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SCE&G®
A SCANA COMPANY

November 19, 2012

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (UNIT 1)
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
CORE OPERATING LIMITS REPORT (COLR) FOR CYCLE 21

In accordance with Section 6.9.1.11 of the Virgil C. Summer Nuclear Station Technical Specifications, South Carolina Electric & Gas Company (SCE&G), acting for itself and as an agent for South Carolina Public Service Authority, hereby submits the Core Operating Limits Report (COLR) for Cycle 21.

Should you have any questions, please call Mr. Bruce Thompson at (803) 931-5042.

Very truly yours,

Thomas D. Gatlin

JMG/TDG/ts

Attachment

c: Without Attachment unless noted

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SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION

UNIT 1

CORE OPERATING LIMITS REPORT

FOR

CYCLE 21

REVISION 0

November 2012

LIST OF EFFECTIVE PAGES

PAGE	REVISION
i	0
ii	0
iii	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0

Table of Contents

List of Tables

List of Figures

1.0 Core Operating Limits Report

This Core Operating Limits Report (COLR) for V. C. Summer Station Cycle 21 has been prepared in accordance with the requirements of Technical Specification 6.9.1.11.

The Technical Specifications affected by this report are listed below:

3.1.1.3	Moderator Temperature Coefficient
3.1.3.5	Shutdown Rod Insertion Limits
3.1.3.6	Control Rod Insertion Limits
3.2.1	Axial Flux Difference
3.2.2	Heat Flux Hot Channel Factor
3.2.3	RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor
3.3.3.11	Power Distribution Measurement Uncertainty

2.0 Operating Limits

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the subsections which follow. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.9.1.11.

2.1 Moderator Temperature Coefficient (Specification 3.1.1.3):

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:
The BOL/ARO-MTC shall be less positive than the limits shown in Figure 1.
The EOL/ARO/RTP-MTC shall be less negative than -4.8×10^{-4} $\Delta k/k/°F$ (-48 pcm/°F).
where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
RTP stands for RATED THERMAL POWER
EOL stands for End of Cycle Life

2.1.2 The MTC Surveillance limit is:
The 300 ppm/ARO/RTP-MTC should be less negative than or equal to -4.1×10^{-4} $\Delta k/k/°F$ (-41 pcm/°F).

2.1.3 The Revised Predicted near-EOL 300 ppm MTC shall be calculated using the following algorithm from Reference 2:

Revised Predicted MTC = Predicted MTC + AFD Correction*+ Predictive Correction**

*AFD Correction is 0.05 pcm/°F/%ΔAFD.

**Predictive Correction is -3 pcm/°F.

If the Revised Predicted MTC is less negative than the SR 4.1.1.3b limit of -4.1×10^{-4} $\Delta k/k/°F$, and all of the benchmark data contained in the surveillance procedure are met, then an MTC measurement in accordance with SR 4.1.1.3b is not required.

2.2 Shutdown Rod Insertion Limits (Specification 3.1.3.5):

The shutdown rods shall be withdrawn to at least 230 steps.

2.3 Control Rod Insertion Limits (Specification 3.1.3.6):

Control Bank A and B rods shall be withdrawn to at least 230 steps. Control Bank C and D Rod Insertion Limits are specified by Figure 2. Control rod overlap is 102 steps.

2.4 Axial Flux Difference (Specification 3.2.1):

2.4.1 The Axial Flux Difference (AFD) Limits for Relaxed Axial Offset Control (RAOC) operation for Cycle 21 are shown in Figure 3.

2.4.2 The Axial Flux Difference (AFD) target band during base load operations for Cycle 21 is: BOL - EOL (0 – 23,000 MWD/MTU): ±5% about a measured target value.

2.4.3 The minimum allowable power level for base load operation, APL^{ND}, is 75% of RATED THERMAL POWER.

2.5 Heat Flux Hot Channel Factor - $F_Q(z)$ (Specification 3.2.2):

$$F_Q(Z) \le \frac{F_Q^{RTP}}{P} \times K(Z) \qquad \text{for } P > 0.5$$

$$F_Q(Z) \le \frac{F_Q^{RTP}}{0.5} \times K(Z) \qquad \text{for } P \le 0.5 \qquad \text{where: } P = \frac{Thermal\ Power}{Rated\ Thermal\ Power}$$

2.5.1 $F_Q^{RTP} = 2.45$

2.5.2 K(z) is provided in Figure 4.

2.5.3 Elevation dependent W(z) values for RAOC operation at 150, 3000, 5000, 8000, 10000, 14000, and 20000 MWD/MTU are shown in Tables 1 through 7, respectively. This information is sufficient to determine W(z) versus core height in the range of 0 MWD/MTU to EOL burnup through the use of three point interpolation. Table 8 shows FQ margin decreases for RAOC operation that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to increase F_Q^M (z) as per Surveillance Requirement 4.2.2.2e. A 2% penalty factor shall be used at all burnups that are outside the range of Table 8.

2.5.4 Elevation dependent $W(z)_{BL}$ values for Baseload operation between 75 and 100% of rated thermal power with the item 2.4.2 specified target band about a measured target value at 150, 3000, 5000, 8000, 10000, 14000, and 20000 MWD/MTU are shown in Tables 9 through 15, respectively. This information is sufficient to determine $W(z)_{BL}$ versus core height for burnups in the range of 0 MWD/MTU to EOL burnup through the use of three point interpolation. Table 16 shows FQ margin decreases for base load operation that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to increase $F_Q^M(z)$ as per Surveillance Requirement 4.2.2.4e. A 2% penalty factor shall be used at all burnups that are outside the range of Table 16.

2.6 RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^N$ (Specification 3.2.3):

$$R = \frac{F_{\Delta H}^N}{F_{\Delta H}^{RTP} \times \left(1 + PF_{\Delta H}^N \times (1 - P)\right)} \qquad \text{where: } P = \frac{Thermal\ Power}{Rated\ Thermal\ Power}$$

2.6.1 $F_{\Delta H}^{RTP} = 1.62$

2.6.2 $PF_{\Delta H}^N = 0.3$

2.6.3 The Acceptable Operation Region from the combination of Reactor Coolant System total flow and R is provided in Figure 5.

2.7 Power Distribution Measurement Uncertainty (Specifications 3.2.2 and 3.2.3):

If the Power Distribution Monitoring System is OPERABLE, as defined in Technical Specification 3.3.3.11, the uncertainty, $U_{F\Delta H}$, to be applied to the Nuclear Enthalpy Rise Hot Channel Factor $F^N{}_{\Delta H}$ shall be calculated by the following formula:

$$U_{F\Delta H} = 1.0 + \frac{U_{\Delta H}}{100.0}$$

where: $U_{\Delta H}$ = Uncertainty for enthalpy rise as defined in equation (5-19) in Reference 1 or 4.0, whichever is larger.

