Convergence             0.00027
```

Core Average Exposure: MWd/MTU 27998.1

	N(PRA)	Axial Profile Power	Axial Profile Exposure
Top	25	0.195	4.960
	24	0.578	14.895
	23	0.762	19.869
	22	0.869	22.698
	21	0.944	24.872
:JR	20	1.004	26.424
	19	1.051	27.751
	18	1.083	28.633
	17	1.101	28.832
	16	1.165	29.420
	15	1.187	30.465
	14	1.170	31.167
	13	1.197	30.894
	12	1.198	31.732
	11	1.202	32.262
	10	1.216	32.776
	9	1.238	33.804
	8	1.240*	34.437
	7	1.220	34.656
	6	1.194	35.685
	5	1.143	36.361*
	4	1.069	35.492
	3	0.985	32.751
	2	0.781	24.943
Bottom	1	0.209	6.853

Edit Zone	Radial Power Avg.	Max.	IR	JR
30	0.439	0.528	5	14
31	0.404	0.548	13	48
32	0.788	1.061	11	12
33	1.057	1.188	25	12
34	1.205	1.375	15	12
35	1.265	1.417	19	12

```
                 % AXIAL TILT  -6.665 -12.283
          AVG BOT 8ft/12ft  1.0530  1.0727

Active Channel Flow: Mlb/hr        57.94
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.417	35	19	12	1.663	0.890	33	19	14	7.12	0.755	45.6	33	29	44	8	7.63	0.785	51.4	33	23	44	8
1.408	35	25	10	1.564	0.889	35	25	10	6.92	0.751	47.9	33	21	42	9	7.55	0.783	52.0	33	21	12	8
1.407	35	25	14	1.568	0.886	35	23	12	6.84	0.728	45.9	33	27	42	9	7.43	0.745	49.0	33	27	12	9
1.404	35	17	14	1.585	0.877	35	19	12	9.00	0.707	18.5	35	23	12	15	9.91	0.738	24.4	35	23	42	8
1.398	35	21	14	1.688	0.877	33	23	14	8.77	0.703	21.1	35	21	44	8	9.83	0.735	24.9	35	21	44	8
1.375	34	15	12	1.692	0.875	33	25	12	6.66	0.702	45.2	33	23	40	9	7.37	0.734	48.5	33	23	14	9
1.372	35	23	12	1.593	0.873	35	17	14	6.60	0.702	45.9	33	23	26	9	7.16	0.731	50.7	33	19	44	8
1.361	35	17	10	1.697	0.872	33	19	10	6.50	0.701	47.3	33	19	44	8	7.26	0.728	49.2	33	25	8	9
1.357	35	19	16	1.599	0.869	35	25	14	8.74	0.688	18.8	35	25	10	15	9.71	0.728	25.2	34	29	46	8
1.350	35	21	10	1.709	0.866	33	17	12	6.26	0.688	49.0	33	17	42	8	7.27	0.727	48.9	33	23	26	9

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.37 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 13,500.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        14000.0 (1409.20 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.42
Flow: Mlb/hr                      68.26 ( 88.65 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 36 -- 36 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 36 -- 36 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              7.30

k-effective:                     0.99752
Void Fraction:                     0.464
Core Delta-P: psia                19.542
Core Plate Delta-P: psia          15.017
Coolant Temp: Deg-F               547.8
In Channel Flow: Mlb/hr           59.73
Total Bypass Flow (%):             12.5
Total Water Rod Flow (%):           3.1
Source Convergence               0.00050
```

Core Average Exposure: MWd/MTU 28498.1

	Axial Profile N(PRA)	Power	Exposure
Top	25	0.202	5.068
	24	0.597	15.202
	23	0.787	20.272
	22	0.899	23.162
	21	0.978	25.375
	20	1.041	26.960
	19	1.090	28.312
	18	1.123	29.211
	17	1.141	29.419
	16	1.205	30.007
	15	1.224	31.064
	14	1.202	31.757
	13	1.225	31.464
	12	1.220	32.301
	11	1.217	32.834
	10	1.222	33.355
	9	1.233*	34.393
	8	1.221	35.027
	7	1.185	35.236
	6	1.140	36.252
	5	1.070	36.903*
	4	0.984	36.000
	3	0.895	33.219
	2	0.708	25.314
Bottom	1	0.189	6.959

Edit Zone	Radial Power Avg.	Max.	IR	JR
30	0.439	0.527	5	14
31	0.403	0.547	13	48
32	0.788	1.061	11	12
33	1.055	1.185	25	12
34	1.209	1.377	15	12
35	1.266	1.418	19	12

% AXIAL TILT -3.341 -12.098
AVG BOT 8ft/12ft 1.0368 1.0717

Active Channel Flow: Mlb/hr 57.60
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.418	35	19	12	1.645	0.900	33	19	14	6.94	0.754	47.9	33	23	44	9	7.59	0.782	51.5	33	23	44	9
1.410	35	25	10	1.545	0.900	35	23	12	6.85	0.750	48.6	33	21	42	9	7.51	0.780	52.1	33	21	12	9
1.408	35	25	14	1.548	0.898	35	25	10	9.23	0.730	19.4	35	23	12	15	7.37	0.745	49.8	33	27	12	9
1.405	35	17	14	1.567	0.887	35	19	12	6.79	0.728	46.7	33	27	42	9	7.31	0.735	49.3	33	23	14	9
1.399	35	21	14	1.672	0.885	33	23	14	9.15	0.721	19.0	35	21	10	15	10.04	0.733	22.2	35	23	12	15
1.378	35	23	12	1.675	0.884	33	25	12	8.96	0.710	19.7	35	25	10	15	7.15	0.732	50.8	33	19	44	9
1.377	34	15	12	1.676	0.883	33	19	10	6.61	0.702	45.9	33	23	40	9	7.21	0.730	50.0	33	25	8	9
1.363	35	17	10	1.579	0.880	35	17	14	6.49	0.700	47.4	33	19	44	9	10.02	0.730	22.0	34	23	8	15
1.358	35	19	16	1.581	0.879	35	27	14	8.87	0.699	18.9	35	19	12	15	10.00	0.727	21.8	35	21	10	15
1.357	35	21	10	1.583	0.878	34	37	12	6.47	0.693	46.6	33	23	26	9	9.97	0.723	21.4	34	21	8	15

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.38 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 14,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        14400.0 (1449.50 )
Delta E: MWd/MTU, (GWd)          400.0 (  40.26 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.16
Flow: Mlb/hr                     68.92 ( 89.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- 36 -- 36 -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 35
 11  -- -- -- -- -- -- -- -- -- -- -- -- -- 31
 13  -- -- --  0 -- 36 -- 36 --  0 -- -- -- 27
 15  -- -- -- -- -- -- -- -- -- -- -- -- -- 23
 17  -- -- -- 12 --  6 --  6 -- 12 -- -- -- 19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- 36 -- 36 -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              7.30

k-effective:                    0.99776
Void Fraction:                      0.455
Core Delta-P: psia                 19.707
Core Plate Delta-P: psia           15.182
Coolant Temp: Deg-F                547.7
In Channel Flow: Mlb/hr             60.35
Total Bypass Flow (%):              12.4
Total Water Rod Flow (%):            3.1
Source Convergence               0.00047
```

```
Core Average Exposure: MWd/MTU    28898.0

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
      Top  25  0.208   5.157      30   0.438  0.526    5 14
           24  0.615  15.455      31   0.402  0.547   13 48
           23  0.810  20.605      32   0.788  1.061   11 12
           22  0.927  23.545      33   1.053  1.182   25 12
           21  1.008  25.792      34   1.213  1.379   15 12
           20  1.074  27.404      35   1.266  1.417   19 12
           19  1.124  28.777
           18  1.157  29.690
           17  1.174  29.906
           16  1.237  30.493
           15  1.253* 31.558
           14  1.227  32.242
           13  1.247  31.930
           12  1.237  32.765
           11  1.228  33.297
           10  1.226  33.819
            9  1.227  34.862
            8  1.204  35.491
            7  1.155  35.686
            6  1.095  36.686
            5  1.010  37.310*
            4  0.914  36.374
            3  0.823  33.559
            2  0.649  25.583
      Bottom  1  0.174   7.036
          % AXIAL TILT  -0.544 -11.909
      AVG BOT 8ft/12ft  1.0228  1.0708

Active Channel Flow: Mlb/hr        58.22
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.417	35	19 12	1.541	0.902	35	23 12	6.88	0.752	48.5 33	23 44	9	7.52	0.782	52.1 33	23 44	9
1.410	35	25 10	1.643	0.901	33	19 14	6.78	0.747	49.2 33	21 42	9	7.43	0.777	52.7 33	21 12	9
1.407	35	25 14	1.549	0.897	35	25 10	9.37	0.745	20.2 35	23 12	15	10.23	0.751	22.8 34	23 8	15
1.405	35	17 14	1.565	0.888	35	19 12	9.33	0.740	19.7 35	21 10	15	10.18	0.749	23.0 35	23 12	15
1.398	35	21 14	1.670	0.886	33	19 10	6.74	0.727	47.3 33	27 42	9	10.24	0.747	22.2 35	21 44	15
1.380	35	23 12	1.571	0.885	34	37 12	9.10	0.726	20.5 35	25 10	15	10.23	0.747	22.2 34	21 8	15
1.379	34	15 12	1.673	0.885	33	23 14	9.06	0.718	19.7 35	19 12	15	7.30	0.744	50.4 33	27 12	9
1.366	35	17 10	1.675	0.884	33	25 12	8.97	0.706	18.9 35	25 14	15	7.20	0.734	50.4 33	23 40	9
1.362	35	21 10	1.679	0.881	33	23 44	8.98	0.706	18.7 35	21 14	15	7.10	0.732	51.5 33	19 44	9
1.358	35	19 16	1.578	0.881	35	27 14	8.88	0.702	19.2 34	23 8	15	7.17	0.731	50.6 33	25 8	9

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.39 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 14,400.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        14401.0 (1449.60 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.47
Flow: Mlb/hr                     68.14 ( 88.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- --  6 --  6 -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- --  0 -- -- -- -- --  0 -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- --  0 -- -- -- -- --  0 -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- --  6 --  6 -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           5.47

k-effective:                  0.99776
Void Fraction:                  0.481
Core Delta-P: psia             19.748
Core Plate Delta-P: psia       15.223
Coolant Temp: Deg-F             548.0
In Channel Flow: Mlb/hr         59.52
Total Bypass Flow (%):           12.7
Total Water Rod Flow (%):         3.2
Source Convergence            0.00040
```

Core Average Exposure: MWd/MTU 28899.1

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.177	5.158	30	0.424	0.524	5	14
24	0.523	15.455	31	0.390	0.525	13	48
23	0.689	20.606	32	0.768	1.057	11	12
22	0.794	23.546	33	1.064	1.210	23	22
21	0.871	25.793	34	1.191	1.356	11	16
:JR 20	0.941	27.405	35	1.289	1.460	23	24
19	1.005	28.778					
18	1.064	29.691					
17	1.101	29.907					
16	1.177	30.495					
15	1.205	31.559					
14	1.189	32.244					
13	1.215	31.931					
12	1.210	32.766					
11	1.206	33.298					
10	1.210	33.821					
9	1.223*	34.863					
8	1.221	35.492					
7	1.209	35.687					
6	1.213	36.687					
5	1.189	37.311*					
4	1.144	36.375					
3	1.087	33.560					
2	0.892	25.584					
Bottom 1	0.244	7.036					
% AXIAL TILT	-9.720	-11.909					
AVG BOT 8ft/12ft	1.0777	1.0708					

Active Channel Flow: Mlb/hr 57.36
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.460	35	23	24	1.538	0.903	35	23	24	6.45	0.679	45.1	33	23	22	8	6.73	0.703	52.6	33	13	16	8
1.452	35	25	22	1.549	0.897	35	27	22	8.45	0.679	21.3	35	23	24	15	6.86	0.702	50.8	33	19	22	8
1.446	35	25	26	1.552	0.896	35	21	28	6.41	0.678	45.5	33	21	24	8	6.98	0.700	49.2	33	23	22	6
1.445	35	21	22	1.553	0.895	35	25	26	8.43	0.676	21.2	35	21	26	15	7.08	0.700	47.8	33	21	30	8
1.444	35	21	26	1.553	0.895	35	21	22	6.15	0.676	49.0	33	13	16	8	6.69	0.699	52.7	33	15	40	8
1.430	35	23	20	1.655	0.894	33	21	24	8.44	0.675	20.7	35	25	22	15	6.85	0.699	50.5	33	29	28	5
1.409	35	19	20	1.667	0.888	33	23	22	6.28	0.675	47.0	33	23	26	5	9.12	0.697	27.3	35	29	30	5
1.407	35	19	24	1.673	0.885	33	21	20	6.13	0.674	49.1	33	15	40	8	6.78	0.697	51.1	33	27	30	6
1.397	35	15	16	1.675	0.884	33	25	24	6.23	0.672	47.3	33	19	22	8	9.50	0.696	22.6	34	11	38	15
1.395	35	17	18	1.681	0.880	33	25	20	8.45	0.672	20.1	35	21	22	15	6.60	0.694	53.1	33	11	18	8

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.40 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 14,401.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        14900.0 (1499.80 )
Delta E: MWd/MTU, (GWd)          499.0 (  50.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.58
Flow: Mlb/hr                     70.46 ( 91.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --                51     :JR
  3        -- -- -- -- -- -- -- -- --          47
  5     -- -- -- -- -- -- -- -- -- -- --       43
  7     -- -- -- --  6 --  6 -- -- -- --       39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --    35
 11 -- -- --  0 -- -- -- -- --  0 -- -- --    31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --    27
 15 -- -- --  0 -- -- -- -- --  0 -- -- --    23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --    19
 19    -- -- -- --  6 --  6 -- -- -- --       15
 21    -- -- -- -- -- -- -- -- -- -- --       11
 23       -- -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --                 3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              5.47

k-effective:                    0.99805
Void Fraction:                    0.464
Core Delta-P: psia               20.520
Core Plate Delta-P: psia         15.993
Coolant Temp: Deg-F              547.9
In Channel Flow: Mlb/hr          61.66
Total Bypass Flow (%):            12.5
Total Water Rod Flow (%):          3.1
Source Convergence              0.00042
```

Core Average Exposure: MWd/MTU 29398.2

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.186	5.256	30	0.424	0.523	5	14
	24	0.550	15.731	31	0.390	0.526	13	48
	23	0.725	20.970	32	0.770	1.060	11	12
	22	0.836	23.969	33	1.061	1.194	23	22
	21	0.917	26.257	34	1.198	1.360	15	12
	20	0.990	27.906	35	1.286	1.438	23	24
	19	1.054	29.313					
	18	1.114	30.257					
	17	1.150	30.493					
	16	1.225	31.087					
	15	1.249	32.165					
	14	1.228	32.842					
	13	1.250*	32.507					
	12	1.239	33.341					
	11	1.227	33.870					
	10	1.220	34.395					
	9	1.219	35.443					
	8	1.200	36.071					
	7	1.170	36.261					
	6	1.151	37.263					
	5	1.101	37.875*					
	4	1.034	36.917					
	3	0.964	34.075					
	2	0.785	26.007					
Bottom	1	0.214	7.160					

```
                % AXIAL TILT  -5.483 -11.789
          AVG BOT 8ft/12ft    1.0565  1.0704

Active Channel Flow: Mlb/hr        59.47
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.438	35	23	24	1.575	0.882	35	29	30	8.74	0.696	20.1	35	15	38	15	9.90	0.732	23.6	34	11	38	15
1.432	35	25	22	1.582	0.879	35	21	22	8.56	0.693	22.2	35	23	24	15	9.84	0.725	23.4	34	15	42	15
1.429	35	21	22	1.584	0.878	35	27	22	8.71	0.692	19.9	35	13	40	15	9.74	0.715	22.9	34	11	14	15
1.423	35	21	26	1.692	0.875	33	21	24	8.54	0.691	22.0	35	21	26	15	9.71	0.713	22.8	34	13	12	15
1.421	35	25	26	1.591	0.874	35	21	28	8.57	0.690	21.6	35	25	22	15	6.76	0.702	52.2	33	13	16	9
1.418	35	23	20	1.700	0.871	33	21	20	8.61	0.690	20.9	35	21	22	15	9.57	0.702	22.7	35	13	14	15
1.402	35	19	20	1.597	0.870	35	27	28	8.64	0.688	20.2	34	11	16	15	6.72	0.699	52.2	33	15	40	9
1.396	35	15	16	1.598	0.870	34	11	38	8.61	0.684	20.0	34	15	42	15	6.81	0.697	50.9	33	19	22	9
1.393	35	17	18	1.703	0.869	33	23	22	8.61	0.682	19.5	35	13	36	15	9.46	0.697	23.2	35	15	16	15
1.392	35	19	24	1.712	0.864	33	25	20	8.45	0.681	21.7	35	25	26	15	9.31	0.695	24.8	35	21	28	15

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.41 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 14,900.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        15400.0 (1550.10 )
Delta E: MWd/MTU, (GWd)          500.0 (  50.33 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.34
Flow: Mlb/hr                     73.92 ( 96.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              --  --  --  --  --              51     :JR
  3        --  --  --  --  --  --  --  --  --        47
  5     --  --  --  --  --  --  --  --  --  --     43
  7     --  --  --  --   6  --   6  --  --  --     39
  9  --  --  --  --  --  --  --  --  --  --  --  35
 11  --  --  --   0  --  --  --  --  --   0  --  --  31
 13  --  --  --  --  --  --  --  --  --  --  --  --  27
 15  --  --  --   0  --  --  --  --  --   0  --  --  23
 17  --  --  --  --  --  --  --  --  --  --  --  --  19
 19     --  --  --  --   6  --   6  --  --  --     15
 21     --  --  --  --  --  --  --  --  --  --     11
 23        --  --  --  --  --  --  --  --         7
 25              --  --  --  --  --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %           5.47

k-effective:                  0.99839
Void Fraction:                  0.446
Core Delta-P: psia             21.783
Core Plate Delta-P: psia       17.256
Coolant Temp: Deg-F             547.9
In Channel Flow: Mlb/hr         64.83
Total Bypass Flow (%):           12.3
Total Water Rod Flow (%):         3.0
Source Convergence            0.00050
```

```
Core Average Exposure: MWd/MTU    29898.2

                    Axial Profile    Edit   Radial Power
          N(PRA)  Power  Exposure   Zone   Avg.   Max.   IR JR
Top 25     0.196   5.359     30   0.424  0.523    5 14
    24     0.580  16.022     31   0.390  0.527   13 48
    23     0.764  21.354     32   0.772  1.064   11 12
    22     0.881  24.415     33   1.057  1.177   23 22
    21     0.966  26.746     34   1.206  1.365   15 42
    20     1.039  28.433     35   1.283  1.414   23 24
    19     1.103  29.875
    18     1.161  30.851
    17     1.193  31.106
    16     1.265  31.705
    15     1.284* 32.795
    14     1.258  33.462
    13     1.279  33.102
    12     1.263  33.930
    11     1.243  34.454
    10     1.226  34.975
     9     1.212  36.022
     8     1.178  36.642
     7     1.130  36.817
     6     1.090  37.810
     5     1.019  38.398*
     4     0.935  37.409
     3     0.856  34.534
     2     0.691  26.379
Bottom   1  0.188   7.269

