Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

MAY 06 2009

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Gentlemen:

In the Matter of the Tennessee Valley Authority	))	Docket No. 50-390

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 – CORE OPERATING LIMITS REPORT (COLR) FOR CYCLE 9, REVISION 1

The purpose of this letter is to provide Revision 1 of the Cycle 9 COLR in accordance with WBN Technical Specification 5.9.5.d. Revision 1 updates the axial flux difference limits and was in effect as of April 23, 2009.

There are no regulatory commitments associated with this submittal. If you have any questions concerning this letter, please contact Mike Brandon, Site Licensing and Industry Affairs Manager, at (423) 365-1824.

Sincerely,

Mike Skaggs
Site Vice President
Watts Bar Nuclear Plant

cc: See Page 2

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NRR

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Enclosure
cc (Enclosure):
NRC Resident Inspector
Watts Bar Nuclear Plant
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Spring City, Tennessee 37381

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Enclosure

Watts Bar Nuclear Plant Unit 1
Cycle 9 Core Operating Limits Report, Revision 1

COLR for Watts Bar Unit 1, Cycle 9

QA Record
L36 090421 807

WATTS BAR NUCLEAR PLANT, UNIT 1, CYCLE 9

CORE OPERATING LIMITS REPORT

Revision 1

April 2009

Prepared by: John Strange, 4/22/09
Nuclear Fuel Date

Verified by: [signature], 4/22/09
Nuclear Fuel Date

Reviewed by: [signature], 4/23/09
Manager, Nuclear Fuel Design Date

[signature], 4/23/09
Reactor Engineering Supervisor Date

Approved by: [signature], 4/23/09
PORC Chairman Date

[signature], 4-23-09
Plant Manager Date

Revision	Date of PORC Approval	PORC Meeting Number	Affected Pages	Reason for Revision
0	3-5-08	4222	1-10	Initial issue
1	4-23-09	4256	1, 8, 9	Revise AFD limits and W(z) values

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Watts Bar Unit 1 Cycle 9 has been prepared in accordance with the requirements of the Technical Specifications 5.9.5.

The Technical Specifications affected by this report are listed below:

3.1.4 Moderator Temperature Coefficient (MTC)
3.1.6 Shutdown Bank Insertion Limits
3.1.7 Control Bank Insertion Limits
3.2.1 Heat Flux Hot Channel Factor ($F_Q(Z)$)
3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)
3.2.3 Axial Flux Difference (AFD)
3.5.1 Accumulators
3.5.4 Refueling Water Storage Tank (RWST)
3.9.1 Boron Concentration

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in section 1.0 are presented in the following subsections. These limits have been developed using the NRC approved methodologies specified in the Technical Specifications Section 5.9.5.

The following abbreviations are used in this section:

BOL	--	Beginning of Cycle Life
ARO	--	All Rods Out
HZP	--	Hot Zero Thermal Power
EOL	--	End of Cycle Life
RTP	--	Rated Thermal Power

2.1 MODERATOR TEMPERATURE COEFFICIENT - MTC (LCO 3.1.4)

2.1.1 The MTC limits are:

The BOL/ARO/HZP - MTC shall be less positive than or equal to 0 $\Delta k/k/°F$ (upper limit). With the measured BOL/ARO/HZP - MTC more positive than -1.00×10^{-5} $\Delta k/k/°F$ (as-measured MTC limit), establish control rod withdrawal limits to ensure the MTC remains less positive than or equal to 0 $\Delta k/k/°F$ (upper limit) for all times in core life.

The EOL/ARO/RTP - MTC shall be less negative than or equal to -4.5×10^{-4} $\Delta k/k/°F$ (lower limit).

2.1.2 The 300 ppm surveillance limit is:

The measured 300 ppm /ARO/RTP-MTC should be less negative than or equal to -3.75×10^{-4} $\Delta k/k/°F$.

2.1.3 The 60 ppm surveillance limit is:

The measured 60 ppm /ARO/RTP-MTC should be less negative than or equal to -4.28×10^{-4} $\Delta k/k/°F$.