If the Power Distribution Monitoring System is OPERABLE, as defined in Technical Specification 3.3.3.11, the uncertainty, U_{FQ}, to be applied to the Heat Flux Hot Channel Factor $F_Q(z)$ shall be calculated by the following formula:

$$U_{FQ} = \left(1.0 + \frac{U_Q}{100.0}\right) \cdot U_e$$

where: U_Q = Uncertainty for $F_Q(z)$ = 5.0 when confirming $F_Q(z)$ for RAOC or Base Load operation, or as defined in equation (5-19) in Reference 1 for all other purposes.

U_e = Engineering uncertainty factor.

= 1.03

If the Power Distribution Monitoring System is INOPERABLE, as defined in Technical Specification 3.3.3.11, the uncertainty, $U_{F\Delta H}$, to be applied to the Nuclear Enthalpy Rise Hot Channel Factor $F^N_{\Delta H}$ shall be calculated by the following formula:

$$U_{F\Delta H} = U_{F\Delta Hm}$$

where: $U_{F\Delta Hm}$ = Base $F_{\Delta H}$ measurement uncertainty.

= 1.04

If the Power Distribution Monitoring System is INOPERABLE, as defined in Technical Specification 3.3.3.11, the uncertainty, U_{FQ}, to be applied to the Heat Flux Hot Channel Factor $F_Q(z)$ shall be calculated by the following formula:

$$U_{FQ} = U_{qu} \cdot U_e$$

where: U_{qu} = Base F_Q measurement uncertainty.

= 1.05

U_e = Engineering uncertainty factor.

= 1.03

3.0 References

1) WCAP-12472-P-A, "BEACON Core Monitoring and Operations Support System," August, 1994, (W Proprietary).
WCAP-12472-P-A, Addendum 1-A, "BEACON Core Monitoring and Operations Support System," January 2000, (W Proprietary).

2) WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient," March 1997, (W Proprietary).

Figure 1. Moderator Temperature Coefficient Versus Power Level
V.C. Summer – Cycle 21

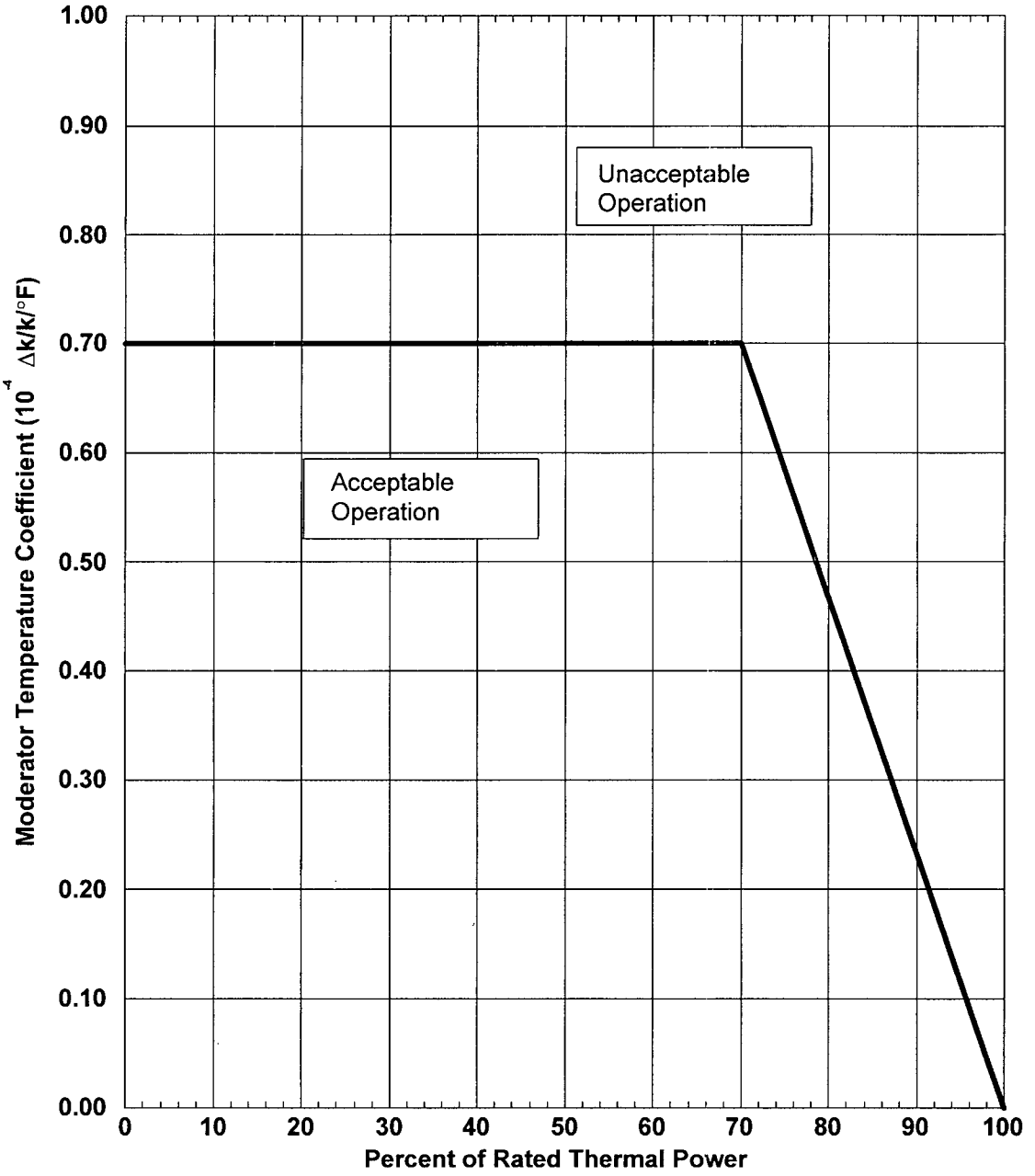


Figure 2. Rod Group Insertion Limits Versus Thermal Power for Three Loop Operation
V. C. Summer - Cycle 21