          % AXIAL TILT  -1.428 -11.602
      AVG BOT 8ft/12ft   1.0351  1.0696

Active Channel Flow: Mlb/hr        62.58
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.414	35	23	24	1.613	0.862	34	11	38	8.99	0.720	20.8	35	13	40	15	10.22	0.762	24.6	34	11	38	15
1.412	35	21	22	1.624	0.856	35	29	30	8.97	0.719	21.1	35	15	38	15	10.17	0.757	24.4	34	15	42	15
1.412	35	25	22	1.625	0.855	35	21	22	8.94	0.716	21.0	34	11	38	15	10.07	0.747	23.9	34	11	14	15
1.405	35	23	20	1.629	0.853	35	27	22	8.91	0.714	20.8	34	15	42	15	10.05	0.745	23.8	34	13	12	15
1.400	35	21	26	1.630	0.853	34	37	12	8.84	0.705	20.4	35	13	36	15	9.85	0.728	23.7	35	13	14	15
1.395	35	25	26	1.743	0.849	33	21	20	8.82	0.702	20.2	35	17	40	15	9.72	0.721	24.0	35	15	38	15
1.394	35	15	16	1.746	0.848	33	21	24	8.69	0.702	21.8	35	21	22	15	7.24	0.720	48.3	33	13	38	15
1.393	35	19	20	1.749	0.846	33	13	16	6.77	0.701	43.4	33	13	38	14	9.73	0.717	23.2	34	9	38	15
1.389	35	17	18	1.643	0.846	34	11	14	8.60	0.701	23.1	35	23	24	15	7.14	0.716	49.1	33	15	40	12
1.376	35	19	24	1.643	0.846	35	21	28	6.79	0.701	43.1	33	15	40	14	9.63	0.715	24.2	34	7	32	15

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.42 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 15,400.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         15900.0 (1600.50 )
Delta E: MWd/MTU, (GWd)           500.0 (  50.33 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.7
Inlet Subcooling: Btu/lbm        -20.86
Flow: Mlb/hr                      78.54 (102.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- --  6 --  6 -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11  -- -- --  0 -- -- -- -- --  0 -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- --  0 -- -- -- -- --  0 -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- --  6 --  6 -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- -- --        7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              5.47

k-effective:                    0.99867
Void Fraction:                    0.426
Core Delta-P: psia               23.568
Core Plate Delta-P: psia         19.038
Coolant Temp: Deg-F              547.9
In Channel Flow: Mlb/hr          69.06
Total Bypass Flow (%):            12.1
Total Water Rod Flow (%):          3.0
Source Convergence              0.00049
```

```
Core Average Exposure: MWd/MTU    30398.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
Top 25    0.207   5.467          30   0.423 0.522    5 14
    24    0.615  16.329          31   0.390 0.527   39  6
    23    0.811  21.759          32   0.775 1.069   11 12
    22    0.934  24.885          33   1.054 1.162   15 40
    21    1.021  27.260          34   1.216 1.371   15 42
    20    1.094  28.987          35   1.279 1.393   21 22
    19    1.155  30.463
    18    1.209  31.471
    17    1.234  31.743
    16    1.301  32.343
    15   1.314*  33.443
    14    1.282  34.096
    13    1.301  33.710
    12    1.280  34.530
    11    1.252  35.045
    10    1.224  35.558
     9    1.198  36.599
     8    1.150  37.202
     7    1.085  37.354
     6    1.025  38.328
     5   0.936*  38.882*
     4    0.840  37.853
     3    0.756  34.940
     2    0.607  26.707
Bottom   1  0.166   7.364

          % AXIAL TILT   2.778 -11.354
AVG BOT 8ft/12ft  1.0115  1.0685

Active Channel Flow: Mlb/hr        66.73
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.393	35	21 22	1.634	0.851	34	11 38	9.22	0.744	21.8 35	13 40	15	10.49	0.790	25.7 34	11 38	15
1.392	35	15 38	1.644	0.845	34	37 12	9.17	0.741	21.9 34	11 38	15	10.45	0.786	25.4 34	15 42	15
1.391	35	27 32	1.657	0.839	34	11 14	9.15	0.739	22.0 35	15 38	15	10.36	0.775	25.0 34	11 14	15
1.390	35	23 20	1.659	0.838	34	13 12	9.16	0.739	21.8 34	15 42	15	10.37	0.774	24.7 34	13 42	15
1.390	35	23 24	1.780	0.831	33	13 16	9.02	0.725	21.4 35	13 36	15	10.06	0.751	24.7 35	13 14	15
1.383	35	19 20	1.672	0.831	35	21 22	9.01	0.723	21.2 35	17 40	15	10.06	0.747	24.2 34	9 38	15
1.383	35	17 18	1.676	0.829	35	29 30	8.98	0.721	21.2 34	11 40	15	7.42	0.744	49.1 33	13 38	15
1.377	35	13 40	1.678	0.828	35	27 22	6.97	0.720	43.2 33	13 38	15	10.02	0.742	23.9 34	15 44	15
1.377	35	31 28	1.793	0.825	33	17 16	7.00	0.720	42.7 33	15 40	15	9.90	0.742	25.2 34	7 32	15
1.373	35	17 40	1.689	0.823	35	37 38	8.97	0.719	21.1 34	13 42	15	9.91	0.742	25.0 35	15 38	15

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.43 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 15,900.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        15901.0 (1600.60 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.5
Inlet Subcooling: Btu/lbm       -24.01
Flow: Mlb/hr                     69.30 ( 90.00 %)

       1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --                51     :JR
   3        -- -- -- -- -- -- -- -- --          47
   5     -- -- -- -- -- -- -- -- -- -- --       43
   7     -- -- -- -- 10 --  8 -- -- -- --       39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --    35
  11 -- -- --  8 -- -- -- -- --  8 -- -- --    31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --    27
  15 -- -- --  8 -- -- -- -- --  8 -- -- --    23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --    19
  19    -- -- -- --  8 -- 10 -- -- -- --       15
  21    -- -- -- -- -- -- -- -- -- -- --       11
  23       -- -- -- -- -- -- -- -- --           7
  25             -- -- -- -- --                 3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              4.81

k-effective:                     0.99865
Void Fraction:                     0.437
Core Delta-P: psia                19.653
Core Plate Delta-P: psia          15.128
Coolant Temp: Deg-F               547.5
In Channel Flow: Mlb/hr           60.79   Active Channel Flow: Mlb/hr       58.68
Total Bypass Flow (%):            12.3    (of total core flow)
Total Water Rod Flow (%):          3.0    (of total core flow)
Source Convergence               0.00043
```

```
Core Average Exposure: MWd/MTU    30399.1

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
      Top 25  0.234   5.467    30  0.421 0.519   5 40
          24  0.692  16.330    31  0.387 0.522  39  6
          23  0.907  21.760    32  0.765 1.048  11 42
          22  1.041  24.886    33  1.063 1.160  21 34
          21  1.129  27.262    34  1.194 1.349  11 38
          20  1.172  28.989    35  1.291 1.393  21 22
          19  1.200  30.464
          18  1.227  31.472
          17  1.232  31.744
          16  1.281* 32.345
          15  1.280  33.444
          14  1.239  34.097
          13  1.250  33.711
          12  1.225  34.531
          11  1.196  35.046
          10  1.168  35.559
           9  1.144  36.600
           8  1.101  37.203
           7  1.043  37.355
           6  0.992  38.329
           5  0.913  38.883*
           4  0.825  37.853
           3  0.746  34.941
           2  0.600  26.708
      Bottom  1  0.164   7.364

          % AXIAL TILT   6.393 -11.354
      AVG BOT 8ft/12ft  0.9791  1.0685
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.393	35	21	22	1.661	0.891	33	21 34	8.95	0.722	21.8 35	13 40	15	10.17	0.766	25.7 34	11 38	15
1.391	35	19	34	1.661	0.891	33	15 36	8.91	0.720	22.0 35	15 38	15	10.13	0.761	25.5 34	15 42	15
1.390	35	23	34	1.561	0.890	34	11 38	8.90	0.719	21.9 34	11 38	15	10.04	0.750	24.8 34	11 40	15
1.389	35	17	36	1.562	0.890	35	21 22	8.89	0.717	21.8 34	15 42	15	10.03	0.749	24.7 34	13 42	15
1.385	35	23	24	1.566	0.888	34	37 12	6.91	0.710	42.6 33	13 38	17	7.50	0.732	46.8 33	17 38	18
1.385	35	27	32	1.668	0.887	33	17 38	6.94	0.709	42.1 33	15 40	17	7.33	0.729	48.3 33	13 38	17
1.384	35	15	38	1.567	0.887	35	29 20	8.78	0.706	21.4 35	13 36	15	9.74	0.727	24.8 35	13 40	15
1.379	35	21	26	1.672	0.885	33	23 22	6.88	0.705	42.4 33	17 38	18	7.10	0.727	50.9 33	27 30	18
1.371	35	19	24	1.672	0.885	33	15 40	8.78	0.704	21.2 35	17 40	15	7.14	0.725	50.3 33	23 26	18
1.369	35	13	36	1.571	0.885	35	27 22	6.73	0.704	44.4 33	23 22	18	7.51	0.725	45.7 33	15 40	18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.44 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 15,901.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)         16300.0 (1640.70 )
Delta E: MWd/MTU, (GWd)           399.0 (  40.16 )
Power: MWt                       2923.0 (100.00 %)
Core Pressure: psia              1044.6
Inlet Subcooling: Btu/lbm         -22.40
Flow: Mlb/hr                      73.73 ( 95.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- 10 --  8 -- -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- -- 35
  11 -- -- --  8 -- -- -- -- --  8 -- -- -- 31
  13 -- -- -- -- -- -- -- -- -- -- -- -- -- 27
  15 -- -- --  8 -- -- -- -- --  8 -- -- -- 23
  17 -- -- -- -- -- -- -- -- -- -- -- -- -- 19
  19    -- -- -- --  8 -- 10 -- -- -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              4.81

k-effective:                     0.99895
Void Fraction:                     0.419
Core Delta-P: psia                21.309
Core Plate Delta-P: psia          16.783
Coolant Temp: Deg-F               547.5
In Channel Flow: Mlb/hr           64.82
Total Bypass Flow (%):             12.1
Total Water Rod Flow (%):           3.0
Source Convergence               0.00047
```

Core Average Exposure: MWd/MTU 30798.0

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.243	5.571	30	0.421	0.519	5	40
	24	0.722	16.622	31	0.387	0.522	39	6
	23	0.946	22.143	32	0.767	1.053	11	42
	22	1.085	25.328	33	1.060	1.155	15	36
	21	1.174	27.742	34	1.202	1.353	11	38
	20	1.213	29.487	35	1.288	1.386	17	36
	19	1.237	30.975					
	18	1.259	31.994					
	17	1.257	32.268					
	16	1.301*	32.860					
	15	1.295	33.960					
	14	1.251	34.596					
	13	1.263	34.185					
	12	1.235	34.996					
	11	1.200	35.500					
	10	1.166	36.002					
	9	1.134	37.034					
	8	1.082	37.621					
	7	1.011	37.751					
	6	0.946	38.706					
	5	0.855	39.229*					
	4	0.758	38.166					
	3	0.677	35.224					
	2	0.542	26.936					
Bottom	1	0.148	7.431					

% AXIAL TILT 9.393 -11.059
AVG BOT 8ft/12ft 0.9612 1.0669

Active Channel Flow: Mlb/hr 62.63
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR	JR K	Value	Margin	Exp. FT	IR	JR K
1.386	35	17	36	1.585	0.877	34	11 38	9.07	0.736	22.5 35	13	40 15	10.31	0.783	26.5 34	11	38 15
1.384	35	15	38	1.586	0.876	34	37 12	9.02	0.733	22.7 34	11	38 15	10.28	0.778	26.3 34	15	42 15
1.384	35	19	34	1.701	0.870	33	15 36	9.02	0.732	22.5 34	15	42 15	10.21	0.768	25.6 34	11	40 15
1.379	35	21	32	1.706	0.868	33	15 40	8.98	0.731	22.7 35	15	38 15	10.21	0.767	25.5 34	13	42 15
1.378	35	23	34	1.709	0.866	33	17 38	7.12	0.730	42.4 33	15	40 18	7.65	0.753	47.4 33	17	38 18
1.369	35	13	36	1.715	0.863	33	39 16	7.01	0.728	43.8 33	13	38 18	7.45	0.748	49.3 33	13	38 18
1.368	35	27	32	1.715	0.863	33	21 34	7.14	0.726	41.7 33	21	38 21	7.69	0.748	46.4 33	15	40 18
1.367	35	29	30	1.614	0.861	35	29 20	7.01	0.723	43.0 33	17	38 18	7.65	0.743	46.3 33	15	36 18
1.365	35	17	40	1.616	0.860	35	15 38	7.19	0.721	40.3 33	23	40 21	9.92	0.742	25.0 34	9	38 15
1.362	35	31	28	1.617	0.860	35	21 22	7.06	0.720	42.0 33	15	36 18	9.86	0.742	25.6 35	13	40 15

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.45 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 16,300.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        16700.0 (1681.00 )
Delta E: MWd/MTU, (GWd)          400.0 (  40.26 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.68
Flow: Mlb/hr                     79.12 (102.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- 10 --  8 -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- --  8 -- -- -- -- --  8 -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- --  8 -- -- -- -- --  8 -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- --  8 -- 10 -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              4.81

k-effective:                    0.99907
Void Fraction:                    0.401
Core Delta-P: psia               23.431
Core Plate Delta-P: psia         18.902
Coolant Temp: Deg-F              547.6
In Channel Flow: Mlb/hr          69.73   Active Channel Flow: Mlb/hr      67.43
Total Bypass Flow (%):            11.9   (of total core flow)
Total Water Rod Flow (%):          2.9   (of total core flow)
Source Convergence              0.00020
```

```
Core Average Exposure: MWd/MTU    31198.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.   Max.   IR JR
Top       25  0.254    5.678     30  0.420 0.518   5 40
          24  0.756   16.928     31  0.386 0.522  39  6
          23  0.992   22.544     32  0.769 1.058  11 42
          22  1.137   25.791     33  1.057 1.153  15 40
          21  1.225   28.243     34  1.210 1.360  37 12
          20  1.260   30.005     35  1.285 1.383  37 16
          19  1.276   31.502
          18  1.291   32.531
          17  1.280   32.804
          16  1.319*  33.385
          15  1.308   34.482
          14  1.259   35.101
          13  1.270   34.665
          12  1.239   35.466
          11  1.198   35.956
          10  1.158   36.446
           9  1.119   37.465
           8  1.056   38.033
           7  0.973   38.136
           6  0.897   39.065
           5  0.797   39.554*
           4  0.696   38.454
           3  0.616   35.481
           2  0.492   27.142
Bottom     1  0.134    7.491

        % AXIAL TILT  12.567 -10.733
AVG BOT 8ft/12ft      0.9414  1.0652
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.383	35	37	16	1.604	0.867	34	37 12	7.35	0.753	42.4 33	21 38	21	10.44	0.798	27.4 34	11 38	15
1.380	35	17	36	1.605	0.866	34	11 38	7.30	0.753	43.0 33	15 40	18	10.41	0.794	27.2 34	15 42	15
1.374	35	19	34	1.746	0.848	33	15 40	7.19	0.752	44.4 33	13 38	18	10.36	0.786	26.5 34	11 40	15
1.368	35	39	18	1.641	0.847	34	11 14	7.43	0.750	41.0 33	23 40	21	10.36	0.785	26.4 34	13 42	15
1.366	35	39	14	1.750	0.846	33	15 36	9.16	0.749	23.3 35	13 40	15	7.80	0.773	48.1 33	17 38	18
1.365	35	23	34	1.644	0.846	35	23 38	9.13	0.746	23.4 34	11 38	15	7.88	0.772	47.0 33	15 40	18
1.365	35	31	32	1.644	0.846	35	35 14	9.13	0.746	23.3 34	15 42	15	7.61	0.772	50.1 33	13 38	18
1.365	35	17	40	1.644	0.845	34	13 12	9.16	0.742	22.2 35	15 38	17	7.99	0.769	45.4 33	21 38	21
1.360	34	37	12	1.644	0.845	35	13 36	7.14	0.741	43.6 33	17 38	18	7.80	0.764	47.1 33	17 42	18
1.359	34	41	16	1.645	0.845	35	21 40	7.19	0.738	42.6 33	15 36	18	7.80	0.764	47.0 33	15 36	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.46 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 16,700.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        16701.0 (1681.10 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -23.27
Flow: Mlb/hr                     71.22 ( 92.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- 10 -- -- -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11 -- -- -- --  8 -- -- --  8 -- -- -- --  31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15 -- -- -- --  8 -- -- --  8 -- -- -- --  23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- 10 -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              3.59

k-effective:                     0.99914
Void Fraction:                     0.424
Core Delta-P: psia                20.314
Core Plate Delta-P: psia          15.789
Coolant Temp: Deg-F               547.4
In Channel Flow: Mlb/hr           62.57   Active Channel Flow: Mlb/hr       60.43
Total Bypass Flow (%):             12.2   (of total core flow)
Total Water Rod Flow (%):           3.0   (of total core flow)
Source Convergence               0.00048
```

Core Average Exposure: MWd/MTU 31199.1

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.239	5.679	30	0.419	0.516	5	40
	24	0.707	16.929	31	0.385	0.520	47	40
	23	0.928	22.545	32	0.766	1.044	11	12
	22	1.070	25.793	33	1.057	1.158	15	36
	21	1.164	28.244	34	1.209	1.357	41	16
	20	1.215	30.006	35	1.288	1.393	39	36
	19	1.244	31.504					
	18	1.269	32.532					
	17	1.268	32.805					
	16	1.312*	33.387					
	15	1.305	34.484					
	14	1.262	35.102					
	13	1.275	34.667					
	12	1.246	35.467					
	11	1.208	35.957					
	10	1.170	36.447					
	9	1.133	37.466					
	8	1.076	38.034					
	7	1.002	38.137					
	6	0.936	39.066					
	5	0.847	39.555*					
	4	0.754	38.455					
	3	0.676	35.482					
	2	0.544	27.142					
Bottom	1	0.149	7.491					
	% AXIAL TILT	9.450	-10.732					
	AVG BOT 8ft/12ft	0.9630	1.0652					

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.393	35	39	36	1.677	0.918	33	15	36	9.14	0.743	22.7	34	41	38	15	10.36	0.792	27.4	34	11	38	15
1.388	35	37	38	1.679	0.917	33	17	38	9.12	0.743	22.9	35	37	38	15	10.31	0.787	27.2	34	15	42	15
1.388	35	35	40	1.681	0.916	33	15	40	9.12	0.741	22.6	35	39	40	15	10.17	0.771	26.5	34	11	40	15
1.380	35	33	38	1.683	0.915	33	13	16	9.14	0.740	22.2	35	35	40	15	10.16	0.770	26.4	34	13	42	15
1.376	35	41	34	1.684	0.914	33	19	40	9.06	0.740	23.3	34	15	42	15	10.12	0.764	26.0	34	45	22	15
1.374	35	35	36	1.686	0.913	33	13	34	9.13	0.739	22.2	35	39	36	15	7.53	0.760	49.6	33	13	38	17
1.374	35	39	32	1.700	0.906	33	13	24	7.08	0.737	43.9	33	13	38	17	9.98	0.757	26.6	34	45	30	15
1.371	35	41	30	1.702	0.905	33	9	30	7.04	0.735	44.2	33	37	40	17	7.63	0.756	48.1	33	17	38	18
1.365	35	39	28	1.560	0.904	34	11	38	8.99	0.732	22.9	35	41	34	15	7.71	0.755	47.0	33	15	40	18
1.362	35	33	42	1.563	0.902	34	37	12	7.04	0.731	43.6	33	17	38	18	10.07	0.754	25.1	34	43	38	15