2.2 SHUTDOWN BANK INSERTION LIMITS (LCO 3.1.6)

2.2.1 The shutdown banks shall be withdrawn to a position greater than or equal to 225 steps withdrawn.

2.3 CONTROL BANK INSERTION LIMITS (LCO 3.1.7)

2.3.1 The control banks are fully withdrawn or shall be limited in physical insertion as shown in Figure 1.

2.3.2 Each control bank shall be considered fully withdrawn from the core at greater than or equal to 225 steps.

2.3.3 The control banks shall be operated in sequence by withdrawal of Bank A, Bank B, Bank C, and Bank D. The control banks shall be sequenced in reverse order upon insertion.

2.3.4. Each control bank not fully withdrawn from the core shall be operated with the following overlap as a function of park position.

Park Position (steps)	Bank Overlap (steps)	Bank Difference(steps)
225	109	116
226	110	116
227	111	116
228	112	116
229	113	116
230	114	116
231	115	116

2.4 HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$ (LCO 3.2.1)

$F_Q(Z) \leq [CFQ / P] * K(Z)$ for $P > 0.5$

$F_Q(Z) \leq [CFQ / 0.5] * K(Z)$ for $P \leq 0.5$

Where P = Thermal Power / Rated Thermal Power

2.4.1 CFQ = 2.50

2.4.2 K(Z) is provided in Figure 2.

2.4.3 $F_Q^C(Z) = F_Q^M(Z) * 1.0815$

where: $F_Q^M(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results and 1.0815 is a factor that accounts for fuel manufacturing tolerances and flux map measurement uncertainty.

2.4.4 $F_Q^W(Z) = F_Q^C(Z) * W(Z)$

where: W(Z) values are provided in Table A.1. The table provides sufficient information to determine W(Z) versus core height for all cycle burnups.

2.4.5 $F_Q^W(Z)$ Penalty Factor

The $F_Q^W(Z)$ penalty factor is provided in Table A.2.