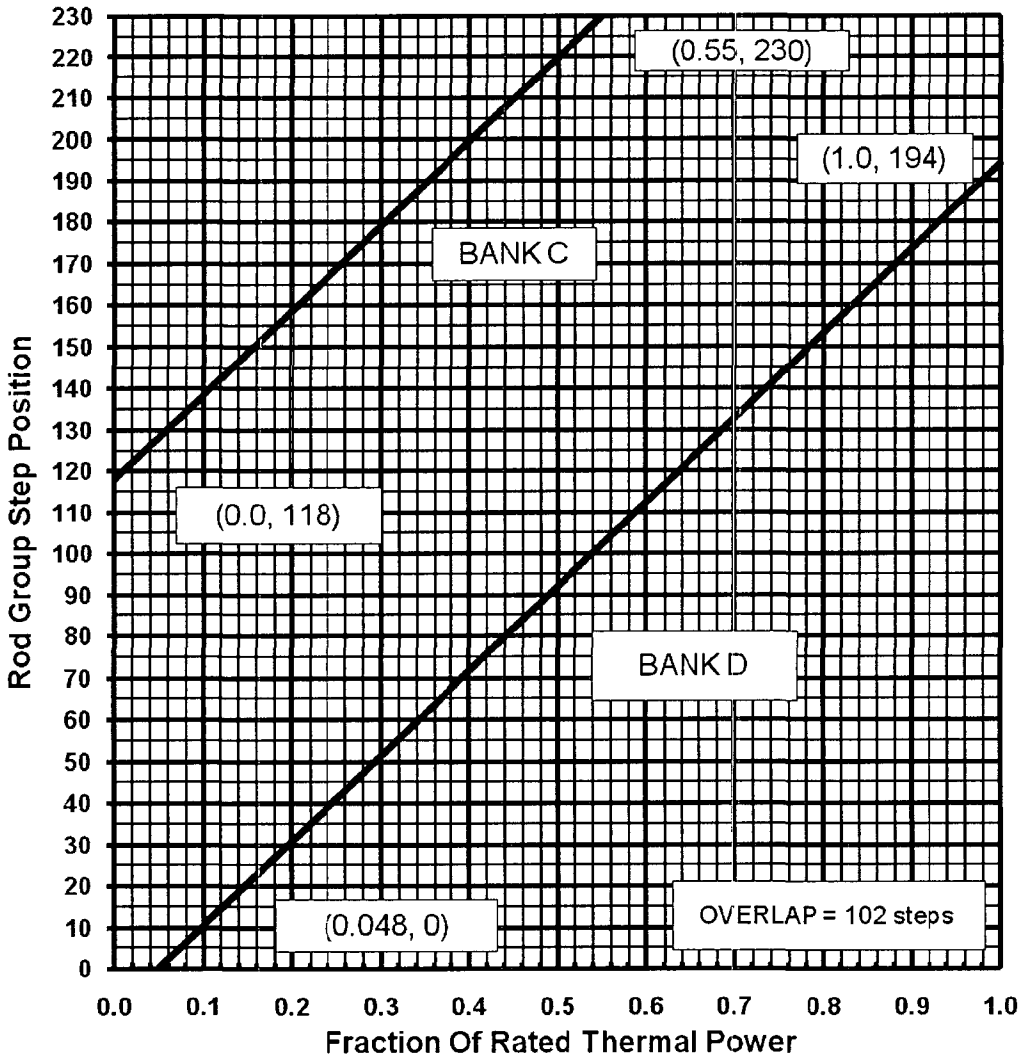


Figure 3. Axial Flux Difference Limits as a Function of Rated Thermal Power V. C. Summer – Cycle 21

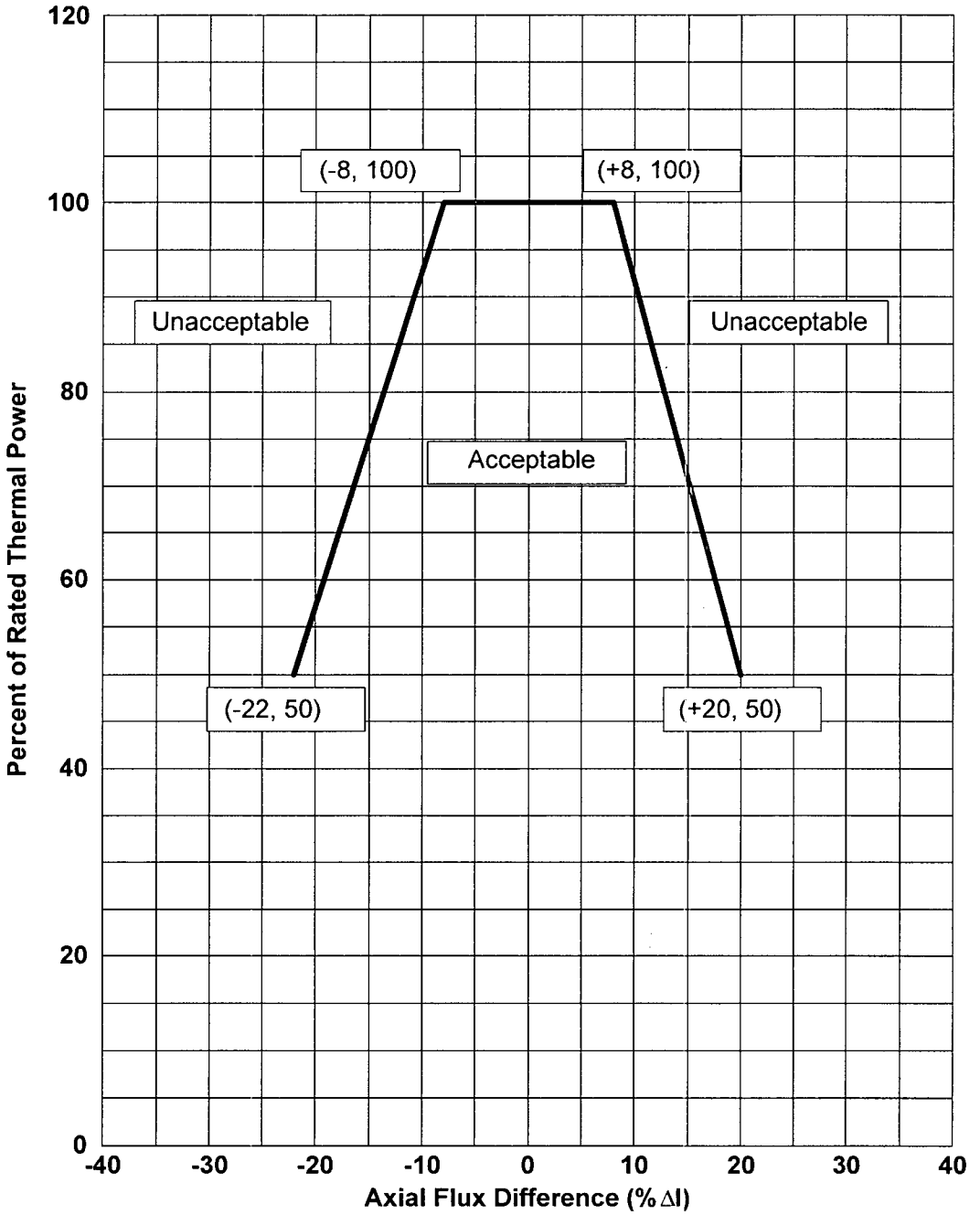


Figure 4. K(z) - Normalized $F_Q(z)$ as a Function of Core Height
V. C. Summer – Cycle 21