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.47 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 16,701.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17200.0 (1731.30 )
Delta E: MWd/MTU, (GWd)          499.0 (  50.23 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.51
Flow: Mlb/hr                     79.69 (103.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- 10 -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- --  8 -- -- --  8 -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- --  8 -- -- --  8 -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- 10 -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              3.59

k-effective:                    0.99950
Void Fraction:                    0.396
Core Delta-P: psia               23.650
Core Plate Delta-P: psia         19.120
Coolant Temp: Deg-F              547.5
In Channel Flow: Mlb/hr          70.27
Total Bypass Flow (%):           11.8
Total Water Rod Flow (%):         2.9
Source Convergence              0.00045
```

Core Average Exposure: MWd/MTU 31698.1

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.253	5.811	30	0.418	0.515	5	40
24	0.752	17.302	31	0.384	0.520	47	40
23	0.987	23.035	32	0.768	1.052	41	12
22	1.137	26.362	33	1.054	1.156	35	38
21	1.230	28.864	34	1.218	1.366	41	16
20	1.274	30.653	35	1.285	1.395	39	36
19	1.294	32.166					
18	1.309	33.208					
17	1.297	33.480					
16	1.333*	34.047					
15	1.321	35.141					
14	1.272	35.737					
13	1.285	35.272					
12	1.252	36.058					
11	1.207	36.530					
10	1.161	37.002					
9	1.115	38.004					
8	1.044	38.544					
7	0.955	38.612					
6	0.874	39.511					
5	0.772	39.956*					
4	0.673	38.812					
3	0.595	35.802					
2	0.477	27.400					
Bottom 1	0.131	7.567					
% AXIAL TILT	13.505	-10.336					
AVG BOT 8ft/12ft	0.9375	1.0631					

Active Channel Flow: Mlb/hr 67.96
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.395	35	39	36	1.750	0.880	33	15	40	7.29	0.765	44.7 33	37	40	18	10.59	0.812	27.6 34	41	38	15
1.389	35	37	38	1.603	0.880	34	11	38	7.25	0.764	45.1 33	13	38	18	10.55	0.809	27.7 34	37	42	15
1.388	35	35	40	1.751	0.879	33	39	16	9.31	0.763	23.7 34	41	38	15	10.47	0.796	26.8 34	41	40	15
1.380	35	41	34	1.603	0.879	34	37	12	9.27	0.760	23.6 35	39	40	15	10.44	0.794	26.8 34	39	42	15
1.376	35	33	38	1.755	0.878	33	35	38	9.25	0.758	23.7 34	37	42	15	10.35	0.789	27.0 34	45	22	15
1.374	35	39	32	1.756	0.877	33	15	36	9.22	0.757	23.8 35	37	38	15	7.70	0.789	51.0 33	13	38	18
1.372	35	41	30	1.761	0.875	33	11	36	7.22	0.755	44.3 33	35	38	18	7.94	0.786	47.9 33	15	40	18
1.371	35	35	36	1.764	0.873	33	19	40	9.24	0.754	23.2 35	35	40	15	7.91	0.785	48.2 33	35	42	18
1.366	34	41	16	1.765	0.873	33	39	34	7.35	0.754	42.6 33	11	36	18	7.82	0.783	48.9 33	17	38	18
1.366	35	39	40	1.623	0.869	35	37	38	9.24	0.754	23.1 35	39	36	15	10.34	0.782	26.2 34	43	38	15

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.48 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,200.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17201.0 (1731.40 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -21.56
Flow: Mlb/hr                     76.23 ( 99.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- 12 -- -- -- -- --     39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11 -- -- -- -- 10 -- -- -- 10 -- -- -- --  31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15 -- -- -- -- 10 -- -- -- 10 -- -- -- --  23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19    -- -- -- -- -- 12 -- -- -- -- --     15
  21    -- -- -- -- -- -- -- -- -- -- --     11
  23       -- -- -- -- -- -- -- --           7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              3.41

k-effective:                    0.99950
Void Fraction:                    0.401
Core Delta-P: psia               22.163
Core Plate Delta-P: psia         17.635
Coolant Temp: Deg-F              547.4
In Channel Flow: Mlb/hr          67.15
Total Bypass Flow (%):            11.9
Total Water Rod Flow (%):          2.9
Source Convergence              0.00046
```

Core Average Exposure: MWd/MTU 31699.0

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.255	5.811	30	0.416	0.512	5	40
	24	0.758	17.303	31	0.382	0.517	47	40
	23	0.996	23.036	32	0.763	1.043	41	12
	22	1.151	26.363	33	1.059	1.155	37	36
	21	1.254	28.865	34	1.208	1.356	41	16
	20	1.311	30.654	35	1.291	1.389	39	36
	19	1.326	32.167					
	18	1.327	33.209					
	17	1.305	33.481					
	16	1.333*	34.048					
	15	1.315	35.142					
	14	1.262	35.739					
	13	1.272	35.273					
	12	1.236	36.059					
	11	1.191	36.531					
	10	1.144	37.003					
	9	1.098	38.005					
	8	1.030	38.545					
	7	0.943	38.613					
	6	0.865	39.511					
	5	0.766	39.957*					
	4	0.668	38.813					
	3	0.592	35.803					
	2	0.475	27.401					
Bottom	1	0.130	7.567					

% AXIAL TILT 14.555 -10.335
AVG BOT 8ft/12ft 0.9286 1.0631

Active Channel Flow: Mlb/hr 64.92
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.389	35	39	36	1.713	0.899	33	15	36	7.71	0.800	43.5	33	27	38	20	8.14	0.819	49.4	33	27	38	20
1.383	35	37	38	1.716	0.898	33	35	38	9.91	0.791	20.5	35	27	40	20	10.49	0.804	27.6	34	41	38	15
1.383	35	35	40	1.718	0.896	33	15	40	7.70	0.768	39.8	33	19	22	21	10.45	0.801	27.7	34	37	42	15
1.376	35	33	38	1.720	0.895	33	39	16	7.30	0.766	44.7	33	37	40	18	10.82	0.797	23.2	35	27	40	20
1.374	35	39	32	1.722	0.894	33	19	40	7.26	0.765	45.1	33	13	38	18	7.74	0.791	50.7	33	13	38	18
1.373	35	35	36	1.722	0.894	33	39	34	7.41	0.764	43.1	33	17	24	21	7.89	0.790	48.9	33	17	38	18
1.372	35	41	34	1.730	0.890	33	39	30	7.30	0.764	44.3	33	35	38	18	7.97	0.788	47.9	33	15	40	18
1.368	35	41	30	1.734	0.888	33	11	36	7.27	0.762	44.6	33	33	40	18	7.94	0.787	48.2	33	35	42	18
1.366	35	39	28	1.588	0.888	34	11	38	7.33	0.759	43.4	33	15	36	18	10.35	0.787	26.8	34	41	40	15
1.358	35	31	40	1.588	0.888	34	37	12	7.28	0.758	43.9	33	39	34	18	8.33	0.787	43.7	33	19	22	21

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.49 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,201.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17450.0 (1756.50 )
Delta E: MWd/MTU, (GWd)          249.0 (  25.06 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.33
Flow: Mlb/hr                      80.31 (104.30 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- 12 -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- 10 -- -- -- 10 -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- 10 -- -- -- 10 -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- 12 -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %              3.41

k-effective:                    0.99963
Void Fraction:                    0.388
Core Delta-P: psia               23.802
Core Plate Delta-P: psia         19.272
Coolant Temp: Deg-F              547.5
In Channel Flow: Mlb/hr          70.87
Total Bypass Flow (%):            11.8
Total Water Rod Flow (%):          2.9
Source Convergence              0.00043
```

```
Core Average Exposure: MWd/MTU    31948.0

                 Axial Profile    Edit   Radial Power
N(PRA)  Power  Exposure          Zone   Avg.   Max.   IR JR
Top 25  0.263    5.881            30   0.415  0.511    5 40
    24  0.782   17.503            31   0.382  0.517   47 40
    23  1.027   23.299            32   0.764  1.047   41 12
    22  1.186   26.669            33   1.057  1.155   37 36
    21  1.287   29.198            34   1.214  1.361   41 38
    20  1.341   31.002            35   1.288  1.390   39 36
    19  1.350*  32.519
    18  1.346   33.561
    17  1.318   33.828
    16  1.343   34.383
    15  1.321   35.472
    14  1.266   36.056
    13  1.276   35.574
    12  1.238   36.352
    11  1.190   36.813
    10  1.139   37.274
     9  1.088   38.265
     8  1.012   38.789
     7  0.919   38.836
     6  0.833   39.716
     5  0.729   40.138*
     4  0.629   38.971
     3  0.554   35.943
     2  0.443   27.513
Bottom  1  0.122    7.600

          % AXIAL TILT  16.579 -10.102
        AVG BOT 8ft/12ft  0.9157  1.0618

Active Channel Flow: Mlb/hr        68.56
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR	K	Value	Margin	Exp.	FT	IR JR	K
1.390	35	39	36	1.739	0.886	33	35 38	7.80	0.813	44.0	33	27 38	20	8.24	0.833	49.8	33	27 38	20
1.384	35	37	38	1.741	0.885	33	37 36	10.06	0.807	21.0	35	27 40	20	10.58	0.815	28.2	34	41 38	15
1.383	35	35	40	1.749	0.880	33	39 16	7.42	0.782	45.1	33	37 40	18	10.98	0.812	23.8	35	27 40	20
1.374	35	41	34	1.601	0.880	34	37 12	7.79	0.780	40.2	33	19 22	21	10.54	0.812	28.2	34	37 42	15
1.374	35	33	38	1.750	0.880	33	15 40	7.37	0.780	45.5	33	13 38	18	7.83	0.806	51.4	33	13 38	18
1.374	35	39	32	1.603	0.880	34	11 38	7.51	0.778	43.5	33	17 24	21	7.93	0.804	50.0	33	37 40	18
1.371	35	35	36	1.752	0.879	33	11 36	7.39	0.776	44.7	33	35 38	18	8.06	0.803	48.6	33	35 42	18
1.369	35	41	30	1.755	0.878	33	19 14	7.36	0.774	45.0	33	33 40	18	7.98	0.802	49.3	33	17 38	18
1.366	35	39	28	1.756	0.877	33	39 34	7.38	0.771	44.3	33	39 34	18	8.43	0.801	44.2	33	19 22	21
1.361	34	41	38	1.614	0.874	35	35 32	7.40	0.771	44.0	33	37 36	18	10.46	0.800	27.4	34	41 40	15

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.50 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,450.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17451.0 (1756.60 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.6
Inlet Subcooling: Btu/lbm       -22.41
Flow: Mlb/hr                     73.65 ( 95.65 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11  -- -- -- -- 12 -- -- -- 12 -- -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- -- -- 12 -- -- -- 12 -- -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- --           7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              2.19

k-effective:                     0.99972
Void Fraction:                     0.408
Core Delta-P: psia                21.171
Core Plate Delta-P: psia          16.646
Coolant Temp: Deg-F               547.3
In Channel Flow: Mlb/hr           64.80
Total Bypass Flow (%):             12.0
Total Water Rod Flow (%):           3.0
Source Convergence               0.00048
```

Core Average Exposure: MWd/MTU 31949.1

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.247	5.882	30	0.407	0.499	5	40
	24	0.731	17.503	31	0.374	0.505	39	48
	23	0.961	23.300	32	0.749	1.021	41	12
	22	1.115	26.670	33	1.067	1.162	31	38
	21	1.221	29.199	34	1.190	1.332	37	42
	20	1.288	31.004	35	1.307	1.412	29	38
	19	1.320	32.521					
	18	1.325	33.563					
	17	1.305	33.829					
	16	1.336*	34.385					
	15	1.319	35.474					
	14	1.268	36.057					
	13	1.281	35.575					
	12	1.246	36.353					
	11	1.201	36.815					
	10	1.153	37.275					
	9	1.106	38.266					
	8	1.038	38.790					
	7	0.953	38.837					
	6	0.877	39.717					
	5	0.781	40.139*					
	4	0.687	38.971					
	3	0.612	35.943					
	2	0.494	27.513					
Bottom	1	0.136	7.600					

% AXIAL TILT 13.278 -10.101
AVG BOT 8ft/12ft 0.9386 1.0618

Active Channel Flow: Mlb/hr 62.62
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.412	35	29	38	1.693	0.909	33	29	40	7.52	0.790	44.8	33	35	30	20	8.03	0.814	50.0	33	35	30	20
1.403	35	31	40	1.694	0.909	33	19	40	7.68	0.785	42.1	33	19	22	20	8.27	0.805	46.4	33	19	22	20
1.402	35	27	40	1.555	0.907	35	29	38	9.62	0.779	22.2	35	17	32	20	10.27	0.791	28.2	34	37	42	15
1.387	35	33	38	1.698	0.907	33	31	38	9.57	0.776	22.4	35	33	30	20	10.25	0.789	28.2	34	41	38	15
1.384	35	27	36	1.702	0.905	33	23	18	7.26	0.758	44.2	33	31	38	18	7.60	0.781	51.2	33	13	38	18
1.383	35	31	36	1.704	0.904	33	25	38	7.21	0.757	44.7	33	35	38	18	10.50	0.781	24.3	35	35	22	20
1.372	35	35	40	1.709	0.901	33	33	36	7.23	0.756	44.3	33	39	34	18	10.43	0.780	25.0	35	19	30	20
1.372	35	29	42	1.715	0.898	33	15	36	7.25	0.755	44.0	33	37	36	18	7.76	0.780	49.3	33	17	38	18
1.366	35	35	36	1.716	0.898	33	35	38	7.17	0.755	45.1	33	37	40	18	7.75	0.777	49.1	33	37	36	18
1.363	35	37	38	1.577	0.894	35	27	14	7.17	0.755	45.0	33	33	40	18	7.67	0.777	50.0	33	37	40	18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.51 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,451.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17750.0 (1786.70 )
Delta E: MWd/MTU, (GWd)          299.0 (  30.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.46
Flow: Mlb/hr                     79.89 (103.75 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- --     35
  11  -- -- -- -- 12 -- -- -- 12 -- -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- -- -- 12 -- -- -- 12 -- -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- --           7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              2.19

k-effective:                    0.99976
Void Fraction:                    0.390
Core Delta-P: psia               23.674
Core Plate Delta-P: psia         19.145
Coolant Temp: Deg-F              547.5
In Channel Flow: Mlb/hr          70.47
Total Bypass Flow (%):           11.8
Total Water Rod Flow (%):         2.9
Source Convergence              0.00027
```

Core Average Exposure: MWd/MTU 32248.1

	Axial Profile		Edit	Radial Power			
N(PRA)	Power	Exposure	Zone	Avg.	Max.	IR	JR
Top 25	0.256	5.963	30	0.406	0.498	5	40
24	0.760	17.735	31	0.373	0.505	47	40
23	0.999	23.604	32	0.750	1.027	41	42
22	1.157	27.026	33	1.065	1.158	31	38
21	1.261	29.588	34	1.197	1.338	37	42
20	1.322	31.414	35	1.304	1.405	29	38
19	1.347*	32.941					
18	1.346	33.985					
17	1.319	34.245					
16	1.345	34.788					
15	1.324	35.871					
14	1.271	36.440					
13	1.284	35.940					
12	1.247	36.707					
11	1.197	37.156					
10	1.145	37.603					
9	1.093	38.580					
8	1.018	39.085					
7	0.925	39.108					
6	0.842	39.966					
5	0.741	40.361*					
4	0.644	39.166					
3	0.571	36.117					
2	0.459	27.653					
Bottom 1	0.127	7.641					
% AXIAL TILT	15.592	-9.838					
AVG BOT 8ft/12ft	0.9235	1.0604					

Active Channel Flow: Mlb/hr 68.17
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR	K	Value	Margin	Exp.	FT	IR JR	K
1.405	35	29	38	1.605	0.878	35	29 38	7.61	0.804	45.3	33	35 30	20	8.15	0.831	50.5	33	35 30	20
1.399	35	31	40	1.755	0.878	33	19 40	7.65	0.797	43.9	33	33 32	20	8.36	0.818	46.9	33	19 22	20
1.397	35	27	40	1.757	0.877	33	31 38	9.76	0.792	22.5	35	35 32	20	10.36	0.803	28.8	34	37 42	15
1.383	35	33	38	1.760	0.875	33	29 40	9.67	0.788	23.0	35	33 30	20	10.47	0.803	27.7	34	11 38	17
1.376	35	31	36	1.762	0.874	33	35 38	7.30	0.773	45.5	33	37 40	18	7.71	0.798	51.9	33	13 38	18
1.375	35	27	36	1.614	0.874	35	35 32	7.27	0.771	45.8	33	39 38	18	10.66	0.796	24.8	35	17 32	20
1.373	35	35	40	1.764	0.873	33	37 36	7.34	0.771	44.7	33	39 34	18	7.81	0.795	50.5	33	37 40	18
1.369	35	29	42	1.773	0.868	33	33 36	7.31	0.771	45.2	33	35 38	18	7.87	0.795	49.7	33	35 38	18
1.364	35	39	36	1.773	0.868	33	25 38	7.34	0.769	44.5	33	37 36	18	7.93	0.795	49.1	33	41 36	18
1.364	35	37	38	1.774	0.868	33	23 18	7.27	0.769	45.5	33	33 40	18	7.92	0.794	49.1	33	35 42	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.52 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,750.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        17751.0 (1786.80 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                     2923.0 (100.00 %)
Core Pressure: psia            1044.6
Inlet Subcooling: Btu/lbm      -22.19
Flow: Mlb/hr                   74.31 ( 96.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- 14 -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- 14 -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- --               3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              1.03

k-effective:                   0.99988
Void Fraction:                   0.408
Core Delta-P: psia              21.486
Core Plate Delta-P: psia        16.960
Coolant Temp: Deg-F              547.3
In Channel Flow: Mlb/hr          65.37
Total Bypass Flow (%):           12.0
Total Water Rod Flow (%):         3.0
Source Convergence             0.00048
```

```
Core Average Exposure: MWd/MTU    32249.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone  Avg.  Max.   IR JR
      Top 25  0.240   5.964      30  0.398 0.490    5 14
          24  0.710  17.736      31  0.366 0.497   47 40
          23  0.935  23.605      32  0.735 1.009   41 42
          22  1.087  27.027      33  1.075 1.171   37 32
          21  1.192  29.590      34  1.173 1.322   41 38
          20  1.261  31.416      35  1.322 1.411   35 36
          19  1.302  32.943
          18  1.325  33.987
          17  1.309  34.247
          16  1.342* 34.789
          15  1.327  35.873
          14  1.279  36.441
          13  1.295  35.941
          12  1.261  36.709
          11  1.215  37.157
          10  1.165  37.604
           9  1.115  38.581
           8  1.046  39.086
           7  0.960  39.109
           6  0.884  39.967
           5  0.789  40.361*
           4  0.695  39.167
           3  0.622  36.118
           2  0.503  27.654
      Bottom  1  0.140   7.642
  % AXIAL TILT  12.297  -9.837
AVG BOT 8ft/12ft  0.9474  1.0604