2.5 NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR – $F_{\Delta H}^N$ (LCO 3.2.2)

$F_{\Delta H}^N \leq F_{\Delta H}^{RTP} * (1 + PF * (1-P))$

where P = Thermal Power / Rated Thermal Power

$F_{\Delta H}^{RTP}$ = 1.65 for RFA-2 fuel, and

PF = 0.3

2.6 AXIAL FLUX DIFFERENCE - AFD (LCO 3.2.3)

2.6.1 The AFD limits for Cycle 9 are provided in Figure 3.

2.7 REFUELING BORON CONCENTRATION (LCO 3.9.1)

2.7.1 The refueling boron concentration shall be ≥ 2000 ppm.

2.8 ACCUMULATORS (LCO 3.5.1)

2.8.1 There are 368 tritium producing burnable absorber rods (TPBARs) in the reactor core for Cycle 9.

2.9 REFUELING WATER STORAGE TANK – RWST (LCO 3.5.4)

2.9.1 There are 368 tritium producing burnable absorber rods (TPBARs) in the reactor core for Cycle 9.

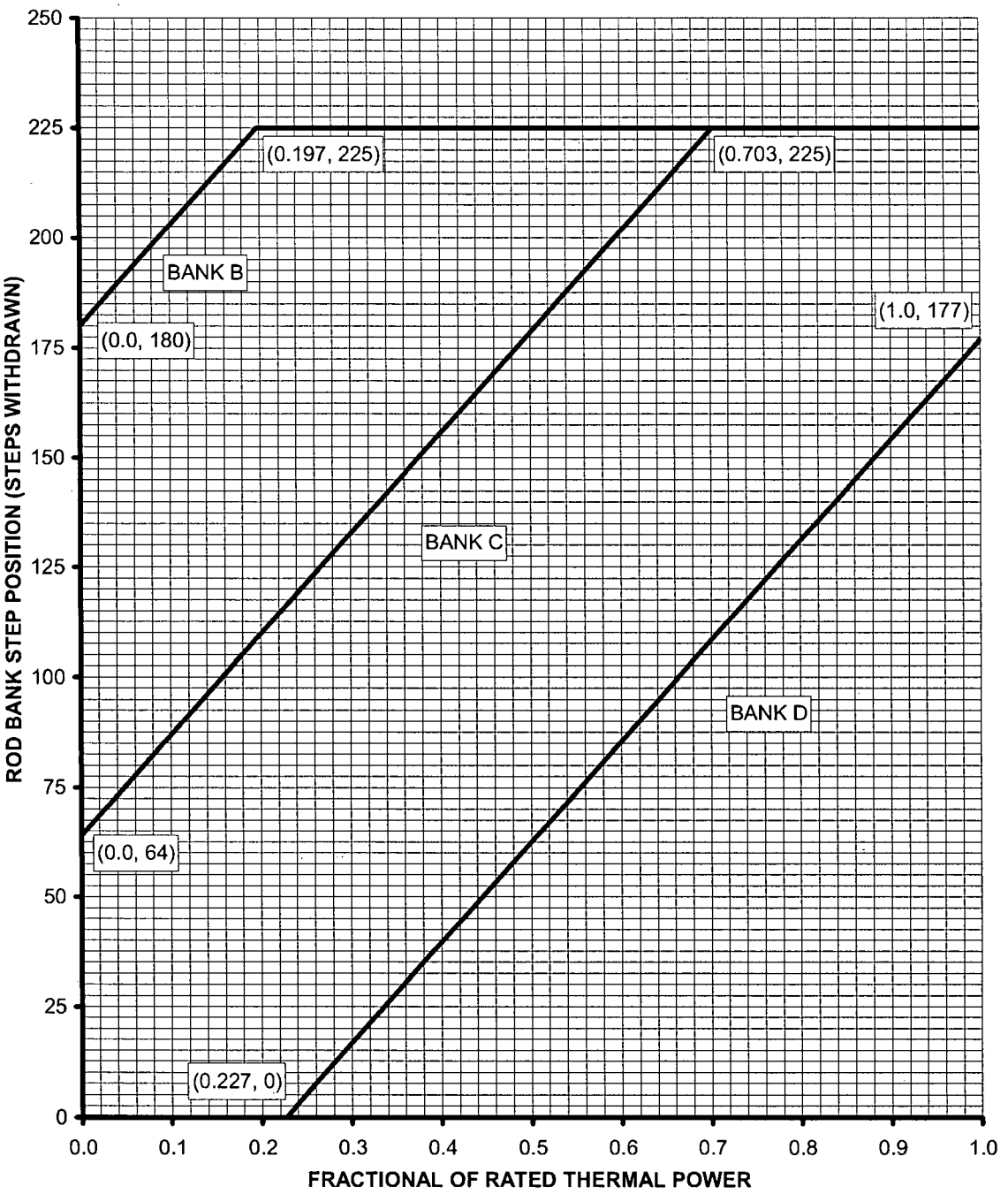

Figure 1
Control Bank Insertion Limits Versus Thermal Power
Four Loop Operation

* Fully withdrawn region shall be the condition where shutdown and control banks are at a position within the interval of ≥ 225 and ≤ 231 steps withdrawn.