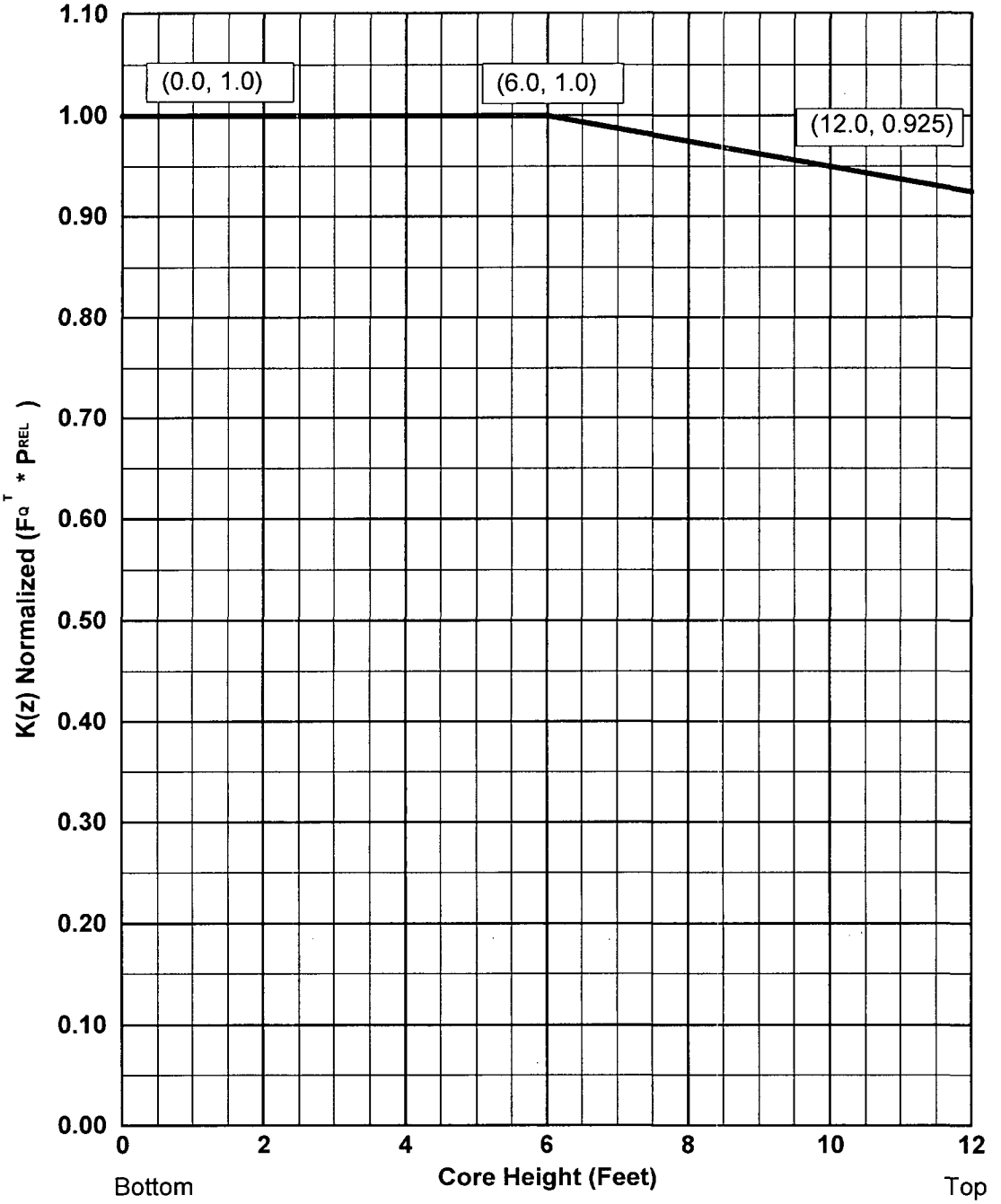


Table 1. RAOC W(z) at 150 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.139	6.140	1.178
0.140	1.138	6.279	1.185
0.279	1.144	6.419	1.192
0.419	1.157	6.558	1.198
0.558	1.174	6.698	1.203
0.698	1.182	6.837	1.208
0.837	1.181	6.977	1.212
0.977	1.178	7.116	1.215
1.116	1.175	7.256	1.218
1.256	1.170	7.395	1.219
1.395	1.164	7.535	1.220
1.535	1.157	7.674	1.220
1.674	1.150	7.814	1.218
1.814	1.142	7.953	1.216
1.953	1.134	8.093	1.213
2.093	1.126	8.233	1.209
2.233	1.118	8.372	1.204
2.372	1.109	8.512	1.198
2.512	1.101	8.651	1.190
2.651	1.093	8.791	1.182
2.791	1.084	8.930	1.180
2.930	1.079	9.070	1.181
3.070	1.079	9.209	1.183
3.209	1.079	9.349	1.190
3.349	1.083	9.488	1.199
3.488	1.088	9.628	1.207
3.628	1.094	9.767	1.215
3.767	1.098	9.907	1.223
3.907	1.103	10.046	1.230
4.046	1.107	10.186	1.236
4.186	1.111	10.326	1.242
4.326	1.115	10.465	1.247
4.465	1.119	10.605	1.252
4.605	1.122	10.744	1.256
4.744	1.125	10.884	1.258
4.884	1.128	11.023	1.259
5.023	1.130	11.163	1.259
5.163	1.131	11.302	1.259
5.302	1.132	11.442	1.253
5.442	1.134	11.581	1.236
5.581	1.141	11.721	1.216
5.721	1.151	11.860	1.193
5.860	1.161	12.000	1.167
6.000	1.170		

Table 2. RAOC W(z) at 3000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.256	6.140	1.127
0.140	1.255	6.279	1.135
0.279	1.258	6.419	1.143
0.419	1.267	6.558	1.150
0.558	1.278	6.698	1.157
0.698	1.281	6.837	1.163
0.837	1.276	6.977	1.169
0.977	1.269	7.116	1.174
1.116	1.261	7.256	1.178
1.256	1.251	7.395	1.182
1.395	1.240	7.535	1.185
1.535	1.227	7.674	1.187
1.674	1.214	7.814	1.188
1.814	1.199	7.953	1.189
1.953	1.185	8.093	1.189
2.093	1.170	8.233	1.188
2.233	1.154	8.372	1.187
2.372	1.140	8.512	1.183
2.512	1.127	8.651	1.177
2.651	1.116	8.791	1.173
2.791	1.105	8.930	1.174
2.930	1.096	9.070	1.180
3.070	1.088	9.209	1.190
3.209	1.082	9.349	1.201
3.349	1.082	9.488	1.211
3.488	1.082	9.628	1.222
3.628	1.083	9.767	1.231
3.767	1.084	9.907	1.240
3.907	1.086	10.046	1.249
4.046	1.087	10.186	1.256
4.186	1.089	10.326	1.262
4.326	1.090	10.465	1.268
4.465	1.091	10.605	1.272
4.605	1.092	10.744	1.274
4.744	1.093	10.884	1.275
4.884	1.093	11.023	1.276
5.023	1.094	11.163	1.275
5.163	1.094	11.302	1.272
5.302	1.095	11.442	1.264
5.442	1.096	11.581	1.250
5.581	1.099	11.721	1.233
5.721	1.103	11.860	1.212
5.860	1.110	12.000	1.188
6.000	1.118		