Active Channel Flow: Mlb/hr        63.17
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.411	35	35	36	1.690	0.911	33	33	36	7.54	0.803	46.1 33	35	24	19	8.07	0.824	50.6 33	35	24	19
1.410	35	31	36	1.695	0.908	33	37	32	7.66	0.800	44.4 33	33	22	19	8.11	0.817	49.5 33	19	32	19
1.407	35	33	34	1.707	0.902	33	37	36	9.64	0.786	23.0 35	17	32	19	7.81	0.792	50.1 33	37	22	19
1.405	35	37	34	1.709	0.901	33	39	30	9.44	0.771	23.2 35	33	24	19	10.22	0.792	28.8 34	41	38	15
1.403	35	29	38	1.568	0.899	35	35	36	9.36	0.762	22.9 35	35	36	15	7.73	0.789	50.7 33	35	20	19
1.401	35	35	32	1.713	0.899	33	31	38	7.27	0.759	44.2 33	15	32	19	10.53	0.788	25.1 35	35	22	19
1.400	35	37	30	1.717	0.897	33	17	20	9.26	0.758	23.5 35	37	34	15	10.16	0.787	28.8 34	37	42	15
1.399	35	39	32	1.719	0.896	33	39	34	9.25	0.758	23.5 35	33	38	15	7.52	0.777	51.7 33	13	38	18
1.395	35	33	38	1.721	0.895	33	35	38	7.21	0.757	44.7 33	39	34	18	7.51	0.776	51.6 33	39	20	18
1.389	35	31	40	1.578	0.894	35	37	30	7.21	0.755	44.5 33	37	36	18	7.67	0.775	49.8 33	17	38	18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.53 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 17,751.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18025.0 (1814.40 )
Delta E: MWd/MTU, (GWd)          274.0 (  27.58 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.40
Flow: Mlb/hr                      80.08 (104.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- 14 -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- 14 -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --        7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %              1.03

k-effective:                    1.00000
Void Fraction:                    0.391
Core Delta-P: psia               23.810
Core Plate Delta-P: psia         19.281
Coolant Temp: Deg-F              547.5
In Channel Flow: Mlb/hr          70.62
Total Bypass Flow (%):            11.8
Total Water Rod Flow (%):          2.9
Source Convergence              0.00044
```

```
Core Average Exposure: MWd/MTU    32523.1

                 Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure   Zone   Avg.  Max.   IR JR
Top 25    0.249   6.036    30   0.398 0.489    5 14
    24    0.739  17.942    31   0.365 0.498   47 40
    23    0.972  23.876    32   0.737 1.014   41 42
    22    1.128  27.345    33   1.073 1.167   37 32
    21    1.231  29.938    34   1.179 1.328   41 38
:JR 20    1.295  31.784    35   1.319 1.406   35 36
    19    1.330  33.323
    18    1.346  34.374
    17    1.323  34.629
    16    1.352* 35.160
    15    1.334  36.239
    14    1.283  36.794
    13    1.299  36.278
    12    1.263  37.037
    11    1.212  37.474
    10    1.158  37.907
     9    1.105  38.872
     8    1.027  39.358
     7    0.933  39.359
     6    0.849  40.198
     5    0.748  40.567*
     4    0.651  39.348
     3    0.577  36.280
     2    0.466  27.785
Bottom 1  0.129   7.680

% AXIAL TILT      14.605  -9.608
AVG BOT 8ft/12ft   0.9326  1.0592

Active Channel Flow: Mlb/hr       68.31
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.406	35	35	36	1.751	0.879	33	33	36	7.60	0.814	46.6	33	35	24	19	8.16	0.837	51.1	33	35	24	19
1.403	35	31	36	1.753	0.878	33	37	32	7.71	0.810	44.8	33	33	22	19	8.31	0.828	48.5	33	33	22	19
1.402	35	37	34	1.610	0.876	35	35	36	9.75	0.796	23.2	35	35	22	19	7.90	0.806	50.6	33	37	22	19
1.400	35	33	34	1.761	0.875	33	37	36	9.50	0.779	23.8	35	33	24	19	10.32	0.804	29.4	34	41	38	15
1.397	35	39	32	1.766	0.872	33	39	30	7.36	0.772	44.7	33	15	32	19	7.82	0.803	51.2	33	35	20	19
1.397	35	29	38	1.620	0.870	35	37	30	7.32	0.772	45.2	33	39	34	18	10.67	0.801	25.4	35	35	22	19
1.395	35	37	30	1.771	0.869	33	39	34	7.31	0.769	45.0	33	37	36	18	10.26	0.800	29.4	34	37	42	15
1.394	35	35	32	1.772	0.869	33	31	38	9.39	0.768	23.5	35	35	36	15	7.62	0.794	52.3	33	13	38	18
1.391	35	33	38	1.774	0.868	33	35	38	7.27	0.768	45.2	33	17	34	19	7.62	0.791	52.1	33	39	20	18
1.385	35	31	40	1.626	0.867	35	39	32	7.30	0.766	44.7	33	39	30	18	7.78	0.790	50.3	33	17	38	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.54 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,025.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18026.0 (1814.50 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                     2923.0 (100.00 %)
Core Pressure: psia            1044.6
Inlet Subcooling: Btu/lbm      -21.68
Flow: Mlb/hr                    75.85 ( 98.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- --           7
  25              -- -- -- -- --              3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     0.99998
Void Fraction:                     0.408
Core Delta-P: psia                22.182
Core Plate Delta-P: psia          17.656
Coolant Temp: Deg-F                547.4
In Channel Flow: Mlb/hr            66.74
Total Bypass Flow (%):              12.0
Total Water Rod Flow (%):            3.0
Source Convergence               0.00039
```

```
Core Average Exposure: MWd/MTU    32524.0

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
      Top 25  0.234   6.037    30  0.391 0.481    5 40
          24  0.693  17.942    31  0.359 0.488   47 40
          23  0.911  23.877    32  0.724 0.994   41 42
          22  1.060  27.346    33  1.081 1.161   37 32
          21  1.161  29.939    34  1.160 1.302   41 38
          20  1.229  31.786    35  1.335 1.403   37 30
          19  1.270  33.325
          18  1.298  34.375
          17  1.296  34.631
          16  1.339* 35.161
          15  1.331  36.241
          14  1.290  36.796
          13  1.312  36.280
          12  1.281  37.038
          11  1.235  37.475
          10  1.184  37.908
           9  1.133  38.873
           8  1.062  39.359
           7  0.975  39.360
           6  0.898  40.198
           5  0.802  40.567*
           4  0.709  39.349
           3  0.636  36.280
           2  0.517  27.785
      Bottom  1\ 0.144   7.681

          % AXIAL TILT  10.710  -9.607
      AVG BOT 8ft/12ft  0.9598  1.0592

Active Channel Flow: Mlb/hr        64.50
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power			MCPR				APLHGR					LHGR				
Value	FT	IR JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.403	35	37 30	1.736	0.887	33	37 26	9.20	0.753	23.5 35	35 36	15	10.05	0.783	29.4 34	41 38	15
1.392	35	35 32	1.740	0.885	33	37 32	9.22	0.751	23.0 35	37 30	15	9.98	0.778	29.4 34	37 42	15
1.391	35	39 28	1.745	0.883	33	39 30	9.13	0.750	24.0 35	37 34	15	7.36	0.764	52.1 33	13 38	18
1.389	35	33 34	1.750	0.880	33	33 36	9.16	0.749	23.4 35	35 32	15	7.51	0.763	50.2 33	35 38	18
1.388	35	31 36	1.602	0.880	35	37 30	9.15	0.749	23.4 35	39 32	15	7.57	0.763	49.5 33	41 36	18
1.387	35	35 36	1.762	0.874	33	37 18	9.08	0.747	24.1 35	33 38	15	9.86	0.762	28.6 34	41 40	15
1.386	35	37 34	1.615	0.873	35	35 36	9.13	0.746	23.3 35	33 34	15	7.34	0.762	52.1 33	39 20	18
1.386	35	39 32	1.766	0.872	33	35 20	7.06	0.745	45.2 33	39 34	18	7.44	0.761	50.8 33	41 32	18
1.380	35	29 38	1.618	0.872	35	35 22	9.13	0.745	23.0 35	31 36	15	7.50	0.761	50.0 33	37 36	18
1.379	35	35 28	1.770	0.870	33	39 34	9.09	0.744	23.5 35	39 28	15	7.43	0.760	50.9 33	37 40	18

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.55 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,026.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18225.0 (1834.50 )
Delta E: MWd/MTU, (GWd)          199.0 (  20.03 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.7
Inlet Subcooling: Btu/lbm       -20.29
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                    1.00008
Void Fraction:                    0.395
Core Delta-P: psia               24.068
Core Plate Delta-P: psia         19.539
Coolant Temp: Deg-F              547.5
In Channel Flow: Mlb/hr          70.94
Total Bypass Flow (%):           11.8
Total Water Rod Flow (%):         2.9
Source Convergence             0.00046
```

```
Core Average Exposure: MWd/MTU    32723.2

                 Axial Profile    Edit   Radial Power
N(PRA)  Power  Exposure  Zone   Avg.   Max.   IR JR
Top 25  0.240    6.088    30   0.391  0.481    5 40
    24  0.714   18.088    31   0.359  0.488   47 40
    23  0.939   24.069    32   0.726  0.998   41 42
    22  1.091   27.571    33   1.080  1.159   37 32
    21  1.190   30.186    34   1.165  1.307   41 38
:JR 20  1.254   32.046    35   1.332  1.399   37 30
    19  1.291   33.594
    18  1.314   34.651
    17  1.306   34.906
    16  1.346*  35.430
    15  1.336   36.508
    14  1.292   37.055
    13  1.314   36.528
    12  1.282   37.281
    11  1.233   37.708
    10  1.179   38.132
     9  1.125   39.087
     8  1.048   39.560
     7  0.955   39.545
     6  0.873   40.368
     5  0.772   40.719*
     4  0.676   39.483
     3  0.603   36.401
     2  0.489   27.883
Bottom 1  0.136    7.710

% AXIAL TILT      12.424   -9.454
AVG BOT 8ft/12ft   0.9488   1.0584

Active Channel Flow: Mlb/hr      68.61
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.399	35	37	30	1.784	0.863	33	37 26	9.22	0.757	23.8 35	35 36	15	10.13	0.793	29.8 34	41 38	15
1.389	35	39	28	1.637	0.862	35	37 30	7.15	0.756	45.5 33	39 34	18	10.06	0.787	29.8 34	37 42	15
1.388	35	35	22	1.788	0.861	33	37 32	9.23	0.755	23.3 35	37 30	15	7.68	0.777	49.9 33	41 36	18
1.384	35	39	32	1.791	0.860	33	39 30	9.15	0.755	24.4 35	37 34	15	7.44	0.776	52.4 33	13 38	18
1.384	35	35	36	1.798	0.856	33	33 36	7.14	0.754	45.3 33	37 36	18	7.60	0.775	50.5 33	35 38	18
1.384	35	33	34	1.647	0.856	35	35 36	9.18	0.753	23.8 35	39 32	15	7.53	0.774	51.2 33	37 40	18
1.383	35	37	34	1.805	0.853	33	37 36	9.17	0.752	23.8 35	35 32	15	7.42	0.773	52.4 33	39 20	18
1.383	35	31	36	1.654	0.853	35	39 28	7.05	0.752	46.3 33	37 40	18	7.53	0.773	51.1 33	41 32	18
1.376	35	29	38	1.654	0.852	35	35 22	7.03	0.752	46.5 33	39 38	18	9.95	0.773	29.0 34	41 40	15
1.373	35	35	28	1.656	0.852	35	37 20	9.10	0.751	24.4 35	33 38	15	7.59	0.773	50.4 33	37 36	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.56 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,225.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18226.0 (1834.60 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -24.32
Flow: Mlb/hr                     77.00 (100.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --                51     :JR
   3        -- -- -- -- -- -- -- -- --          47
   5     -- -- -- -- -- -- -- -- -- -- --       43
   7     -- -- -- -- -- -- -- -- -- -- --       39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --    35
  11  -- -- -- -- -- -- -- -- -- -- -- -- --    31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --    27
  15  -- -- -- -- -- -- -- -- -- -- -- -- --    23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --    19
  19     -- -- -- -- -- -- -- -- -- -- --       15
  21     -- -- -- -- -- -- -- -- -- -- --       11
  23        -- -- -- -- -- -- -- -- --          7
  25              -- -- -- -- --                3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                    1.00007
Void Fraction:                    0.392
Core Delta-P: psia               22.395
Core Plate Delta-P: psia         17.857
Coolant Temp: Deg-F              546.8
In Channel Flow: Mlb/hr           67.87
Total Bypass Flow (%):            11.9
Total Water Rod Flow (%):          2.9
Source Convergence              0.00046
```

```
Core Average Exposure: MWd/MTU    32724.2

                    Axial Profile    Edit   Radial Power
              N(PRA) Power Exposure  Zone  Avg.   Max.   IR JR
           Top 25  0.236   6.089    30  0.392  0.482    5 40
               24  0.700  18.089    31  0.360  0.489   47 40
               23  0.920  24.070    32  0.730  1.000   41 42
               22  1.069  27.572    33  1.079  1.155   37 32
               21  1.168  30.187    34  1.166  1.305   41 38
               20  1.232  32.048    35  1.329  1.394   37 30
               19  1.269  33.596
               18  1.294  34.652
               17  1.289  34.907
               16  1.331* 35.431
               15  1.325  36.509
               14  1.286  37.056
               13  1.312  36.529
               12  1.284  37.282
               11  1.241  37.710
               10  1.193  38.133
                9  1.144  39.088
                8  1.071  39.561
                7  0.981  39.546
                6  0.899  40.369
                5  0.797  40.720*
                4  0.697  39.484
                3  0.620  36.401
                2  0.502  27.884
           Bottom  1  0.140   7.710
      % AXIAL TILT    10.762  -9.453
AVG BOT 8ft/12ft      0.9584   1.0584

Active Channel Flow: Mlb/hr       65.64
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.394	35	37	30	1.770	0.870	33	37	26	9.09	0.746	23.8	35	35	36 15	9.99	0.782	29.8	34	41	38 15
1.384	35	39	28	1.774	0.868	33	37	32	9.02	0.744	24.4	35	37	34 15	9.93	0.777	29.9	34	37	42 15
1.383	35	35	22	1.778	0.866	33	39	30	9.10	0.744	23.3	35	37	30 15	7.54	0.763	49.9	33	41	36 18
1.380	35	39	32	1.633	0.863	35	37	30	7.02	0.743	45.5	33	39	34 18	9.83	0.763	29.0	34	41	40 15
1.380	35	35	36	1.785	0.863	33	33	36	9.05	0.743	23.8	35	39	32 15	7.31	0.763	52.4	33	13	38 18
1.379	35	33	34	1.792	0.859	33	37	18	9.04	0.741	23.8	35	35	32 15	7.46	0.761	50.5	33	35	38 18
1.379	35	37	34	1.644	0.858	35	35	36	8.98	0.741	24.4	35	33	38 15	9.80	0.761	29.0	34	39	42 15
1.379	35	31	36	1.799	0.856	33	39	34	7.01	0.740	45.3	33	37	36 18	7.40	0.760	51.2	33	37	40 18
1.371	35	29	38	1.802	0.854	33	35	20	8.85	0.739	25.8	35	37	38 15	7.40	0.759	51.1	33	41	32 18
1.368	35	35	28	1.650	0.854	35	35	22	8.91	0.739	25.1	35	39	36 15	7.29	0.759	52.4	33	39	20 18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.57 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,226.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18375.0 (1849.60 )
Delta E: MWd/MTU, (GWd)          149.0 (  15.00 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -23.17
Flow: Mlb/hr                     80.39 (104.40 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %              0.00

k-effective:                     1.00009
Void Fraction:                     0.383
Core Delta-P: psia                23.770
Core Plate Delta-P: psia          19.230
Coolant Temp: Deg-F               546.9
In Channel Flow: Mlb/hr           70.95
Total Bypass Flow (%):             11.7
Total Water Rod Flow (%):           2.9
Source Convergence              0.00048
```

```
Core Average Exposure: MWd/MTU    32873.1

                    Axial Profile    Edit   Radial Power
          N(PRA)  Power  Exposure   Zone   Avg.   Max.   IR JR
          Top 25  0.241    6.127     30  0.392  0.482    5 40
              24  0.716   18.199     31  0.360  0.490   47 40
              23  0.942   24.215     32  0.731  1.003   41 42
              22  1.093   27.742     33  1.078  1.154   37 32
              21  1.190   30.373     34  1.170  1.309   41 38
              20  1.251   32.243     35  1.328  1.392   37 30
              19  1.285   33.797
              18  1.306   34.858
              17  1.297   35.112
              16  1.337*  35.632
              15  1.329   36.709
              14  1.288   37.249
              13  1.314   36.715
              12  1.285   37.464
              11  1.239   37.885
              10  1.189   38.302
               9  1.137   39.250
               8  1.060   39.713
               7  0.965   39.685
               6  0.879   40.497
               5  0.773   40.833*
               4  0.672   39.582
               3  0.596   36.489
               2  0.482   27.955
  Bottom       1  0.134    7.731
  % AXIAL TILT    12.102   -9.339
  AVG BOT 8ft/12ft 0.9498  1.0578

Active Channel Flow: Mlb/hr       68.65
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR K	Value	Margin	Exp.	FT	IR JR K
1.392	35	37	30	1.805	0.859	33	37 26	7.09	0.752	45.7	33	39 34 18	10.05	0.789	30.1	34	41 38 15
1.383	35	39	28	1.807	0.858	33	37 32	9.11	0.750	24.1	35	35 36 15	9.99	0.784	30.2	34	37 42 15
1.379	35	39	32	1.656	0.857	35	37 30	6.98	0.748	46.7	33	39 38 18	7.62	0.773	50.1	33	41 36 18
1.379	35	35	32	1.810	0.856	33	39 30	7.00	0.748	46.5	33	37 40 18	7.37	0.772	52.9	33	13 38 18
1.378	35	35	36	1.666	0.852	35	35 36	7.07	0.748	45.5	33	37 36 18	9.90	0.770	29.3	34	41 40 15
1.377	35	37	34	1.819	0.852	33	33 36	9.04	0.748	24.7	35	37 34 15	7.47	0.770	51.5	33	37 40 18
1.376	35	33	34	1.823	0.850	33	37 18	9.12	0.747	23.6	35	37 30 15	7.53	0.770	50.8	33	35 38 18
1.376	35	31	36	1.672	0.849	35	39 28	9.08	0.747	24.1	35	39 32 15	7.47	0.769	51.3	33	41 32 18
1.369	35	29	38	1.675	0.848	35	37 20	6.99	0.745	46.2	33	35 38 18	7.58	0.769	50.1	33	35 42 18
1.364	35	35	28	1.675	0.848	35	39 32	9.00	0.744	24.7	35	33 38 15	7.36	0.768	52.6	33	39 20 18

```
  * LHGR calculated with pin-power reconstruction
  * CPR calculated with pin-power reconstruction & CPR limit type 3
  * Thermal limit file:
```