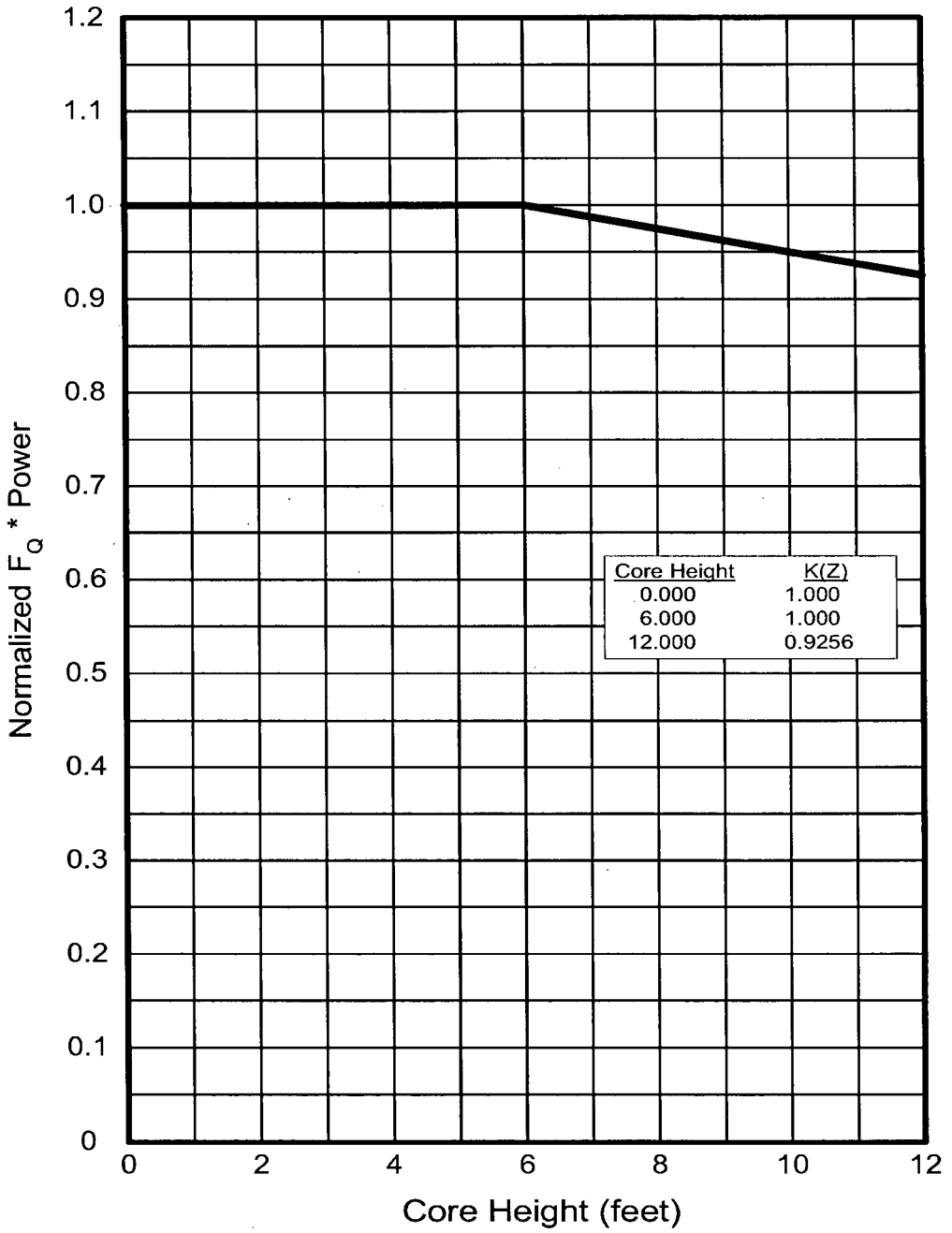

Figure 2
K(Z) - Normalized $F_Q(Z)$ as a Function of Core Height