Table 3. RAOC W(z) at 5000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.262	6.140	1.110
0.140	1.260	6.279	1.119
0.279	1.264	6.419	1.127
0.419	1.271	6.558	1.136
0.558	1.282	6.698	1.144
0.698	1.283	6.837	1.152
0.837	1.278	6.977	1.159
0.977	1.271	7.116	1.166
1.116	1.264	7.256	1.172
1.256	1.256	7.395	1.177
1.395	1.246	7.535	1.182
1.535	1.234	7.674	1.186
1.674	1.223	7.814	1.189
1.814	1.210	7.953	1.192
1.953	1.197	8.093	1.194
2.093	1.183	8.233	1.195
2.233	1.170	8.372	1.195
2.372	1.156	8.512	1.194
2.512	1.142	8.651	1.191
2.651	1.129	8.791	1.191
2.791	1.116	8.930	1.193
2.930	1.103	9.070	1.201
3.070	1.091	9.209	1.211
3.209	1.084	9.349	1.221
3.349	1.084	9.488	1.231
3.488	1.084	9.628	1.239
3.628	1.084	9.767	1.247
3.767	1.084	9.907	1.254
3.907	1.083	10.046	1.258
4.046	1.082	10.186	1.263
4.186	1.081	10.326	1.271
4.326	1.081	10.465	1.281
4.465	1.081	10.605	1.288
4.605	1.081	10.744	1.295
4.744	1.082	10.884	1.301
4.884	1.084	11.023	1.304
5.023	1.086	11.163	1.306
5.163	1.087	11.302	1.308
5.302	1.088	11.442	1.305
5.442	1.090	11.581	1.294
5.581	1.091	11.721	1.278
5.721	1.093	11.860	1.258
5.860	1.097	12.000	1.233
6.000	1.103		

Table 4. RAOC W(z) at 8000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.300	6.140	1.110
0.140	1.298	6.279	1.118
0.279	1.301	6.419	1.125
0.419	1.308	6.558	1.133
0.558	1.318	6.698	1.140
0.698	1.319	6.837	1.147
0.837	1.314	6.977	1.154
0.977	1.307	7.116	1.160
1.116	1.298	7.256	1.166
1.256	1.288	7.395	1.171
1.395	1.275	7.535	1.175
1.535	1.261	7.674	1.179
1.674	1.247	7.814	1.181
1.814	1.231	7.953	1.183
1.953	1.215	8.093	1.185
2.093	1.199	8.233	1.186
2.233	1.182	8.372	1.186
2.372	1.166	8.512	1.185
2.512	1.149	8.651	1.181
2.651	1.133	8.791	1.180
2.791	1.117	8.930	1.181
2.930	1.102	9.070	1.187
3.070	1.089	9.209	1.195
3.209	1.079	9.349	1.204
3.349	1.079	9.488	1.213
3.488	1.079	9.628	1.220
3.628	1.080	9.767	1.227
3.767	1.080	9.907	1.233
3.907	1.081	10.046	1.236
4.046	1.081	10.186	1.239
4.186	1.083	10.326	1.244
4.326	1.084	10.465	1.250
4.465	1.085	10.605	1.257
4.605	1.086	10.744	1.263
4.744	1.087	10.884	1.267
4.884	1.088	11.023	1.270
5.023	1.089	11.163	1.272
5.163	1.089	11.302	1.272
5.302	1.089	11.442	1.269
5.442	1.089	11.581	1.257
5.581	1.090	11.721	1.241
5.721	1.092	11.860	1.221
5.860	1.096	12.000	1.197
6.000	1.102		

Table 5. RAOC W(z) at 10000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.288	6.140	1.115
0.140	1.287	6.279	1.122
0.279	1.290	6.419	1.129
0.419	1.297	6.558	1.136
0.558	1.308	6.698	1.143
0.698	1.309	6.837	1.150
0.837	1.305	6.977	1.156
0.977	1.298	7.116	1.161
1.116	1.290	7.256	1.166
1.256	1.280	7.395	1.170
1.395	1.268	7.535	1.174
1.535	1.254	7.674	1.177
1.674	1.240	7.814	1.179
1.814	1.225	7.953	1.180
1.953	1.209	8.093	1.181
2.093	1.193	8.233	1.181
2.233	1.177	8.372	1.180
2.372	1.161	8.512	1.178
2.512	1.144	8.651	1.174
2.651	1.128	8.791	1.171
2.791	1.118	8.930	1.171
2.930	1.109	9.070	1.176
3.070	1.101	9.209	1.183
3.209	1.095	9.349	1.189
3.349	1.094	9.488	1.196
3.488	1.093	9.628	1.202
3.628	1.093	9.767	1.207
3.767	1.093	9.907	1.211
3.907	1.093	10.046	1.213
4.046	1.093	10.186	1.217
4.186	1.093	10.326	1.223
4.326	1.093	10.465	1.230
4.465	1.093	10.605	1.236
4.605	1.093	10.744	1.241
4.744	1.093	10.884	1.245
4.884	1.092	11.023	1.247
5.023	1.092	11.163	1.248
5.163	1.091	11.302	1.247
5.302	1.091	11.442	1.244
5.442	1.091	11.581	1.231
5.581	1.093	11.721	1.215
5.721	1.096	11.860	1.195
5.860	1.101	12.000	1.171
6.000	1.108		

Table 6. RAOC W(z) at 14000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.246	6.140	1.137
0.140	1.245	6.279	1.146
0.279	1.249	6.419	1.154
0.419	1.258	6.558	1.161
0.558	1.271	6.698	1.167
0.698	1.275	6.837	1.173
0.837	1.273	6.977	1.178
0.977	1.268	7.116	1.182
1.116	1.263	7.256	1.185
1.256	1.255	7.395	1.188
1.395	1.245	7.535	1.190
1.535	1.235	7.674	1.191
1.674	1.223	7.814	1.191
1.814	1.211	7.953	1.191
1.953	1.199	8.093	1.190
2.093	1.186	8.233	1.188
2.233	1.172	8.372	1.185
2.372	1.159	8.512	1.181
2.512	1.146	8.651	1.175
2.651	1.132	8.791	1.170
2.791	1.118	8.930	1.170
2.930	1.106	9.070	1.175
3.070	1.099	9.209	1.182
3.209	1.095	9.349	1.186
3.349	1.095	9.488	1.190
3.488	1.096	9.628	1.193
3.628	1.096	9.767	1.196
3.767	1.096	9.907	1.198
3.907	1.096	10.046	1.204
4.046	1.096	10.186	1.211
4.186	1.097	10.326	1.217
4.326	1.098	10.465	1.222
4.465	1.100	10.605	1.227
4.605	1.103	10.744	1.231
4.744	1.105	10.884	1.233
4.884	1.107	11.023	1.234
5.023	1.108	11.163	1.234
5.163	1.109	11.302	1.232
5.302	1.109	11.442	1.227
5.442	1.110	11.581	1.213
5.581	1.112	11.721	1.195
5.721	1.115	11.860	1.174
5.860	1.120	12.000	1.150
6.000	1.128		