Figure A.58 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,375.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18376.0 (1849.70 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -27.11
Flow: Mlb/hr                     77.00 (100.00 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00004
Void Fraction:                     0.380
Core Delta-P: psia                22.157
Core Plate Delta-P: psia          17.608
Coolant Temp: Deg-F               546.1
In Channel Flow: Mlb/hr           67.95   Active Channel Flow: Mlb/hr       65.75
Total Bypass Flow (%):             11.7   (of total core flow)
Total Water Rod Flow (%):           2.9   (of total core flow)
Source Convergence              0.00048
```

```
Core Average Exposure: MWd/MTU    32874.1

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
      Top 25  0.236   6.128     30  0.394 0.483    5 40
          24  0.703  18.200     31  0.361 0.491   47 40
          23  0.925  24.216     32  0.736 1.005   41 42
          22  1.073  27.743     33  1.076 1.151   37 32
          21  1.170  30.374     34  1.171 1.307   41 38
          20  1.231  32.245     35  1.325 1.387   37 30
          19  1.266  33.799
          18  1.289  34.859
          17  1.282  35.113
          16  1.324* 35.633
          15  1.319  36.710
          14  1.282  37.250
          13  1.312  36.716
          12  1.288  37.465
          11  1.247  37.887
          10  1.202  38.303
           9  1.155  39.252
           8  1.082  39.714
           7  0.989  39.686
           6  0.902  40.497
           5  0.794  40.833*
           4  0.689  39.583
           3  0.611  36.490
           2  0.494  27.955
      Bottom  1  0.137   7.731
          % AXIAL TILT  10.610  -9.338
    AVG BOT 8ft/12ft  0.9586  1.0578
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.387	35	37	30	1.789	0.866	33	37 26	8.99	0.740	24.1	35	35	36 15	9.93	0.779	30.1	34	41	38 15
1.378	35	39	28	1.792	0.865	33	37 32	6.97	0.739	45.7	33	39	34 18	9.86	0.774	30.2	34	37	42 15
1.375	35	39	32	1.795	0.863	33	39 30	8.93	0.738	24.7	35	37	34 15	9.78	0.761	29.3	34	41	40 15
1.375	35	35	22	1.652	0.860	35	37 30	8.96	0.737	24.1	35	39	32 15	7.50	0.761	50.1	33	41	36 18
1.374	35	35	36	1.804	0.859	33	33 36	8.99	0.737	23.6	35	37	30 15	7.25	0.760	52.9	33	13	38 18
1.373	35	37	34	1.808	0.857	33	37 18	6.89	0.737	46.5	33	37	40 18	9.75	0.759	29.3	34	39	42 15
1.372	35	33	34	1.662	0.854	35	35 36	6.87	0.737	46.7	33	39	38 18	7.35	0.758	51.5	33	37	40 18
1.371	35	31	36	1.814	0.854	33	39 34	6.96	0.736	45.5	33	37	36 18	7.41	0.758	50.8	33	35	38 18
1.365	35	29	38	1.668	0.851	35	39 28	8.88	0.735	24.7	35	33	38 15	9.71	0.757	29.5	34	45	22 15
1.360	35	35	28	1.670	0.850	35	37 20	8.78	0.735	26.1	35	37	38 15	7.46	0.757	50.1	33	35	42 18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.59 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,376.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18525.0 (1864.70 )
Delta E: MWd/MTU, (GWd)          149.0 (  15.00 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -25.83
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- --     35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                    1.00010
Void Fraction:                    0.370
Core Delta-P: psia               23.549
Core Plate Delta-P: psia         18.999
Coolant Temp: Deg-F              546.2
In Channel Flow: Mlb/hr          71.11
Total Bypass Flow (%):            11.6
Total Water Rod Flow (%):          2.8
Source Convergence              0.00040
```

```
Core Average Exposure: MWd/MTU    33023.0

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
      Top 25  0.242   6.167    30  0.393 0.483   5 40
          24  0.721  18.311    31  0.360 0.491  47 40
          23  0.948  24.362    32  0.737 1.007  41 42
          22  1.099  27.914    33  1.075 1.150  37 32
          21  1.194  30.560    34  1.174 1.311  41 38
   :JR    20  1.252  32.440    35  1.323 1.385  37 30
          19  1.283  34.000
          18  1.302  35.064
          17  1.292  35.317
          16  1.332* 35.832
          15  1.325  36.908
          14  1.285  37.443
          13  1.315  36.902
          12  1.289  37.647
          11  1.245  38.063
          10  1.198  38.474
           9  1.148  39.415
           8  1.069  39.867
           7  0.970  39.826
           6  0.879  40.625
           5  0.766  40.946*
           4  0.661  39.680
           3  0.583  36.576
           2  0.471  28.025
      Bottom  1  0.131   7.752