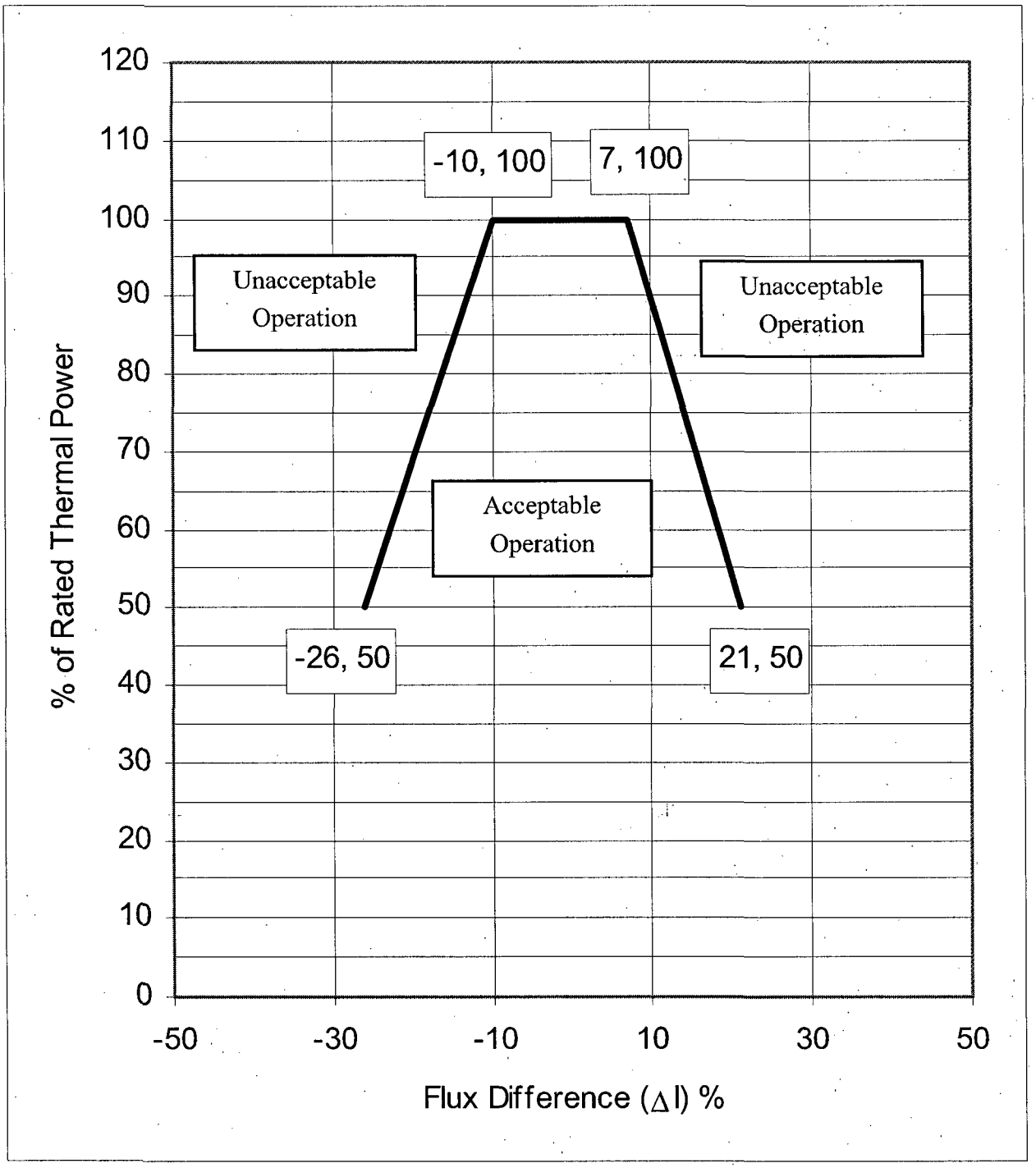

Figure 3
Axial Flux Difference Acceptable Operation Limits as a Function of Rated Thermal Power (RAOC)