Table 7. RAOC W(z) at 20000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.185	6.140	1.191
0.140	1.182	6.279	1.199
0.279	1.186	6.419	1.206
0.419	1.197	6.558	1.212
0.558	1.212	6.698	1.217
0.698	1.218	6.837	1.221
0.837	1.218	6.977	1.224
0.977	1.216	7.116	1.226
1.116	1.212	7.256	1.227
1.256	1.206	7.395	1.227
1.395	1.199	7.535	1.225
1.535	1.191	7.674	1.223
1.674	1.182	7.814	1.220
1.814	1.172	7.953	1.217
1.953	1.162	8.093	1.211
2.093	1.152	8.233	1.204
2.233	1.142	8.372	1.196
2.372	1.132	8.512	1.191
2.512	1.121	8.651	1.191
2.651	1.111	8.791	1.190
2.791	1.100	8.930	1.191
2.930	1.090	9.070	1.194
3.070	1.083	9.209	1.195
3.209	1.079	9.349	1.195
3.349	1.084	9.488	1.198
3.488	1.088	9.628	1.204
3.628	1.093	9.767	1.211
3.767	1.097	9.907	1.217
3.907	1.101	10.046	1.222
4.046	1.104	10.186	1.227
4.186	1.108	10.326	1.232
4.326	1.113	10.465	1.236
4.465	1.119	10.605	1.239
4.605	1.126	10.744	1.241
4.744	1.132	10.884	1.243
4.884	1.138	11.023	1.243
5.023	1.143	11.163	1.242
5.163	1.147	11.302	1.238
5.302	1.151	11.442	1.231
5.442	1.155	11.581	1.215
5.581	1.160	11.721	1.194
5.721	1.166	11.860	1.172
5.860	1.174	12.000	1.147
6.000	1.183		

Table 8. RAOC F_Q Margin Decreases in Excess of 2% Per 31 EFPD – Cycle 21

Cycle Burnup (MWD/MTU)	Maximum Decrease in FQ Margin
1008	1.0200
1180	1.0200
1352	1.0200
1523	1.0245
1695	1.0245
1867	1.0245
2038	1.0242
2210	1.0238
2382	1.0231
2553	1.0221
2725	1.0207
2896	1.0200
3068	1.0200
3240	1.0200
3411	1.0200
3583	1.0200
3755	1.0200
3926	1.0200
4098	1.0200
4270	1.0200
4441	1.0209
4613	1.0214
4785	1.0209
4956	1.0200

Table 9. BASELOAD W(z) at 150 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.126	6.140	1.063
0.140	1.127	6.279	1.062
0.279	1.128	6.419	1.062
0.419	1.129	6.558	1.062
0.558	1.131	6.698	1.063
0.698	1.131	6.837	1.065
0.837	1.130	6.977	1.067
0.977	1.129	7.116	1.069
1.116	1.128	7.256	1.071
1.256	1.126	7.395	1.072
1.395	1.125	7.535	1.074
1.535	1.123	7.674	1.075
1.674	1.120	7.814	1.077
1.814	1.118	7.953	1.078
1.953	1.115	8.093	1.079
2.093	1.112	8.233	1.080
2.233	1.109	8.372	1.081
2.372	1.105	8.512	1.082
2.512	1.102	8.651	1.083
2.651	1.098	8.791	1.084
2.791	1.094	8.930	1.085
2.930	1.090	9.070	1.085
3.070	1.086	9.209	1.086
3.209	1.082	9.349	1.087
3.349	1.080	9.488	1.087
3.488	1.079	9.628	1.088
3.628	1.079	9.767	1.088
3.767	1.078	9.907	1.089
3.907	1.077	10.046	1.089
4.046	1.077	10.186	1.089
4.186	1.077	10.326	1.090
4.326	1.076	10.465	1.090
4.465	1.076	10.605	1.091
4.605	1.076	10.744	1.091
4.744	1.075	10.884	1.092
4.884	1.075	11.023	1.092
5.023	1.074	11.163	1.092
5.163	1.073	11.302	1.093
5.302	1.072	11.442	1.093
5.442	1.071	11.581	1.092
5.581	1.070	11.721	1.092
5.721	1.069	11.860	1.092
5.860	1.067	12.000	1.092
6.000	1.065		

Table 10. BASELOAD W(z) at 3000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.099	6.140	1.059
0.140	1.100	6.279	1.057
0.279	1.101	6.419	1.056
0.419	1.103	6.558	1.054
0.558	1.104	6.698	1.051
0.698	1.105	6.837	1.049
0.837	1.105	6.977	1.049
0.977	1.106	7.116	1.050
1.116	1.106	7.256	1.052
1.256	1.105	7.395	1.055
1.395	1.105	7.535	1.057
1.535	1.105	7.674	1.059
1.674	1.104	7.814	1.061
1.814	1.104	7.953	1.062
1.953	1.103	8.093	1.064
2.093	1.102	8.233	1.066
2.233	1.101	8.372	1.068
2.372	1.099	8.512	1.069
2.512	1.098	8.651	1.071
2.651	1.096	8.791	1.073
2.791	1.094	8.930	1.074
2.930	1.093	9.070	1.076
3.070	1.091	9.209	1.077
3.209	1.088	9.349	1.078
3.349	1.086	9.488	1.080
3.488	1.084	9.628	1.081
3.628	1.082	9.767	1.082
3.767	1.081	9.907	1.084
3.907	1.079	10.046	1.085
4.046	1.078	10.186	1.086
4.186	1.077	10.326	1.087
4.326	1.075	10.465	1.088
4.465	1.074	10.605	1.089
4.605	1.072	10.744	1.090
4.744	1.071	10.884	1.091
4.884	1.070	11.023	1.092
5.023	1.069	11.163	1.093
5.163	1.068	11.302	1.094
5.302	1.067	11.442	1.094
5.442	1.066	11.581	1.094
5.581	1.065	11.721	1.094
5.721	1.063	11.860	1.094
5.860	1.062	12.000	1.094
6.000	1.061		