          % AXIAL TILT  12.094  -9.226
      AVG BOT 8ft/12ft  0.9492  1.0573

Active Channel Flow: Mlb/hr        68.83
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.385	35	37	30	1.823	0.850	33	37	26	7.04	0.749	46.0	33	39	34 18	10.01	0.787	30.4	34	41	38 15
1.378	35	39	28	1.825	0.849	33	37	32	6.95	0.747	47.0	33	39	38 18	9.94	0.782	30.5	34	37	42 15
1.375	35	39	32	1.674	0.848	35	37	30	6.97	0.747	46.7	33	37	40 18	7.59	0.772	50.4	33	41	36 18
1.373	35	35	36	1.828	0.848	33	39	30	7.02	0.745	45.7	33	37	36 18	7.33	0.771	53.1	33	13	38 18
1.372	35	37	34	1.683	0.844	35	35	36	9.03	0.744	24.4	35	35	36 15	9.87	0.770	29.6	34	41	40 15
1.372	35	35	32	1.839	0.843	33	37	36	8.96	0.742	24.9	35	37	34 15	7.44	0.769	51.7	33	37	40 18
1.369	35	33	34	1.839	0.843	33	33	36	9.00	0.742	24.4	35	39	32 15	9.84	0.768	29.6	34	39	42 15
1.369	35	31	36	1.689	0.841	35	39	28	6.94	0.742	46.4	33	35	38 18	7.54	0.768	50.4	33	35	42 18
1.362	35	29	38	1.845	0.840	33	39	34	6.91	0.741	46.8	33	41	32 18	7.49	0.768	51.0	33	35	38 18
1.356	35	35	28	1.690	0.840	35	39	32	9.02	0.741	23.9	35	37	30 15	7.43	0.767	51.7	33	41	32 18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.60 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,525.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18526.0 (1864.80 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -29.70
Flow: Mlb/hr                     77.08 (100.10 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51     :JR
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00010
Void Fraction:                     0.368
Core Delta-P: psia                21.964
Core Plate Delta-P: psia          17.404
Coolant Temp: Deg-F               545.5
In Channel Flow: Mlb/hr           68.10
Total Bypass Flow (%):             11.6
Total Water Rod Flow (%):           2.8
Source Convergence               0.00049
```

Core Average Exposure: MWd/MTU 33024.0

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.238	6.167	30	0.395	0.484	5	40
	24	0.708	18.312	31	0.362	0.492	47	40
	23	0.931	24.363	32	0.741	1.009	41	42
	22	1.080	27.915	33	1.074	1.147	37	32
	21	1.175	30.561	34	1.175	1.309	41	38
	20	1.233	32.442	35	1.320	1.381	37	30
	19	1.265	34.001					
	18	1.286	35.065					
	17	1.278	35.318					
	16	1.320*	35.833					
	15	1.317	36.910					
	14	1.281	37.444					
	13	1.314	36.903					
	12	1.293	37.649					
	11	1.254	38.064					
	10	1.211	38.475					
	9	1.166	39.416					
	8	1.090	39.868					
	7	0.992	39.827					
	6	0.900	40.626					
	5	0.784	40.946*					
	4	0.675	39.681					
	3	0.595	36.577					
	2	0.481	28.025					
Bottom	1	0.133	7.752					
% AXIAL TILT		10.715	-9.225					
AVG BOT 8ft/12ft		0.9575	1.0573					

Active Channel Flow: Mlb/hr 65.92
(of total core flow)
(of total core flow)

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.381	35	37	30	1.807	0.858	33	37 26	6.93	0.737	46.0	33	39	34 18	9.89	0.778	30.4	34	41	38 15
1.374	35	39	28	1.808	0.857	33	37 32	6.85	0.736	47.0	33	39	38 18	9.83	0.774	30.5	34	37	42 15
1.371	35	39	32	1.812	0.855	33	39 30	6.86	0.736	46.7	33	37	40 18	9.76	0.762	29.6	34	41	40 15
1.369	35	35	36	1.669	0.851	35	37 30	8.92	0.736	24.4	35	35	36 15	7.47	0.760	50.4	33	41	36 18
1.369	35	37	34	1.823	0.850	33	37 18	8.85	0.734	24.9	35	37	34 15	9.73	0.760	29.6	34	39	42 15
1.368	35	35	32	1.823	0.850	33	33 36	6.91	0.733	45.7	33	37	36 18	7.22	0.760	53.2	33	13	38 18
1.365	35	33	34	1.828	0.848	33	39 34	8.89	0.733	24.4	35	39	32 15	9.69	0.757	29.8	34	45	22 15
1.365	35	31	36	1.678	0.846	35	35 36	8.91	0.732	23.9	35	37	30 15	7.33	0.757	51.7	33	37	40 18
1.359	35	29	38	1.684	0.843	35	39 28	8.73	0.732	26.3	35	37	38 15	7.43	0.756	50.4	33	35	42 18
1.352	35	35	28	1.839	0.843	33	35 38	8.78	0.732	25.6	35	39	36 15	7.37	0.756	51.0	33	35	38 18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.61 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,526.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18650.0 (1877.30 )
Delta E: MWd/MTU, (GWd)          124.0 (  12.48 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -28.40
Flow: Mlb/hr                     80.27 (104.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                    1.00011
Void Fraction:                    0.360
Core Delta-P: psia               23.244
Core Plate Delta-P: psia         18.685
Coolant Temp: Deg-F              545.6
In Channel Flow: Mlb/hr          71.01
Total Bypass Flow (%):           11.5
Total Water Rod Flow (%):         2.8
Source Convergence              0.00049
```

```
Core Average Exposure: MWd/MTU    33148.0

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.   IR JR
Top 25    0.242   6.200    30  0.394 0.484    5 40
    24    0.722  18.405    31  0.361 0.492   47 40
    23    0.950  24.485    32  0.741 1.011   41 42
    22    1.100  28.058    33  1.074 1.146   37 32
    21    1.193  30.717    34  1.178 1.312   41 38
:JR 20    1.249  32.605    35  1.319 1.380   37 30
    19    1.279  34.169
    18    1.296  35.235
    17    1.285  35.487
    16   1.326*  35.998
    15    1.321  37.074
    14    1.283  37.605
    13    1.316  37.058
    12    1.293  37.801
    11    1.253  38.212
    10    1.208  38.618
     9    1.160  39.554
     8    1.079  39.997
     7    0.977  39.944
     6    0.881  40.732
     5    0.763 41.039*
     4    0.654  39.760
     3    0.575  36.647
     2    0.464  28.082
Bottom 1  0.129   7.769

% AXIAL TILT  11.862  -9.132
AVG BOT 8ft/12ft  0.9502  1.0568

Active Channel Flow: Mlb/hr      68.76
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.380	35	37	30	1.839	0.843	33	37	26	6.99	0.745	46.1	33	39	34 18	9.95	0.785	30.7	34	41	38 15
1.373	35	39	28	1.840	0.842	33	37	32	6.91	0.744	47.2	33	39	38 18	9.89	0.780	30.7	34	37	42 15
1.371	35	39	32	1.843	0.841	33	39	30	6.93	0.744	46.9	33	37	40 18	7.55	0.770	50.6	33	41	36 18
1.368	35	35	36	1.690	0.840	35	37	30	6.97	0.740	45.9	33	37	36 18	9.83	0.769	29.8	34	41	40 15
1.368	35	37	34	1.852	0.837	33	37	18	8.95	0.739	24.6	35	35	36 15	7.29	0.768	53.3	33	13	38 18
1.366	35	35	32	1.698	0.836	35	35	36	7.01	0.738	45.1	33	41	36 18	9.80	0.767	29.8	34	39	42 15
1.363	35	33	34	1.856	0.835	33	33	36	6.86	0.738	47.0	33	41	32 18	7.39	0.766	51.9	33	37	40 18
1.362	35	31	36	1.858	0.834	33	39	34	8.88	0.737	25.2	35	37	34 15	7.50	0.765	50.6	33	35	42 18
1.357	35	29	38	1.704	0.833	35	39	28	6.89	0.737	46.6	33	35	38 18	9.75	0.765	30.0	34	45	22 15
1.351	35	33	38	1.704	0.833	35	39	32	8.92	0.737	24.6	35	39	32 15	7.38	0.764	51.9	33	41	32 18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.62 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,650.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18651.0 (1877.40 )
Delta E: MWd/MTU, (GWd)            1.0 (   0.10 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -32.10
Flow: Mlb/hr                     77.19 (100.25 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --                51     :JR
   3        -- -- -- -- -- -- -- -- --          47
   5     -- -- -- -- -- -- -- -- -- -- --       43
   7     -- -- -- -- -- -- -- -- -- -- --       39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --    35
  11  -- -- -- -- -- -- -- -- -- -- -- -- --    31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --    27
  15  -- -- -- -- -- -- -- -- -- -- -- -- --    23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --    19
  19     -- -- -- -- -- -- -- -- -- -- --       15
  21     -- -- -- -- -- -- -- -- -- -- --       11
  23        -- -- -- -- -- -- -- -- --          7
  25              -- -- -- -- --                3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00011
Void Fraction:                     0.358
Core Delta-P: psia                21.811
Core Plate Delta-P: psia          17.243
Coolant Temp: Deg-F               544.8
In Channel Flow: Mlb/hr           68.28   Active Channel Flow: Mlb/hr      66.11
Total Bypass Flow (%):             11.5   (of total core flow)
Total Water Rod Flow (%):           2.8   (of total core flow)
Source Convergence              0.00050

Core Average Exposure: MWd/MTU    33149.0

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure      Zone  Avg.  Max.   IR JR
Top 25    0.238   6.200             30  0.396 0.485    5 40
    24    0.710  18.406             31  0.362 0.493   47 40
    23    0.934  24.486             32  0.745 1.013   41 42
    22    1.082  28.059             33  1.073 1.144   37 32
    21    1.175  30.718             34  1.179 1.310   41 38
    20    1.231  32.606             35  1.317 1.376   37 30
    19    1.262  34.170
    18    1.281  35.237
    17    1.272  35.489
    16    1.315  36.000
    15    1.313  37.076
    14    1.279  37.606
    13   1.316*  37.060
    12    1.297  37.802
    11    1.261  38.213
    10    1.221  38.619
     9    1.177  39.555
     8    1.099  39.998
     7    0.998  39.944
     6    0.900  40.733
     5    0.779  41.039*
     4    0.667  39.761
     3    0.587  36.647
     2    0.474  28.083
Bottom   1    0.132   7.769

                % AXIAL TILT  10.558  -9.131
          AVG BOT 8ft/12ft    0.9581  1.0568
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.376	35	37	30	1.825	0.849	33	37 26	6.89	0.734	46.1	33	39	34 18	9.85	0.777	30.7	34	41	38 15
1.369	35	39	28	1.826	0.849	33	37 32	6.81	0.734	47.2	33	39	38 18	9.79	0.772	30.7	34	37	42 15
1.367	35	39	32	1.829	0.847	33	39 30	6.83	0.734	46.9	33	37	40 18	9.73	0.762	29.8	34	41	40 15
1.364	35	35	36	1.838	0.843	33	37 18	8.85	0.731	24.6	35	35	36 15	9.71	0.759	29.8	34	39	42 15
1.364	35	37	34	1.686	0.842	35	37 30	6.87	0.730	45.9	33	37	36 18	7.44	0.759	50.6	33	41	36 18
1.362	35	35	32	1.842	0.842	33	33 36	8.83	0.729	24.6	35	39	32 15	7.19	0.757	53.4	33	13	38 18
1.359	35	31	36	1.844	0.841	33	39 34	8.78	0.729	25.2	35	37	34 15	9.66	0.757	30.0	34	45	22 15
1.359	35	33	34	1.695	0.838	35	35 36	8.67	0.729	26.6	35	37	38 15	7.29	0.755	51.9	33	37	40 18
1.353	35	29	38	1.854	0.836	33	35 38	8.72	0.729	25.8	35	39	36 15	7.39	0.754	50.6	33	35	42 18
1.347	35	33	38	1.700	0.835	35	39 28	6.91	0.728	45.1	33	41	36 18	7.27	0.753	51.9	33	41	32 18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.63 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,651.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18660.6 (1878.30 )
Delta E: MWd/MTU, (GWd)            9.6 (   0.97 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -31.98
Flow: Mlb/hr                     77.46 (100.60 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50


Control Rod Density: %           0.00

k-effective:                  1.00012
Void Fraction:                  0.358
Core Delta-P: psia             21.917
Core Plate Delta-P: psia       17.349
Coolant Temp: Deg-F             544.8
In Channel Flow: Mlb/hr         68.52
Total Bypass Flow (%):           11.5
Total Water Rod Flow (%):         2.8
Source Convergence            0.00046
```

```
Core Average Exposure: MWd/MTU    33158.6

                    Axial Profile    Edit   Radial Power
          N(PRA)  Power Exposure    Zone   Avg.   Max.   IR JR
Top 25    0.238   6.202             30   0.396 0.485    5 40
    24    0.711  18.413             31   0.362 0.493   47 40
    23    0.935  24.496             32   0.745 1.013   41 42
    22    1.084  28.070             33   1.073 1.144   37 32
    21    1.177  30.730             34   1.179 1.310   41 38
    20    1.233  32.619             35   1.317 1.376   37 30
    19    1.263  34.183
    18    1.282  35.250
    17    1.273  35.502
    16    1.316  36.013
    15    1.314  37.088
    14    1.280  37.618
    13   1.317*  37.072
    12    1.297  37.814
    11    1.261  38.225
    10    1.221  38.630
     9    1.176  39.566
     8    1.098  40.008
     7    0.996  39.954
     6    0.898  40.741
     5    0.777  41.047*
     4    0.665  39.767
     3    0.585  36.653
     2    0.472  28.087
Bottom 1  0.131   7.770

% AXIAL TILT      10.657  -9.124
AVG BOT 8ft/12ft   0.9575  1.0567

Active Channel Flow: Mlb/hr        66.35
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR K	Value	Margin	Exp.	FT	IR	JR K
1.376	35	37	30	1.688	0.865	35	37	30	6.89	0.735	46.2	33	39	34 18	9.85	0.778	30.7	34	41	38 15
1.369	35	39	28	1.696	0.861	35	35	36	6.82	0.735	47.2	33	39	38 18	9.79	0.773	30.8	34	37	42 15
1.367	35	39	32	1.828	0.859	33	37	26	6.84	0.735	46.9	33	37	40 18	9.74	0.762	29.9	34	41	40 15
1.364	35	35	36	1.829	0.858	33	37	32	8.85	0.732	24.7	35	35	36 15	9.71	0.760	29.8	34	39	42 15
1.364	35	37	34	1.702	0.858	35	39	28	6.87	0.730	45.9	33	37	36 18	7.45	0.759	50.6	33	41	36 18
1.362	35	35	32	1.703	0.858	35	39	32	8.83	0.730	24.6	35	39	32 15	7.19	0.758	53.4	33	13	38 18
1.359	35	31	36	1.832	0.857	33	39	30	8.79	0.730	25.2	35	37	34 15	9.66	0.758	30.1	34	45	22 15
1.359	35	33	34	1.704	0.857	35	37	20	8.68	0.729	26.6	35	37	38 15	7.29	0.756	51.9	33	37	40 18
1.353	35	29	38	1.711	0.853	35	35	22	8.73	0.729	25.9	35	39	36 15	7.40	0.755	50.6	33	35	42 18
1.347	35	33	38	1.841	0.853	33	37	18	6.92	0.729	45.1	33	41	36 18	7.28	0.754	51.9	33	41	32 18

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.64 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,660.6 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18730.0 (1885.30 )
Delta E: MWd/MTU, (GWd)           69.4 (   6.99 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -31.28
Flow: Mlb/hr                     79.04 (102.65 %)

       1  3  5  7  9 11 13 15 17 19 21 23 25
   1                 -- -- -- -- --              51
   3              -- -- -- -- -- -- -- --        47
   5           -- -- -- -- -- -- -- -- -- -- --  43
   7           -- -- -- -- -- -- -- -- -- -- --  39
   9 -- -- -- -- -- -- -- -- -- -- -- -- --     35
  11 -- -- -- -- -- -- -- -- -- -- -- -- --     31
  13 -- -- -- -- -- -- -- -- -- -- -- -- --     27
  15 -- -- -- -- -- -- -- -- -- -- -- -- --     23
  17 -- -- -- -- -- -- -- -- -- -- -- -- --     19
  19    -- -- -- -- -- -- -- -- -- -- --        15
  21    -- -- -- -- -- -- -- -- -- -- --        11
  23       -- -- -- -- -- -- -- -- --            7
  25             -- -- -- -- --                  3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                    1.00012
Void Fraction:                    0.353
Core Delta-P: psia               22.539
Core Plate Delta-P: psia         17.970
Coolant Temp: Deg-F              544.9
In Channel Flow: Mlb/hr          69.96
Total Bypass Flow (%):           11.5
Total Water Rod Flow (%):         2.8
Source Convergence              0.00041
```

```
                                   Core Average Exposure: MWd/MTU    33228.1

                                   Axial Profile    Edit   Radial Power
                              N(PRA) Power Exposure Zone  Avg.  Max.  IR JR
                            Top 25  0.241   6.221   30  0.396 0.485   5 40
                                24  0.719  18.465   31  0.362 0.493  47 40
                                23  0.946  24.565   32  0.745 1.014  41 42
                                22  1.095  28.150   33  1.072 1.143  37 32
                                21  1.188  30.817   34  1.181 1.312  41 38
                          :JR   20  1.242  32.710   35  1.316 1.375  37 30
                                19  1.271  34.276
                                18  1.288  35.345
                                17  1.277  35.596
                                16  1.320* 36.105
                                15  1.317  37.180
                                14  1.282  37.708
                                13  1.318  37.159
                                12  1.299  37.900
                                11  1.262  38.308
                                10  1.220  38.711
                                 9  1.173  39.643
                                 8  1.092  40.080
                                 7  0.987  40.019
                                 6  0.886  40.801
                                 5  0.764  41.098*
                                 4  0.652  39.811
                                 3  0.573  36.691
                                 2  0.462  28.118
                            Bottom  1  0.128   7.780

                        % AXIAL TILT  11.356  -9.073
                    AVG BOT 8ft/12ft  0.9531  1.0565

Active Channel Flow: Mlb/hr      67.76
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp. FT	IR	JR	K	Value	Margin	Exp. FT	IR	JR	K
1.375	35	37	30	1.698	0.860	35	37	30	6.86	0.739	47.3 33	39	38	18	9.89	0.782	30.9 34	41	38	15
1.369	35	39	28	1.706	0.856	35	35	36	6.87	0.739	47.0 33	37	40	18	9.83	0.777	30.9 34	37	42	15
1.367	35	39	32	1.712	0.853	35	39	32	6.93	0.739	46.3 33	39	34	18	9.78	0.766	30.0 34	41	40	15
1.363	35	37	34	1.712	0.853	35	39	28	6.90	0.734	46.0 33	37	36	18	7.49	0.765	50.7 33	41	36	18
1.363	35	35	36	1.714	0.852	35	37	20	8.87	0.734	24.8 35	35	36	15	9.75	0.764	30.0 34	39	42	15
1.361	35	35	32	1.843	0.852	33	37	26	6.96	0.734	45.2 33	41	36	18	7.23	0.763	53.5 33	13	38	18
1.358	35	31	36	1.844	0.851	33	37	32	6.81	0.733	47.1 33	41	32	18	9.70	0.762	30.2 34	45	22	15
1.357	35	33	34	1.847	0.850	33	39	30	8.85	0.732	24.7 35	39	32	15	7.33	0.761	52.1 33	37	40	18
1.352	35	29	38	1.722	0.848	35	35	22	8.81	0.732	25.3 35	37	34	15	7.44	0.760	50.7 33	35	42	18
1.347	35	33	38	1.723	0.847	34	37	12	8.70	0.732	26.7 35	37	38	15	7.32	0.759	52.0 33	41	32	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.65 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,730.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        18788.1 (1891.20 )
Delta E: MWd/MTU, (GWd)           58.1 (   5.85 )
Power: MWt                      2923.0 (100.00 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -30.68
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --        7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00016
Void Fraction:                     0.349
Core Delta-P: psia                23.107
Core Plate Delta-P: psia          18.538
Coolant Temp: Deg-F               544.9
In Channel Flow: Mlb/hr           71.26   Active Channel Flow: Mlb/hr      69.03
Total Bypass Flow (%):             11.4   (of total core flow)
Total Water Rod Flow (%):           2.8   (of total core flow)
Source Convergence              0.00049
```

```
Core Average Exposure: MWd/MTU    33286.3

                    Axial Profile     Edit   Radial Power
          N(PRA)  Power Exposure     Zone   Avg.   Max.   IR JR
Top 25    0.243   6.236              30   0.395  0.485    5 40
    24    0.727  18.510              31   0.362  0.493   47 40
    23    0.956  24.623              32   0.745  1.015   41 42
    22    1.106  28.218              33   1.072  1.142   37 32
    21    1.198  30.891              34   1.182  1.313   41 38
:JR 20    1.251  32.787              35   1.316  1.374   37 30
    19    1.278  34.355
    18    1.294  35.425
    17    1.282  35.675
    16    1.324* 36.182
    15    1.320  37.258
    14    1.284  37.783
    13    1.320  37.231
    12    1.300  37.972
    11    1.262  38.378
    10    1.218  38.778
     9    1.169  39.708
     8    1.085  40.141
     7    0.978  40.074
     6    0.875  40.849
     5    0.751  41.140*
     4    0.640  39.847
     3    0.561  36.723
     2    0.452  28.143
Bottom 1  0.126   7.787

% AXIAL TILT      12.023  -9.028
AVG BOT 8ft/12ft   0.9491  1.0562
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.374	35	37	30	1.706	0.856	35	37	30	6.89	0.744	47.4	33	39	38	18	9.93	0.786	31.0	34	41	38	15
1.369	35	39	28	1.713	0.852	35	35	36	6.91	0.744	47.1	33	37	40	18	9.87	0.781	31.0	34	37	42	15
1.367	35	39	32	1.719	0.849	35	39	32	6.96	0.743	46.4	33	39	34	18	9.82	0.771	30.1	34	41	40	15
1.363	35	37	34	1.719	0.849	35	39	28	7.00	0.739	45.3	33	41	36	18	7.53	0.770	50.8	33	41	36	18
1.363	35	35	36	1.722	0.848	35	37	20	6.93	0.738	46.1	33	37	36	18	9.79	0.768	30.1	34	39	42	15
1.360	35	35	32	1.856	0.846	33	37	26	6.84	0.737	47.2	33	41	32	18	7.27	0.768	53.6	33	13	38	18
1.357	35	31	36	1.857	0.845	33	37	32	8.89	0.737	24.9	35	35	36	15	9.74	0.766	30.3	34	45	22	15
1.356	35	33	34	1.727	0.845	34	37	12	6.85	0.735	46.8	33	35	38	18	7.37	0.766	52.1	33	37	40	18
1.351	35	29	38	1.728	0.845	34	11	38	8.87	0.735	24.8	35	39	32	15	7.48	0.765	50.8	33	35	42	18
1.346	35	33	38	1.860	0.844	33	39	30	8.72	0.735	26.8	35	37	38	15	7.36	0.764	52.1	33	41	32	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.66 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 18,788.1 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        19165.6 (1929.20 )
Delta E: MWd/MTU, (GWd)          377.5 (  38.00 )
Power: MWt                      2722.7 ( 93.15 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -28.43
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19     -- -- -- -- -- -- -- -- -- -- --     15
 21     -- -- -- -- -- -- -- -- -- -- --     11
 23        -- -- -- -- -- -- -- -- --         7
 25              -- -- -- -- -- --            3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00015
Void Fraction:                     0.330
Core Delta-P: psia                22.641
Core Plate Delta-P: psia          18.082
Coolant Temp: Deg-F               545.1
In Channel Flow: Mlb/hr           71.47   Active Channel Flow: Mlb/hr       69.31
Total Bypass Flow (%):             11.2   (of total core flow)
Total Water Rod Flow (%):           2.7   (of total core flow)
Source Convergence              0.00045
```

```
Core Average Exposure: MWd/MTU    33663.8

                    Axial Profile    Edit   Radial Power
          N(PRA)  Power Exposure  Zone  Avg.   Max.   IR JR
Top       25     0.257   6.341    30  0.396  0.486    5 40
          24     0.772  18.809    31  0.362  0.495   47 40
          23     1.014  25.017    32  0.747  1.022   41 42
          22     1.168  28.676    33  1.069  1.138   39 30
          21     1.256  31.385    34  1.189  1.321   41 38
          20     1.301  33.301    35  1.312  1.370   37 30
          19     1.318  34.878
          18     1.324  35.952
          17     1.303  36.196
          16     1.339* 36.689
          15     1.330  37.762
          14     1.289  38.273
          13     1.322  37.706
          12     1.297  38.438
          11     1.253  38.829
          10     1.202  39.212
           9     1.141  40.123
           8     1.046  40.523
           7     0.928  40.416
           6     0.817  41.153
           5     0.693  41.399*
           4     0.586  40.067
           3     0.513  36.915
           2     0.414  28.299
Bottom     1     0.115   7.833

          % AXIAL TILT  15.482  -8.717
AVG BOT 8ft/12ft        0.9267   1.0546
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp.	FT	IR JR	K	Value	Margin	Exp.	FT	IR JR	K
1.370	35	37	30	1.822	0.805	35	37 30	6.59	0.716	47.9	33	39 38	18	9.39	0.749	31.8	34	41 38	15
1.367	35	39	28	1.972	0.803	33	37 36	6.60	0.715	47.7	33	37 40	18	9.33	0.744	31.8	34	37 42	15
1.365	35	39	32	1.828	0.803	34	37 12	6.63	0.713	46.9	33	39 34	18	7.20	0.741	51.4	33	41 36	18
1.360	35	37	34	1.828	0.803	35	35 36	6.70	0.711	45.9	33	41 36	18	6.94	0.739	54.2	33	13 38	18
1.359	35	35	36	1.975	0.802	33	37 32	6.53	0.708	47.8	33	41 32	18	7.04	0.737	52.7	33	37 40	18
1.353	35	35	32	1.829	0.802	34	11 38	6.60	0.707	46.7	33	37 36	18	7.15	0.736	51.4	33	35 42	18
1.349	35	31	36	1.976	0.802	33	37 26	6.63	0.705	45.9	33	35 42	18	7.03	0.735	52.7	33	41 32	18
1.349	35	33	34	1.830	0.802	35	39 32	6.52	0.704	47.4	33	35 38	18	9.30	0.735	30.9	34	41 40	15
1.346	35	39	36	1.978	0.801	33	39 30	6.56	0.704	46.9	33	43 34	18	9.27	0.733	30.9	34	39 42	15
1.345	35	29	38	1.832	0.800	34	45 30	6.52	0.702	47.2	33	43 30	18	7.14	0.732	51.1	33	39 34	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.67 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 19,165.6 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        19600.0 (1972.90 )
Delta E: MWd/MTU, (GWd)          434.4 (  43.72 )
Power: MWt                      2492.5 ( 85.27 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -25.83
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
  1              -- -- -- -- --              51     :JR
  3        -- -- -- -- -- -- -- -- --        47
  5     -- -- -- -- -- -- -- -- -- -- --     43
  7     -- -- -- -- -- -- -- -- -- -- --     39
  9 -- -- -- -- -- -- -- -- -- -- -- -- --  35
 11 -- -- -- -- -- -- -- -- -- -- -- -- --  31
 13 -- -- -- -- -- -- -- -- -- -- -- -- --  27
 15 -- -- -- -- -- -- -- -- -- -- -- -- --  23
 17 -- -- -- -- -- -- -- -- -- -- -- -- --  19
 19    -- -- -- -- -- -- -- -- -- -- --     15
 21    -- -- -- -- -- -- -- -- -- -- --     11
 23       -- -- -- -- -- -- -- --           7
 25              -- -- -- -- --              3
 IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00018
Void Fraction:                     0.308
Core Delta-P: psia                22.132
Core Plate Delta-P: psia          17.584
Coolant Temp: Deg-F               545.3
In Channel Flow: Mlb/hr           71.70   Active Channel Flow: Mlb/hr      69.61
Total Bypass Flow (%):            10.9    (of total core flow)
Total Water Rod Flow (%):          2.6    (of total core flow)
Source Convergence              0.00044
```

```
Core Average Exposure: MWd/MTU    34098.2

                    Axial Profile    Edit   Radial Power
          N(PRA) Power Exposure  Zone  Avg.  Max.  IR JR
      Top 25  0.274   6.469    30  0.396 0.487   5 40
          24  0.827  19.177    31  0.363 0.497  47 40
          23  1.085  25.499    32  0.750 1.030  41 42
          22  1.243  29.235    33  1.066 1.135  39 30
          21  1.324  31.982    34  1.199 1.331  41 38
          20  1.358  33.917    35  1.308 1.363  39 28
          19  1.361* 35.498
          18  1.357  36.573
          17  1.325  36.804
          16  1.354  37.279
          15  1.339  38.347
          14  1.291  38.838
          13  1.321  38.251
          12  1.292  38.972
          11  1.241  39.344
          10  1.178  39.704
           9  1.104  40.586
           8  0.996  40.945
           7  0.869  40.787
           6  0.754  41.477
           5  0.632  41.672*
           4  0.531  40.297
           3  0.464  37.117
           2  0.374  28.461
      Bottom  1  0.104   7.882

          % AXIAL TILT  19.427  -8.321
      AVG BOT 8ft/12ft  0.9006  1.0524
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR				APLHGR					LHGR				
Value	FT	IR	JR	Value	Margin	FT	IR JR	Value	Margin	Exp. FT	IR JR	K	Value	Margin	Exp. FT	IR JR	K
1.363	35	39	28	1.958	0.761	34	43 38	6.20	0.678	48.6 33	39 38	18	9.02	0.706	29.8 34	41 38	18
1.363	35	39	32	1.965	0.758	34	45 22	6.21	0.678	48.4 33	37 40	18	6.78	0.704	52.1 33	41 36	18
1.363	35	37	30	2.104	0.758	33	41 36	6.31	0.675	46.6 33	41 36	18	8.95	0.702	30.1 34	37 42	18
1.355	35	37	34	1.966	0.758	34	37 12	6.22	0.673	47.6 33	39 34	18	6.61	0.701	53.8 33	39 38	18
1.353	35	35	36	1.966	0.758	34	45 30	6.14	0.670	48.5 33	41 32	18	6.62	0.699	53.5 33	37 40	18
1.347	35	39	36	1.969	0.757	34	11 38	6.19	0.670	47.5 33	43 34	18	6.72	0.698	52.1 33	35 42	18
1.344	35	35	32	1.975	0.754	34	11 14	6.24	0.668	46.6 33	35 42	18	6.62	0.698	53.4 33	41 32	18
1.340	35	31	36	2.114	0.754	33	37 36	6.18	0.667	47.4 33	37 36	18	6.70	0.694	51.8 33	39 34	18
1.339	35	33	34	1.977	0.754	34	37 44	6.13	0.666	47.9 33	43 30	18	6.64	0.692	52.5 33	43 34	18
1.337	35	33	38	1.979	0.753	35	37 30	6.10	0.664	48.0 33	35 38	18	8.95	0.692	28.6 34	45 22	18

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.68 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 19,600.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        20000.0 (2013.20 )
Delta E: MWd/MTU, (GWd)          400.0 (  40.26 )
Power: MWt                      2266.5 ( 77.54 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm        -23.29
Flow: Mlb/hr                     80.46 (104.50 %)
```

```
      1  3  5  7  9 11 13 15 17 19 21 23 25
    1              -- -- -- -- --              51
    3        -- -- -- -- -- -- -- -- --        47
    5     -- -- -- -- -- -- -- -- -- -- --     43
    7     -- -- -- -- -- -- -- -- -- -- --     39
    9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
   11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
   13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
   15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
   17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
   19     -- -- -- -- -- -- -- -- -- -- --     15
   21     -- -- -- -- -- -- -- -- -- -- --     11
   23        -- -- -- -- -- -- -- -- --         7
   25              -- -- -- -- -- --            3
   IR: 2  6 10 14 18 22 26 30 34 38 42 46 50
```

```
Control Rod Density: %          0.00

k-effective:                 1.00022
Void Fraction:                 0.287
Core Delta-P: psia            21.666
Core Plate Delta-P: psia      17.129
Coolant Temp: Deg-F           545.6
In Channel Flow: Mlb/hr       71.92
Total Bypass Flow (%):         10.6
Total Water Rod Flow (%):       2.5
Source Convergence          0.00046
```

```
Core Average Exposure: MWd/MTU    34498.2
```

	N(PRA)	Axial Profile Power	Axial Profile Exposure	Edit Zone	Radial Power Avg.	Radial Power Max.	IR	JR
Top	25	0.291	6.594	30	0.397	0.489	5	40
	24	0.883	19.539	31	0.363	0.500	47	40
	23	1.157	25.974	32	0.752	1.038	41	42
	22	1.317	29.781	33	1.063	1.131	39	30
	21	1.388	32.561	34	1.208	1.341	41	38
:JR	20	1.409*	34.507	35	1.304	1.360	39	32
	19	1.399	36.087					
	18	1.383	37.157					
	17	1.341	37.373					
	16	1.363	37.827					
	15	1.342	38.888					
	14	1.287	39.359					
	13	1.313	38.752					
	12	1.279	39.461					
	11	1.218	39.812					
	10	1.145	40.146					
	9	1.061	40.998					
	8	0.946	41.314					
	7	0.817	41.107					
	6	0.703	41.754					
	5	0.587	41.904*					
	4	0.494	40.492					
	3	0.432	37.287					
	2	0.349	28.599					
Bottom	1	0.098	7.923					
	% AXIAL TILT		22.931		-7.921			
	AVG BOT 8ft/12ft		0.8761		1.0502			

```
Active Channel Flow: Mlb/hr       69.90
(of total core flow)
(of total core flow)
```