Table A.1
$F_Q^W(Z) = F_Q^C(Z) * W(Z)$

Height (ft)	Max W(z) at 150 MWD/MTU	Max W(z) at 2000 MWD/MTU	Max W(z) at 4000 MWD/MTU	Max W(z) at 10000 MWD/MTU	Max W(z) at 18000 MWD/MTU
12.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11.8000	1.0000	1.0000	1.0000	1.0000	1.0000
11.6000	1.0000	1.0000	1.0000	1.0000	1.0000
11.4000	1.0000	1.0000	1.0000	1.0000	1.0000
11.2000	1.0000	1.0000	1.0000	1.0000	1.0000
11.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10.8000	1.3158	1.3647	1.3317	1.2020	1.1787
10.6000	1.3136	1.3556	1.3261	1.1932	1.1745
10.4000	1.3103	1.3436	1.3177	1.1854	1.1703
10.2000	1.3090	1.3295	1.3089	1.1793	1.1644
10.0000	1.3033	1.3142	1.2978	1.1723	1.1600
9.8000	1.2973	1.2965	1.2842	1.1678	1.1558
9.6000	1.2904	1.2817	1.2710	1.1641	1.1555
9.4000	1.2801	1.2715	1.2619	1.1604	1.1590
9.2000	1.2679	1.2609	1.2571	1.1592	1.1620
9.0000	1.2575	1.2502	1.2509	1.1584	1.1728
8.8000	1.2542	1.2447	1.2475	1.1628	1.1843
8.6000	1.2550	1.2454	1.2475	1.1741	1.2001
8.4000	1.2601	1.2480	1.2471	1.1861	1.2220
8.2000	1.2620	1.2479	1.2438	1.1970	1.2399
8.0000	1.2619	1.2460	1.2381	1.2057	1.2553
7.8000	1.2597	1.2422	1.2319	1.2121	1.2682
7.6000	1.2554	1.2367	1.2282	1.2164	1.2781
7.4000	1.2491	1.2293	1.2269	1.2184	1.2851
7.2000	1.2409	1.2203	1.2228	1.2183	1.2893
7.0000	1.2341	1.2131	1.2168	1.2161	1.2906
6.8000	1.2283	1.2067	1.2095	1.2125	1.2892
6.6000	1.2214	1.1991	1.2008	1.2074	1.2850
6.4000	1.2123	1.1896	1.1902	1.2006	1.2783
6.2000	1.2016	1.1785	1.1782	1.1921	1.2690
6.0000	1.1915	1.1699	1.1688	1.1816	1.2574
5.8000	1.1816	1.1610	1.1588	1.1722	1.2435
5.6000	1.1724	1.1518	1.1488	1.1648	1.2273
5.4000	1.1644	1.1447	1.1415	1.1587	1.2093
5.2000	1.1564	1.1371	1.1342	1.1541	1.1943
5.0000	1.1475	1.1291	1.1285	1.1483	1.1897
4.8000	1.1374	1.1213	1.1229	1.1433	1.1876
4.6000	1.1268	1.1136	1.1163	1.1398	1.1827
4.4000	1.1163	1.1051	1.1092	1.1365	1.1771
4.2000	1.1069	1.0962	1.1017	1.1345	1.1704
4.0000	1.0971	1.0869	1.0937	1.1325	1.1629
3.8000	1.0871	1.0774	1.0857	1.1295	1.1548
3.6000	1.0764	1.0677	1.0772	1.1281	1.1460
3.4000	1.0663	1.0583	1.0697	1.1307	1.1373
3.2000	1.0642	1.0550	1.0710	1.1324	1.1318
3.0000	1.0662	1.0636	1.0820	1.1376	1.1357
2.8000	1.0731	1.0810	1.0998	1.1461	1.1491
2.6000	1.0850	1.0968	1.1167	1.1588	1.1665
2.4000	1.1019	1.1137	1.1344	1.1782	1.1830
2.2000	1.1187	1.1309	1.1522	1.1971	1.1991
2.0000	1.1350	1.1472	1.1699	1.2152	1.2147
1.8000	1.1524	1.1658	1.1864	1.2330	1.2297
1.6000	1.1744	1.1906	1.2036	1.2496	1.2439
1.4000	1.2024	1.2205	1.2261	1.2644	1.2564
1.2000	1.2282	1.2480	1.2520	1.2764	1.2664
1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.8000	1.0000	1.0000	1.0000	1.0000	1.0000
0.6000	1.0000	1.0000	1.0000	1.0000	1.0000
0.4000	1.0000	1.0000	1.0000	1.0000	1.0000
0.2000	1.0000	1.0000	1.0000	1.0000	1.0000
0.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table A.2
$F_Q^W(Z)$ Penalty Factor

Core Burnup (MWD/MTU)	$F_Q^W(Z)$ Penalty Factor
All Burnups	1.0200

Note:

1. The Penalty Factor, which is applied to $F_Q^W(Z)$ for compliance with Surveillance Requirement 3.2.1.2.a, is the maximum factor by which $F_Q^W(Z)$ is expected to increase per 31 Effective Full Power Days (EFPD) starting from the burnup at which the $F_Q^W(Z)$ was determined.