Table 11. BASELOAD W(z) at 5000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.096	6.140	1.057
0.140	1.097	6.279	1.056
0.279	1.098	6.419	1.054
0.419	1.100	6.558	1.053
0.558	1.101	6.698	1.050
0.698	1.102	6.837	1.048
0.837	1.103	6.977	1.046
0.977	1.103	7.116	1.047
1.116	1.103	7.256	1.050
1.256	1.103	7.395	1.053
1.395	1.103	7.535	1.055
1.535	1.103	7.674	1.057
1.674	1.103	7.814	1.058
1.814	1.103	7.953	1.060
1.953	1.102	8.093	1.062
2.093	1.101	8.233	1.064
2.233	1.100	8.372	1.066
2.372	1.099	8.512	1.067
2.512	1.098	8.651	1.069
2.651	1.097	8.791	1.071
2.791	1.095	8.930	1.072
2.930	1.094	9.070	1.074
3.070	1.092	9.209	1.075
3.209	1.090	9.349	1.077
3.349	1.088	9.488	1.078
3.488	1.086	9.628	1.079
3.628	1.084	9.767	1.081
3.767	1.082	9.907	1.082
3.907	1.081	10.046	1.083
4.046	1.079	10.186	1.085
4.186	1.078	10.326	1.086
4.326	1.077	10.465	1.087
4.465	1.075	10.605	1.088
4.605	1.074	10.744	1.089
4.744	1.072	10.884	1.090
4.884	1.070	11.023	1.091
5.023	1.069	11.163	1.092
5.163	1.067	11.302	1.093
5.302	1.065	11.442	1.093
5.442	1.063	11.581	1.093
5.581	1.062	11.721	1.093
5.721	1.061	11.860	1.093
5.860	1.060	12.000	1.094
6.000	1.059		

Table 12. BASELOAD W(z) at 8000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.100	6.140	1.059
0.140	1.101	6.279	1.057
0.279	1.102	6.419	1.055
0.419	1.104	6.558	1.053
0.558	1.106	6.698	1.051
0.698	1.107	6.837	1.050
0.837	1.107	6.977	1.049
0.977	1.108	7.116	1.051
1.116	1.108	7.256	1.053
1.256	1.108	7.395	1.055
1.395	1.108	7.535	1.057
1.535	1.107	7.674	1.059
1.674	1.107	7.814	1.061
1.814	1.106	7.953	1.063
1.953	1.105	8.093	1.064
2.093	1.104	8.233	1.066
2.233	1.103	8.372	1.068
2.372	1.102	8.512	1.069
2.512	1.100	8.651	1.071
2.651	1.099	8.791	1.072
2.791	1.097	8.930	1.073
2.930	1.095	9.070	1.075
3.070	1.093	9.209	1.076
3.209	1.091	9.349	1.077
3.349	1.089	9.488	1.078
3.488	1.086	9.628	1.079
3.628	1.084	9.767	1.081
3.767	1.082	9.907	1.082
3.907	1.081	10.046	1.083
4.046	1.079	10.186	1.084
4.186	1.078	10.326	1.085
4.326	1.076	10.465	1.086
4.465	1.075	10.605	1.087
4.605	1.073	10.744	1.088
4.744	1.072	10.884	1.089
4.884	1.070	11.023	1.090
5.023	1.069	11.163	1.090
5.163	1.068	11.302	1.091
5.302	1.067	11.442	1.092
5.442	1.065	11.581	1.092
5.581	1.064	11.721	1.091
5.721	1.063	11.860	1.092
5.860	1.062	12.000	1.092
6.000	1.060		

Table 13. BASELOAD W(z) at 10000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.109	6.140	1.061
0.140	1.110	6.279	1.058
0.279	1.111	6.419	1.056
0.419	1.113	6.558	1.054
0.558	1.114	6.698	1.053
0.698	1.115	6.837	1.053
0.837	1.115	6.977	1.053
0.977	1.116	7.116	1.054
1.116	1.116	7.256	1.056
1.256	1.115	7.395	1.058
1.395	1.115	7.535	1.060
1.535	1.114	7.674	1.062
1.674	1.114	7.814	1.064
1.814	1.113	7.953	1.065
1.953	1.111	8.093	1.067
2.093	1.110	8.233	1.068
2.233	1.108	8.372	1.069
2.372	1.107	8.512	1.071
2.512	1.105	8.651	1.072
2.651	1.102	8.791	1.073
2.791	1.100	8.930	1.074
2.930	1.097	9.070	1.075
3.070	1.095	9.209	1.076
3.209	1.092	9.349	1.077
3.349	1.089	9.488	1.078
3.488	1.086	9.628	1.079
3.628	1.083	9.767	1.079
3.767	1.082	9.907	1.080
3.907	1.081	10.046	1.081
4.046	1.080	10.186	1.082
4.186	1.079	10.326	1.083
4.326	1.078	10.465	1.084
4.465	1.077	10.605	1.084
4.605	1.076	10.744	1.085
4.744	1.075	10.884	1.086
4.884	1.074	11.023	1.087
5.023	1.073	11.163	1.087
5.163	1.072	11.302	1.088
5.302	1.070	11.442	1.088
5.442	1.069	11.581	1.088
5.581	1.068	11.721	1.088
5.721	1.066	11.860	1.088
5.860	1.064	12.000	1.088
6.000	1.063		

Table 14. BASELOAD W(z) at 14000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.122	6.140	1.059
0.140	1.123	6.279	1.058
0.279	1.124	6.419	1.058
0.419	1.125	6.558	1.057
0.558	1.126	6.698	1.058
0.698	1.127	6.837	1.060
0.837	1.127	6.977	1.062
0.977	1.127	7.116	1.064
1.116	1.127	7.256	1.066
1.256	1.126	7.395	1.067
1.395	1.125	7.535	1.069
1.535	1.124	7.674	1.070
1.674	1.123	7.814	1.071
1.814	1.121	7.953	1.072
1.953	1.119	8.093	1.073
2.093	1.117	8.233	1.074
2.233	1.114	8.372	1.075
2.372	1.111	8.512	1.075
2.512	1.108	8.651	1.076
2.651	1.105	8.791	1.076
2.791	1.102	8.930	1.078
2.930	1.098	9.070	1.080
3.070	1.094	9.209	1.083
3.209	1.090	9.349	1.085
3.349	1.087	9.488	1.087
3.488	1.084	9.628	1.090
3.628	1.081	9.767	1.092
3.767	1.080	9.907	1.094
3.907	1.079	10.046	1.095
4.046	1.077	10.186	1.097
4.186	1.076	10.326	1.098
4.326	1.074	10.465	1.099
4.465	1.073	10.605	1.100
4.605	1.073	10.744	1.101
4.744	1.072	10.884	1.102
4.884	1.071	11.023	1.102
5.023	1.070	11.163	1.102
5.163	1.069	11.302	1.102
5.302	1.068	11.442	1.102
5.442	1.067	11.581	1.101
5.581	1.066	11.721	1.100
5.721	1.064	11.860	1.099
5.860	1.063	12.000	1.099
6.000	1.061		