Top Ten Thermal Limits Summary - Sorted by Margin

Power Value	FT	IR	JR	MCPR Value	Margin	FT	IR	JR	APLHGR Value	Margin	Exp.	FT	IR	JR	K	LHGR Value	Margin	Exp.	FT	IR	JR	K
1.360	35	39	32	2.110	0.722	34	43	38	5.82	0.636	48.5	33	39	38	19	8.44	0.666	30.7	34	41	38	18
1.359	35	39	28	2.123	0.717	34	45	22	5.88	0.636	47.5	33	37	40	19	8.37	0.662	31.0	34	37	42	18
1.356	35	37	30	2.129	0.715	34	45	30	5.99	0.634	45.6	33	41	36	19	6.32	0.661	52.7	33	41	36	18
1.350	35	37	34	2.132	0.714	34	37	12	5.88	0.631	46.8	33	43	34	19	6.19	0.659	54.2	33	13	38	19
1.349	35	39	36	2.132	0.714	34	11	38	5.80	0.628	47.7	33	41	32	19	6.33	0.656	52.0	33	37	40	19
1.348	35	35	36	2.132	0.714	34	37	44	5.85	0.628	46.9	33	43	30	19	6.40	0.656	50.9	33	35	42	19
1.341	34	41	38	2.135	0.713	34	41	40	5.76	0.628	48.3	33	39	34	18	8.40	0.655	29.5	34	45	22	18
1.339	35	41	34	2.139	0.712	35	43	22	5.93	0.628	45.6	33	35	42	19	6.27	0.655	52.6	33	41	32	19
1.335	35	37	38	2.139	0.712	34	45	20	7.42	0.622	26.3	34	41	38	18	6.34	0.654	51.5	33	43	34	19
1.335	35	41	30	2.141	0.711	34	45	36	5.72	0.622	48.0	33	37	36	18	6.29	0.652	51.9	33	43	30	19

```
* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:
```

Figure A.69 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 20,000.0 MWd/MTU

```
Cycle:                              19
Exposure: MWd/MTU (GWd)        20414.3 (2054.90 )
Delta E: MWd/MTU, (GWd)          414.3 (  41.70 )
Power: MWt                      2046.4 ( 70.01 %)
Core Pressure: psia             1044.3
Inlet Subcooling: Btu/lbm       -20.81
Flow: Mlb/hr                     80.46 (104.50 %)

      1  3  5  7  9 11 13 15 17 19 21 23 25
   1              -- -- -- -- --              51
   3        -- -- -- -- -- -- -- -- --        47
   5     -- -- -- -- -- -- -- -- -- -- --     43
   7     -- -- -- -- -- -- -- -- -- -- --     39
   9  -- -- -- -- -- -- -- -- -- -- -- -- --  35
  11  -- -- -- -- -- -- -- -- -- -- -- -- --  31
  13  -- -- -- -- -- -- -- -- -- -- -- -- --  27
  15  -- -- -- -- -- -- -- -- -- -- -- -- --  23
  17  -- -- -- -- -- -- -- -- -- -- -- -- --  19
  19     -- -- -- -- -- -- -- -- -- -- --     15
  21     -- -- -- -- -- -- -- -- -- -- --     11
  23        -- -- -- -- -- -- -- -- --         7
  25              -- -- -- -- --               3
  IR: 2  6 10 14 18 22 26 30 34 38 42 46 50

Control Rod Density: %              0.00

k-effective:                     1.00025
Void Fraction:                     0.265
Core Delta-P: psia                21.225
Core Plate Delta-P: psia          16.699
Coolant Temp: Deg-F               545.9
In Channel Flow: Mlb/hr           72.13   Active Channel Flow: Mlb/hr      70.18
Total Bypass Flow (%):            10.4    (of total core flow)
Total Water Rod Flow (%):          2.4    (of total core flow)
Source Convergence              0.00049
```

Core Average Exposure: MWd/MTU 34912.4

	Axial Profile N(PRA)	Power	Exposure	Edit Zone	Radial Power Avg.	Max.	IR	JR
Top	25	0.310	6.731	30	0.397	0.491	5	40
	24	0.947	19.940	31	0.364	0.502	47	40
	23	1.238	26.499	32	0.756	1.047	41	42
	22	1.399	30.380	33	1.059	1.127	39	30
	21	1.460	33.190	34	1.218	1.351	41	38
:JR	20	1.466*	35.142	35	1.299	1.357	39	32
	19	1.441	36.715					
	18	1.412	37.774					
	17	1.359	37.970					
	16	1.372	38.399					
	15	1.344	39.449					
	14	1.283	39.896					
	13	1.305	39.268					
	12	1.263	39.962					
	11	1.192	40.287					
	10	1.107	40.589					
	9	1.013	41.407					
	8	0.891	41.676					
	7	0.759	41.418					
	6	0.647	42.020					
	5	0.537	42.125*					
	4	0.451	40.678					
	3	0.394	37.450					
	2	0.319	28.730					
Bottom	1	0.089	7.962					
	% AXIAL TILT		26.881	-7.472				
	AVG BOT 8ft/12ft		0.8486	1.0477				

Top Ten Thermal Limits Summary - Sorted by Margin

Power				MCPR					APLHGR						LHGR					
Value	FT	IR	JR	Value	Margin	FT	IR	JR	Value	Margin	Exp.	FT	IR	JR	K	Value	Margin	Exp.	FT	IR	JR	K
1.357	35	39	32	2.286	0.680	34	43	38	5.43	0.598	49.2	33	39	38	19	8.10	0.632	29.5	34	11	38	20
1.355	35	39	28	2.289	0.679	34	45	30	5.48	0.597	48.2	33	37	40	19	8.05	0.628	29.5	34	37	12	20
1.351	34	41	38	2.291	0.679	34	11	38	5.59	0.597	46.3	33	41	36	19	8.16	0.624	27.4	34	45	22	20
1.349	35	39	36	2.292	0.679	34	11	14	5.51	0.596	47.5	33	43	34	19	8.09	0.624	28.3	34	45	30	20
1.348	35	37	30	2.292	0.678	34	37	12	5.46	0.591	47.6	33	43	30	19	6.03	0.623	51.7	33	41	36	19
1.345	35	37	34	2.292	0.678	34	45	22	5.53	0.590	46.3	33	35	42	19	5.78	0.621	54.9	33	13	38	19
1.342	35	39	40	2.293	0.678	35	43	22	5.40	0.589	48.3	33	41	32	19	8.12	0.619	27.1	34	45	20	20
1.342	35	41	34	2.300	0.676	34	13	12	7.11	0.588	24.6	34	41	38	20	5.91	0.619	52.7	33	37	40	19
1.342	35	35	36	2.305	0.675	35	43	36	7.07	0.585	24.9	34	37	42	20	5.99	0.619	51.7	33	35	42	19
1.342	34	37	42	2.305	0.675	34	37	44	5.37	0.585	48.2	33	33	44	19	5.94	0.618	52.3	33	43	34	19

* LHGR calculated with pin-power reconstruction
* CPR calculated with pin-power reconstruction & CPR limit type 3
* Thermal limit file:

Figure A.70 Brunswick Unit 1 Cycle 19 Control Rod Pattern and Axial Distributions at 20,414.3 MWd/MTU

Appendix B Elevation Views of the Brunswick Unit 1 Cycle 19 Fresh Reload Batch Fuel Assemblies

[

]

Figure B.1 Elevation View for the Brunswick Unit 1 Cycle 19 Fresh Fuel Reload Batch BRK1-19 ATRIUM 10XM [ ] Fuel Assembly Design (Fabrication Batch BRK1-19)

[

]

Figure B.2 Elevation View for the Brunswick Unit 1 Cycle 19 Fresh Fuel Reload Batch BRK1-19 ATRIUM 10XM [ ] Fuel Assembly Design (Fabrication Batch BRK1-19)

Appendix C Brunswick Unit 1 Cycle 19 Fresh Fuel Locations

Table C.1 Brunswick Unit 1 Cycle 19 Reload Fuel Identification and Locations (Core Coordinates)

Assembly Type: ATRIUM 10XM BRK1-19
Bundle Description: [ ]
Number Loaded: 96

Fuel ID	Core Coord.	Fuel ID	Core Coord.	Fuel ID	Core Coord.	Fuel ID	Core Coord.
A19601	5-28	A19625	7-32	A19649	7-36	A19673	11-38
A19602	25-48	A19626	21-46	A19650	17-46	A19674	15-42
A19603	27-48	A19627	31-46	A19651	35-46	A19675	37-42
A19604	47-28	A19628	45-32	A19652	45-36	A19676	41-38
A19605	47-26	A19629	45-22	A19653	45-18	A19677	41-16
A19606	27- 6	A19630	31- 8	A19654	35- 8	A19678	37-12
A19607	25- 6	A19631	21- 8	A19655	17- 8	A19679	15-12
A19608	5-26	A19632	7-22	A19656	7-18	A19680	11-16
A19609	5-30	A19633	5-34	A19657	7-38	A19681	11-40
A19610	23-48	A19634	19-48	A19658	15-46	A19682	13-42
A19611	29-48	A19635	33-48	A19659	37-46	A19683	39-42
A19612	47-30	A19636	47-34	A19660	45-38	A19684	41-40
A19613	47-24	A19637	47-20	A19661	45-16	A19685	41-14
A19614	29- 6	A19638	33- 6	A19662	37- 8	A19686	39-12
A19615	23- 6	A19639	19- 6	A19663	15- 8	A19687	13-12
A19616	5-24	A19640	5-20	A19664	7-16	A19688	11-14
A19617	7-30	A19641	7-34	A19665	9-38	A19689	9-42
A19618	23-46	A19642	19-46	A19666	15-44	A19690	11-44
A19619	29-46	A19643	33-46	A19667	37-44	A19691	41-44
A19620	45-30	A19644	45-34	A19668	43-38	A19692	43-42
A19621	45-24	A19645	45-20	A19669	43-16	A19693	43-12
A19622	29- 8	A19646	33- 8	A19670	37-10	A19694	41-10
A19623	23- 8	A19647	19- 8	A19671	15-10	A19695	11-10
A19624	7-24	A19648	7-20	A19672	9-16	A19696	9-12

Table C.1 Brunswick Unit 1 Cycle 19 Reload Fuel Identification and Locations (Core Coordinates) *(Continued)*

Assembly Type: ATRIUM 10XM BRK1-19
Bundle Description: [ ]
Number Loaded: 138

Fuel ID	Core Coord.	Fuel ID	Core Coord.	Fuel ID	Core Coord.	Fuel ID	Core Coord.
A19697	25-26	A19732	39-28	A19767	13-32	A19801	41-20
A19698	27-28	A19733	39-26	A19768	39-32	A19802	11-20
A19699	21-28	A19734	13-26	A19769	39-22	A19803	13-36
A19700	31-28	A19735	15-30	A19770	13-22	A19804	39-36
A19701	31-26	A19736	37-30	A19771	15-34	A19805	39-18
A19702	21-26	A19737	37-24	A19772	37-34	A19806	13-18
A19703	23-30	A19738	15-24	A19773	37-20	A19807	15-38
A19704	29-30	A19739	17-32	A19774	15-20	A19808	37-38
A19705	29-24	A19740	35-32	A19775	17-36	A19809	37-16
A19706	23-24	A19741	35-22	A19776	35-36	A19810	15-16
A19707	25-32	A19742	17-22	A19777	35-18	A19811	17-40
A19708	27-32	A19743	19-34	A19778	17-18	A19812	35-40
A19709	27-22	A19744	33-34	A19779	19-38	A19813	35-14
A19710	25-22	A19745	33-20	A19780	33-38	A19814	17-14
A19711	17-28	A19746	19-20	A19781	33-16	A19815	19-42
A19712	35-28	A19747	21-36	A19782	19-16	A19816	33-42
A19713	35-26	A19748	31-36	A19783	21-40	A19817	33-12
A19714	17-26	A19749	31-18	A19784	31-40	A19818	19-12
A19715	19-30	A19750	21-18	A19785	31-14	A19819	21-44
A19716	33-30	A19751	23-38	A19786	21-14	A19820	31-44
A19717	33-24	A19752	29-38	A19787	23-42	A19821	31-10
A19718	19-24	A19753	29-16	A19788	29-42	A19822	21-10
A19719	21-32	A19754	23-16	A19789	29-12	A19823	9-36
A19720	31-32	A19755	25-40	A19790	23-12	A19824	43-36
A19721	31-22	A19756	27-40	A19791	25-44	A19825	43-18
A19722	21-22	A19757	27-14	A19792	27-44	A19826	9-18
A19723	23-34	A19758	25-14	A19793	27-10	A19827	13-40
A19724	29-34	A19759	9-28	A19794	25-10	A19828	39-40
A19725	29-20	A19760	43-28	A19795	9-32	A19829	39-14
A19726	23-20	A19761	43-26	A19796	43-32	A19830	13-14
A19727	25-36	A19762	9-26	A19797	43-22	A19831	17-44
A19728	27-36	A19763	11-30	A19798	9-22	A19832	35-44
A19729	27-18	A19764	41-30	A19799	11-34	A19833	35-10
A19730	25-18	A19765	41-24	A19800	41-34	A19834	17-10
A19731	13-28	A19766	11-24				

Appendix D Brunswick Unit 1 Cycle 19 Radial Exposure and Power Distributions

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									33.631	33.304	31.085	32.345	33.044
50								33.876	22.363	20.601	19.947	19.493	19.748
48					36.773	33.866	32.310	22.989	21.050	0.000	23.680	0.000	0.000
46				36.260	32.887	21.309	21.245	0.000	0.000	0.000	0.000	0.000	21.775
44			38.837	30.880	17.895	0.000	23.776	0.000	0.000	22.996	0.000	23.193	0.000
42			34.212	21.011	0.000	18.146	0.000	0.000	22.650	0.000	23.291	0.000	23.394
40			32.477	20.666	23.262	0.000	0.000	22.398	0.000	22.237	0.000	23.408	0.000
38		34.893	22.887	0.000	0.000	0.000	22.331	0.000	22.482	0.000	23.109	0.000	22.856
36	33.781	22.096	20.658	0.000	0.000	22.095	0.000	22.020	0.000	22.937	0.000	23.119	0.000
34	30.221	19.669	0.000	0.000	22.151	0.000	22.993	0.000	23.133	0.000	22.622	0.000	22.570
32	32.605	20.305	23.517	0.000	0.000	22.462	0.000	22.029	0.000	23.234	0.000	22.606	0.000
30	31.727	19.414	0.000	0.000	22.459	0.000	21.716	0.000	22.624	0.000	22.570	0.000	23.569
28	32.758	19.540	0.000	21.438	0.000	22.610	0.000	22.164	0.000	23.065	0.000	23.733	23.450
26	32.099	19.712	0.000	21.511	0.000	22.556	0.000	22.034	0.000	22.835	0.000	23.181	0.000
24	31.554	19.409	0.000	0.000	22.472	0.000	21.695	0.000	22.580	0.000	22.515	0.000	23.532
22	32.465	20.405	23.523	0.000	0.000	22.428	0.000	21.952	0.000	23.244	0.000	22.348	0.000
20	32.716	19.845	0.000	0.000	22.065	0.000	23.448	0.000	22.370	0.000	22.574	0.000	22.561
18	33.427	22.152	20.709	0.000	0.000	22.148	0.000	22.042	0.000	23.127	0.000	22.993	0.000
16		34.638	22.862	0.000	0.000	0.000	22.392	0.000	22.426	0.000	23.271	0.000	22.884
14			32.314	20.677	23.463	0.000	0.000	22.223	0.000	22.686	0.000	23.778	0.000
12			33.008	21.169	0.000	17.898	0.000	0.000	22.948	0.000	23.242	0.000	23.420
10			39.813	32.370	17.979	0.000	23.739	0.000	0.000	23.060	0.000	23.143	0.000
8				39.076	30.873	21.195	21.376	0.000	0.000	0.000	0.000	0.000	21.701
6					38.879	33.762	34.476	22.920	21.157	0.000	23.687	0.000	0.000
4								36.828	22.275	20.610	19.772	19.397	19.662
2									33.566	32.655	32.712	32.104	30.785

Figure D.1 Brunswick Unit 1 Cycle 19 BOC Exposure Distribution (0.0 GWd/MTU)

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	31.902	31.400	32.501	32.297	32.962								
50	20.026	19.769	20.177	20.834	22.652	34.709							
48	0.000	0.000	24.044	0.000	21.242	23.341	32.424	31.678	38.995				
46	22.010	0.000	0.000	0.000	0.000	0.000	21.323	21.583	31.740	38.628			
44	0.000	22.959	0.000	23.265	0.000	0.000	23.771	0.000	18.216	31.056	39.224		
42	23.559	0.000	23.399	0.000	22.765	0.000	0.000	18.308	0.000	21.458	34.644		
40	0.000	23.472	0.000	23.143	0.000	22.664	0.000	0.000	24.000	21.149	32.646		
38	23.025	0.000	23.630	0.000	22.711	0.000	22.564	0.000	0.000	0.000	23.272	35.322	
36	0.000	23.184	0.000	22.863	0.000	22.462	0.000	22.613	0.000	0.000	21.172	22.503	33.165
34	22.720	0.000	22.852	0.000	23.788	0.000	23.655	0.000	22.555	0.000	0.000	20.809	32.516
32	0.000	22.854	0.000	23.414	0.000	22.419	0.000	22.894	0.000	0.000	23.931	20.070	31.618
30	23.704	0.000	23.232	0.000	22.979	0.000	22.178	0.000	22.936	0.000	0.000	19.746	29.636
28	0.000	23.461	0.000	23.221	0.000	22.508	0.000	23.070	0.000	21.887	0.000	20.016	32.263
26	23.889	23.512	0.000	23.330	0.000	22.585	0.000	23.045	0.000	21.728	0.000	19.842	32.052
24	23.742	0.000	22.936	0.000	23.000	0.000	22.181	0.000	22.921	0.000	0.000	19.676	29.789
22	0.000	22.700	0.000	23.626	0.000	22.446	0.000	22.788	0.000	0.000	23.946	19.917	31.574
20	22.779	0.000	23.011	0.000	22.987	0.000	23.847	0.000	22.593	0.000	0.000	20.636	32.474
18	0.000	23.149	0.000	23.505	0.000	22.320	0.000	22.511	0.000	0.000	21.050	22.366	34.378
16	23.222	0.000	23.190	0.000	22.775	0.000	22.763	0.000	0.000	0.000	23.201	35.554	
14	0.000	23.545	0.000	23.240	0.000	22.604	0.000	0.000	24.012	21.103	33.132		
12	23.649	0.000	23.660	0.000	22.837	0.000	0.000	18.285	0.000	21.314	33.639		
10	0.000	23.323	0.000	23.424	0.000	0.000	23.286	0.000	18.093	31.487	38.761		
8	22.037	0.000	0.000	0.000	0.000	0.000	21.378	21.585	30.694	38.805			
6	0.000	0.000	24.120	0.000	21.233	23.312	32.241	33.372	39.185				
4	19.983	19.728	20.179	20.803	22.661	34.521							
2	32.531	31.726	30.683	32.612	32.323								

Figure D.1 Brunswick Unit 1 Cycle 19 BOC Exposure Distribution (0.0 GWd/MTU) *(Continued)*

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									40.569	41.201	39.810	41.337	42.147
50								42.627	35.057	35.079	35.404	35.376	35.836
48					42.844	41.939	43.003	37.762	38.293	19.905	42.231	20.974	21.071
46				43.030	43.051	35.602	37.904	19.962	21.637	22.600	23.020	23.264	42.740
44			44.811	41.133	33.696	19.353	42.976	22.735	23.171	44.321	23.721	44.547	23.352
42			42.095	35.408	19.424	38.820	23.495	24.302	44.402	24.090	44.829	23.831	44.542
40			43.165	37.506	42.624	23.544	24.204	44.606	24.165	43.952	23.178	44.193	23.183
38		43.926	37.822	20.127	22.856	24.344	44.568	24.540	44.233	23.673	43.900	22.894	43.866
36	40.798	34.985	38.138	21.843	23.334	43.974	23.816	43.572	23.157	43.752	22.849	43.855	23.354
34	38.456	34.402	20.129	22.849	43.816	24.212	44.321	23.345	43.935	22.962	43.594	23.249	44.122
32	41.184	35.842	42.266	23.308	24.128	44.417	23.186	43.018	23.196	44.370	24.185	44.644	24.500
30	40.799	35.415	21.206	23.574	44.288	24.190	42.845	22.924	43.758	23.647	44.681	24.575	45.612
28	41.879	35.808	21.327	42.727	23.670	44.068	22.918	43.077	23.495	44.641	24.518	45.717	44.915
26	41.375	35.971	21.328	42.775	23.672	44.023	22.928	42.971	23.523	44.480	24.560	45.280	23.836
24	40.671	35.429	21.207	23.576	44.314	24.204	42.850	22.974	43.814	23.772	44.728	24.697	45.600
22	41.028	35.924	42.278	23.314	24.140	44.408	23.217	43.005	23.333	44.528	24.286	44.540	24.564
20	40.761	34.541	20.126	22.858	43.771	24.225	44.719	23.407	43.349	23.051	43.628	23.315	44.154
18	40.443	35.024	38.184	21.855	23.349	44.046	23.846	43.638	23.215	43.986	22.890	43.805	23.389
16		43.708	37.807	20.146	22.875	24.368	44.607	24.567	44.205	23.684	44.031	22.888	43.904
14			43.047	37.532	42.802	23.563	24.224	44.514	24.155	44.265	23.159	44.491	23.188
12			41.134	35.549	19.431	38.604	23.506	24.299	44.687	24.095	44.798	23.844	44.573
10			45.716	42.554	33.754	19.355	42.937	22.727	23.171	44.405	23.745	44.553	23.379
8				45.713	41.090	35.491	37.985	19.934	21.631	22.612	23.048	23.301	42.714
6					44.819	41.782	44.900	37.637	38.378	19.912	42.261	21.014	21.119
4								45.478	34.958	35.087	35.255	35.328	35.822
2									40.494	40.605	41.355	41.111	40.056

Figure D.2 Brunswick Unit 1 Cycle 19 EOC Exposure Distribution (19.2 GWd/MTU)

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	41.034	40.437	41.065	40.243	39.940								
50	36.080	35.570	35.531	35.224	35.273	43.611							
48	21.051	20.914	42.476	19.811	38.389	38.000	43.053	39.859	44.911				
46	42.927	23.209	22.936	22.490	21.514	19.837	37.877	35.776	41.829	45.229			
44	23.330	44.347	23.630	44.444	23.017	22.569	42.830	19.187	33.820	41.159	45.095		
42	44.661	23.757	44.821	23.928	44.335	24.091	23.282	38.746	19.198	35.633	42.610		
40	23.149	44.151	23.009	44.509	23.935	44.673	23.953	23.278	43.020	37.701	43.255		
38	43.982	22.773	44.197	23.464	44.226	24.273	44.526	24.037	22.541	19.819	37.910	44.112	
36	23.322	43.835	22.704	43.529	22.914	43.706	23.499	44.119	22.987	21.506	38.312	35.112	40.054
34	44.225	23.161	43.676	22.771	44.254	23.053	44.601	23.845	43.864	22.499	19.809	35.192	40.425
32	24.477	44.792	24.038	44.420	23.003	43.101	22.844	44.462	23.757	22.954	42.359	35.429	40.172
30	45.683	24.523	45.081	23.492	43.887	22.621	42.949	23.813	44.360	23.215	20.900	35.519	38.863
28	23.781	45.390	24.345	44.574	23.212	43.098	22.564	44.128	23.291	42.790	21.021	36.039	41.356
26	45.262	45.447	24.327	44.650	23.195	43.151	22.559	44.102	23.292	42.654	21.025	35.885	41.165
24	45.741	24.473	44.845	23.405	43.833	22.595	42.938	23.811	44.352	23.221	20.907	35.463	39.007
22	24.494	44.679	24.018	44.537	22.922	43.109	22.837	44.370	23.762	22.960	42.380	35.288	40.127
20	44.293	23.172	43.812	22.756	43.590	23.050	44.732	23.852	43.901	22.508	19.817	35.030	40.388
18	23.347	43.850	22.707	44.081	22.915	43.586	23.510	44.040	23.000	21.516	38.212	34.983	41.234
16	44.144	22.813	43.851	23.464	44.271	24.270	44.652	24.052	22.557	19.832	37.850	44.320	
14	23.160	44.247	23.041	44.603	23.936	44.620	23.963	23.293	43.051	37.682	43.657		
12	44.743	23.756	45.044	23.927	44.406	24.108	23.303	38.753	19.222	35.540	41.675		
10	23.347	44.609	23.625	44.597	23.037	22.598	42.430	19.211	33.732	41.575	44.683		
8	42.974	23.225	22.950	22.512	21.546	19.872	37.950	35.793	40.868	45.423			
6	21.095	20.955	42.583	19.857	38.428	38.009	42.906	41.449	45.092				
4	36.090	35.592	35.608	35.265	35.346	43.486							
2	41.724	40.800	39.473	40.602	39.390								

Figure D.2 Brunswick Unit 1 Cycle 19 EOC Exposure Distribution (19.2 GWd/MTU) *(Continued)*

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									0.416	0.464	0.514	0.527	0.529
50								0.514	0.715	0.806	0.861	0.877	0.881
48					0.370	0.475	0.616	0.810	0.924	1.010	0.996	1.058	1.059
46				0.410	0.589	0.806	0.913	0.996	1.048	1.095	1.123	1.138	1.081
44			0.367	0.598	0.884	1.018	1.034	1.106	1.046	1.055	1.155	1.119	1.003
42			0.468	0.814	1.022	1.104	1.170	1.191	1.084	1.126	1.161	1.191	1.015
40			0.621	0.927	1.043	1.175	1.193	1.180	1.211	1.192	1.235	1.196	1.219
38		0.534	0.824	1.010	1.119	1.201	1.195	1.216	1.157	1.191	1.198	1.257	1.222
36	0.426	0.732	0.944	1.067	1.065	1.105	1.222	1.167	0.927	0.919	1.207	1.216	1.174
34	0.488	0.826	1.029	1.117	1.087	1.149	1.193	1.203	0.923	0.940	1.188	1.257	1.159
32	0.510	0.874	1.014	1.147	1.184	1.201	1.262	1.230	1.220	1.186	1.258	1.240	1.258
30	0.537	0.890	1.078	1.165	1.154	1.225	1.249	1.284	1.238	1.267	1.246	1.266	1.194
28	0.538	0.898	1.081	1.109	1.031	1.053	1.254	1.259	1.196	1.165	1.266	1.196	0.930
26	0.545	0.896	1.080	1.108	1.031	1.054	1.254	1.260	1.196	1.168	1.265	1.193	0.937
24	0.539	0.889	1.077	1.164	1.155	1.225	1.249	1.284	1.237	1.266	1.244	1.259	1.186
22	0.508	0.872	1.013	1.147	1.183	1.201	1.262	1.231	1.219	1.181	1.255	1.244	1.258
20	0.476	0.823	1.028	1.116	1.086	1.147	1.193	1.203	0.929	0.939	1.186	1.254	1.161
18	0.425	0.730	0.943	1.066	1.063	1.103	1.221	1.165	0.926	0.917	1.201	1.208	1.174
16		0.536	0.824	1.010	1.118	1.200	1.183	1.213	1.154	1.184	1.185	1.251	1.221
14			0.623	0.927	1.043	1.174	1.191	1.185	1.205	1.172	1.229	1.190	1.217
12			0.481	0.812	1.021	1.104	1.168	1.188	1.081	1.123	1.159	1.190	1.016
10			0.363	0.590	0.882	1.017	1.032	1.103	1.045	1.055	1.155	1.125	1.005
8				0.402	0.594	0.805	0.908	0.993	1.046	1.094	1.123	1.140	1.083
6					0.363	0.471	0.599	0.805	0.921	1.009	0.995	1.059	1.061
4								0.508	0.713	0.805	0.861	0.877	0.884
2									0.415	0.467	0.506	0.528	0.541

Figure D.3 Brunswick Unit 1 Cycle 19 Radial Power Distribution at 0.0 MWd/MTU

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	0.533	0.530	0.504	0.467	0.419								
50	0.880	0.873	0.856	0.803	0.712	0.523							
48	1.059	1.056	0.990	1.006	0.920	0.805	0.614	0.484	0.364				
46	1.079	1.137	1.120	1.090	1.043	0.991	0.909	0.804	0.590	0.401			
44	1.003	1.124	1.151	1.048	1.040	1.099	1.028	1.013	0.879	0.592	0.363		
42	1.013	1.187	1.154	1.117	1.074	1.182	1.162	1.095	1.015	0.805	0.472		
40	1.216	1.189	1.224	1.165	1.198	1.174	1.182	1.165	1.030	0.914	0.616		
38	1.218	1.247	1.174	1.176	1.142	1.202	1.180	1.187	1.105	0.997	0.809	0.520	
36	1.172	1.207	1.194	0.910	0.915	1.149	1.205	1.084	1.048	1.051	0.927	0.717	0.418
34	1.155	1.247	1.174	0.928	0.905	1.185	1.171	1.129	1.067	1.101	1.014	0.810	0.469
32	1.253	1.228	1.242	1.167	1.201	1.208	1.241	1.178	1.165	1.131	0.998	0.865	0.509
30	1.180	1.248	1.216	1.249	1.217	1.263	1.224	1.204	1.133	1.147	1.064	0.880	0.546
28	0.934	1.181	1.251	1.149	1.177	1.236	1.233	1.031	1.014	1.090	1.067	0.888	0.538
26	0.926	1.191	1.253	1.149	1.178	1.235	1.233	1.031	1.014	1.092	1.067	0.888	0.539
24	1.191	1.258	1.231	1.251	1.217	1.263	1.225	1.204	1.133	1.147	1.064	0.880	0.544
22	1.257	1.237	1.246	1.165	1.202	1.208	1.242	1.179	1.165	1.130	0.998	0.864	0.508
20	1.158	1.251	1.176	0.930	0.913	1.186	1.173	1.130	1.065	1.100	1.014	0.809	0.469
18	1.173	1.211	1.198	0.907	0.915	1.150	1.205	1.084	1.048	1.050	0.927	0.716	0.415
16	1.216	1.250	1.188	1.178	1.142	1.200	1.167	1.186	1.104	0.996	0.808	0.517	
14	1.216	1.190	1.226	1.164	1.197	1.172	1.179	1.162	1.029	0.914	0.609		
12	1.013	1.186	1.150	1.116	1.073	1.180	1.159	1.094	1.013	0.806	0.475		
10	1.003	1.114	1.149	1.046	1.040	1.098	1.026	1.012	0.878	0.589	0.364		
8	1.080	1.136	1.119	1.090	1.043	0.991	0.908	0.803	0.594	0.402			
6	1.060	1.057	0.990	1.008	0.922	0.806	0.615	0.476	0.363				
4	0.882	0.877	0.861	0.807	0.716	0.527							
2	0.535	0.533	0.518	0.470	0.425								

Figure D.3 Brunswick Unit 1 Cycle 19 Radial Power Distribution at 0.0 MWd/MTU *(Continued)*

	1	3	5	7	9	11	13	15	17	19	21	23	25
52									0.299	0.351	0.388	0.400	0.407
50								0.387	0.591	0.686	0.727	0.755	0.770
48					0.258	0.360	0.486	0.709	0.846	1.073	0.908	1.125	1.129
46				0.291	0.465	0.670	0.800	1.090	1.190	1.233	1.249	1.249	1.031
44			0.251	0.468	0.745	1.018	0.933	1.235	1.276	1.071	1.293	1.067	1.281
42			0.347	0.674	1.021	1.009	1.254	1.298	1.090	1.306	1.087	1.307	1.077
40			0.485	0.806	0.946	1.256	1.299	1.099	1.322	1.108	1.338	1.104	1.332
38		0.399	0.713	1.094	1.239	1.302	1.098	1.322	1.114	1.339	1.117	1.348	1.107
36	0.301	0.598	0.852	1.194	1.281	1.099	1.333	1.125	1.353	1.122	1.350	1.110	1.328
34	0.363	0.692	1.076	1.236	1.083	1.315	1.114	1.350	1.121	1.347	1.108	1.319	1.079
32	0.376	0.726	0.909	1.252	1.298	1.097	1.351	1.134	1.348	1.099	1.293	1.052	1.252
30	0.400	0.754	1.125	1.251	1.077	1.317	1.132	1.359	1.112	1.312	1.050	1.227	0.990
28	0.402	0.771	1.129	1.037	1.288	1.096	1.352	1.128	1.330	1.071	1.248	0.986	0.970
26	0.410	0.770	1.129	1.037	1.288	1.096	1.351	1.128	1.329	1.073	1.249	0.997	1.185
24	0.402	0.754	1.124	1.250	1.077	1.315	1.130	1.357	1.109	1.309	1.052	1.235	0.995
22	0.375	0.724	0.908	1.250	1.296	1.095	1.348	1.132	1.344	1.099	1.292	1.056	1.251
20	0.355	0.690	1.073	1.233	1.080	1.311	1.104	1.345	1.123	1.342	1.105	1.315	1.077
18	0.300	0.596	0.850	1.191	1.277	1.096	1.328	1.120	1.347	1.115	1.343	1.109	1.322
16		0.399	0.712	1.090	1.235	1.298	1.097	1.316	1.109	1.331	1.109	1.340	1.102
14			0.484	0.802	0.935	1.251	1.293	1.093	1.314	1.099	1.329	1.095	1.323
12			0.358	0.671	1.016	1.008	1.248	1.291	1.080	1.298	1.080	1.298	1.071
10			0.246	0.463	0.741	1.013	0.929	1.228	1.269	1.064	1.285	1.060	1.274
8				0.284	0.464	0.667	0.793	1.083	1.183	1.226	1.242	1.241	1.026
6					0.249	0.355	0.470	0.704	0.840	1.067	0.902	1.119	1.124
4								0.379	0.588	0.682	0.724	0.751	0.767
2									0.295	0.350	0.381	0.397	0.411

Figure D.4 Brunswick Unit 1 Cycle 19 Radial Power Distribution at 18,788.1 MWd/MTU (EOFP)

	27	29	31	33	35	37	39	41	43	45	47	49	51
52	0.408	0.403	0.383	0.355	0.303								
50	0.769	0.753	0.725	0.686	0.593	0.400							
48	1.129	1.125	0.906	1.076	0.848	0.711	0.489	0.369	0.253				
46	1.030	1.250	1.252	1.237	1.195	1.095	0.805	0.674	0.468	0.290			
44	1.282	1.069	1.297	1.073	1.283	1.242	0.939	1.024	0.748	0.469	0.252		
42	1.077	1.309	1.089	1.312	1.095	1.307	1.262	1.015	1.026	0.675	0.361		
40	1.333	1.106	1.343	1.105	1.330	1.104	1.309	1.265	0.941	0.807	0.493		
38	1.107	1.351	1.122	1.346	1.120	1.334	1.107	1.313	1.249	1.101	0.716	0.400	
36	1.329	1.113	1.357	1.131	1.363	1.132	1.346	1.105	1.293	1.204	0.855	0.599	0.304
34	1.080	1.324	1.112	1.356	1.124	1.363	1.122	1.329	1.092	1.249	1.085	0.693	0.359
32	1.256	1.057	1.303	1.105	1.360	1.142	1.367	1.107	1.314	1.267	0.917	0.734	0.386
30	0.997	1.242	1.055	1.322	1.120	1.374	1.141	1.334	1.088	1.267	1.139	0.763	0.418
28	1.187	0.999	1.258	1.080	1.343	1.138	1.369	1.106	1.306	1.048	1.143	0.779	0.413
26	0.968	0.992	1.255	1.079	1.343	1.137	1.369	1.107	1.306	1.049	1.143	0.780	0.414
24	0.988	1.230	1.052	1.321	1.120	1.374	1.141	1.334	1.087	1.267	1.139	0.763	0.418
22	1.250	1.053	1.298	1.106	1.359	1.141	1.366	1.106	1.313	1.266	0.917	0.735	0.386
20	1.076	1.318	1.107	1.353	1.130	1.361	1.115	1.328	1.090	1.248	1.085	0.694	0.359
18	1.323	1.107	1.351	1.120	1.360	1.130	1.344	1.105	1.292	1.203	0.856	0.599	0.302
16	1.101	1.344	1.115	1.341	1.116	1.330	1.105	1.312	1.248	1.100	0.715	0.398	
14	1.325	1.100	1.336	1.099	1.325	1.101	1.307	1.264	0.940	0.807	0.488		
12	1.070	1.302	1.081	1.307	1.091	1.304	1.261	1.014	1.025	0.676	0.364		
10	1.275	1.062	1.290	1.067	1.279	1.241	0.946	1.023	0.747	0.467	0.253		
8	1.025	1.244	1.247	1.232	1.192	1.094	0.803	0.673	0.469	0.289			
6	1.124	1.121	0.902	1.073	0.846	0.709	0.488	0.364	0.251				
4	0.765	0.750	0.723	0.684	0.592	0.399							
2	0.408	0.402	0.389	0.355	0.305								

Figure D.4 Brunswick Unit 1 Cycle 19 Radial Power Distribution at 18,788.1 MWd/MTU (EOFP) *(Continued)*

AREVA NP Affidavit Regarding Withholding ANP-3013P, Revision 0,
Brunswick Unit 1 Cycle 19 Fuel Cycle Design
MELLLA+ Operating Domain, May 2013

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

1. My name is Alan B. Meginnis. I am Manager, Product Licensing, for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the report ANP-3013(P), Revision 0, "Brunswick Unit 1 Cycle 19 Fuel Cycle Design MELLLA+ Operating Domain," dated May 2013 and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

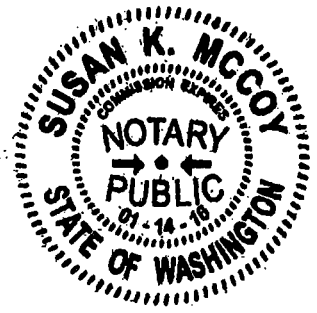
The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b), 6(d) and 6(e) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 22nd day of May, 2013.



Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/14/2016