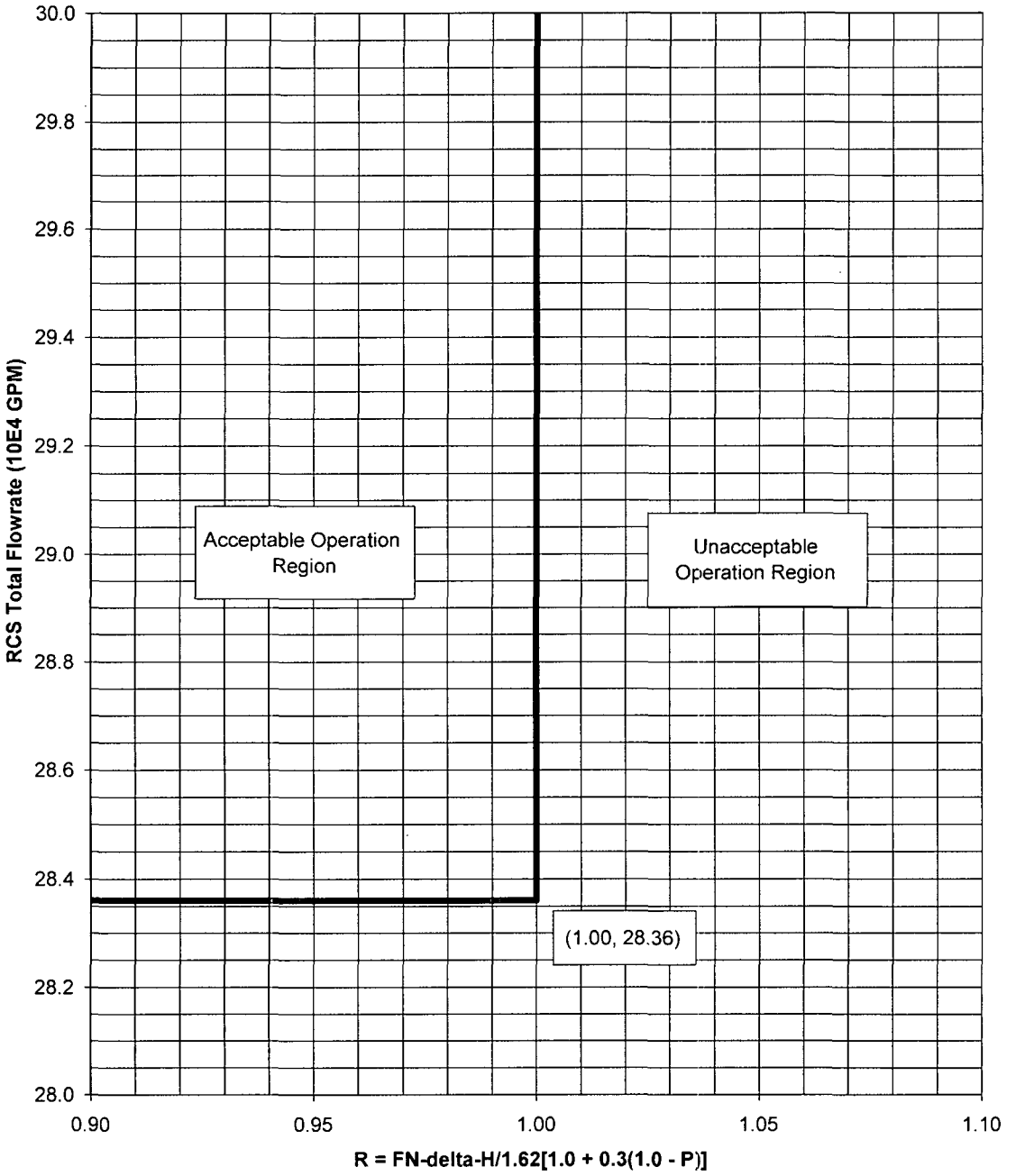
Table 15. BASELOAD W(z) at 20000 MWD/MTU
V. C. Summer – Cycle 21

Core Height (ft)	W(z)	Core Height (ft)	W(z)
0.000	1.150	6.140	1.068
0.140	1.151	6.279	1.071
0.279	1.152	6.419	1.073
0.419	1.153	6.558	1.075
0.558	1.154	6.698	1.077
0.698	1.154	6.837	1.078
0.837	1.154	6.977	1.080
0.977	1.152	7.116	1.081
1.116	1.151	7.256	1.082
1.256	1.149	7.395	1.083
1.395	1.147	7.535	1.084
1.535	1.144	7.674	1.084
1.674	1.141	7.814	1.085
1.814	1.138	7.953	1.085
1.953	1.134	8.093	1.085
2.093	1.129	8.233	1.085
2.233	1.125	8.372	1.085
2.372	1.120	8.512	1.085
2.512	1.114	8.651	1.085
2.651	1.109	8.791	1.084
2.791	1.103	8.930	1.084
2.930	1.097	9.070	1.083
3.070	1.091	9.209	1.083
3.209	1.086	9.349	1.085
3.349	1.082	9.488	1.087
3.488	1.080	9.628	1.090
3.628	1.078	9.767	1.092
3.767	1.077	9.907	1.094
3.907	1.076	10.046	1.096
4.046	1.074	10.186	1.098
4.186	1.073	10.326	1.099
4.326	1.071	10.465	1.100
4.465	1.070	10.605	1.101
4.605	1.069	10.744	1.102
4.744	1.069	10.884	1.103
4.884	1.068	11.023	1.103
5.023	1.068	11.163	1.103
5.163	1.068	11.302	1.103
5.302	1.067	11.442	1.105
5.442	1.066	11.581	1.108
5.581	1.064	11.721	1.105
5.721	1.063	11.860	1.100
5.860	1.063	12.000	1.098
6.000	1.065		

Table 16. BASE LOAD FQ Margin Decreases in Excess of 2% Per 31 EFPD – Cycle 21

Cycle Burnup (MWD/MTU)	Maximum Decrease in FQ Margin
837	1.0200
1008	1.0233
1180	1.0309
1352	1.0368
1523	1.0415
1695	1.0447
1867	1.0462
2038	1.0458
2210	1.0439
2382	1.0413
2553	1.0384
2725	1.0353
2896	1.0320
3068	1.0289
3240	1.0261
3411	1.0236
3583	1.0215
3755	1.0200

Figure 5. RCS Total Flowrate vs. R for Three Loop Operation
V. C. Summer – Cycle 21



Measurement Uncertainty of 2.1% for Flow (includes 0.1% for feedwater venturi fouling) is included in this figure.