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April 13, 2015

AEP-NRC-2015-38
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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Unit 2
CORE OPERATING LIMITS REPORT

Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant Unit 2, is submitting the Core Operating Limits Report (COLR) for Unit 2 Cycle 22 in accordance with Technical Specification 5.6.5. Revision 0 of the Unit 2 Cycle 22 COLR is provided as an enclosure to this letter.

There are no new or revised commitments in this letter. Should you have any questions, please contact me at (269) 466-2649.

Sincerely,

M.K. Scarpello

Michael K. Scarpello
Regulatory Affairs Manager

DMB/amp

Enclosure:

Donald C. Cook Nuclear Plant Unit 2 Cycle 22 Core Operating Limits Report, Revision 0

c: A. W. Dietrich, NRC Washington, D.C.
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A001
NRR

ENCLOSURE TO AEP-NRC-2015-38

Donald C. Cook Nuclear Plant Unit 2 Cycle 22

Core Operating Limits Report
Revision 0

Donald C. Cook Nuclear Plant
Unit 2 Cycle 22
Core Operating Limits Report
Revision 0

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for the Donald C. Cook Nuclear Plant Unit 2 Cycle 22 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the Nuclear Regulatory Commission (NRC) in:

a. WCAP-9272-P-A, Westinghouse Reload Safety Evaluation Methodology, July 1985

b. WCAP-8385, Power Distribution Control and Load Following Procedures – Topical Report, September 1974

c. WCAP-10216-P-A, Rev. 1A, Relaxation of Constant Axial Offset Control/F_Q Surveillance Technical Specification, February 1994

d. Plant-specific adaptation (approved by Amendment 297, dated March 31, 2011) of WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," Revision 0 (Westinghouse Proprietary), approved by letter from H. N. Berkow, NRC, to J. A. Gresham, Westinghouse Electric Company, dated November 5, 2004

e. WCAP-12610-P-A, VANTAGE+ Fuel Assembly Reference Core Report, April 1995

f. WCAP-8745-P-A, Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions, September 1986

g. WCAP-13749-P-A, Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement, March 1997

h. WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, Optimized ZIRLO™, July 2006

The Technical Specifications affected by this report are listed below:

2.1.1	Reactor Core SLs [Safety Limits]
3.1.1	SHUTDOWN MARGIN (SDM)
3.1.3	Moderator Temperature Coefficient (MTC)
3.1.5	Shutdown Bank Insertion Limits
3.1.6	Control Bank Insertion Limits
3.2.1	Heat Flux Hot Channel Factor ($F_Q(Z)$)
3.2.2	Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)
3.2.3	AXIAL FLUX DIFFERENCE (AFD)
3.3.1	Reactor Trip System (RTS) Instrumentation
3.4.1	RCS [Reactor Coolant System] Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits
3.9.1	Boron Concentration

2.0 OPERATING LIMITS

The cycle-specific parameter limits listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 5.6.5.

2.1 SAFETY LIMITS

2.1.1 Reactor Core SLs (Specification 2.1.1)

In Modes 1 and 2, the combination of thermal power, pressurizer pressure, and the highest loop average temperature (**T_{avg}**) shall not exceed the limits as shown in Figure 6 for 4 loop operation.

2.2 REACTIVITY CONTROL

2.2.1 SHUTDOWN MARGIN (SDM) (Specification 3.1.1)

Shutdown margin shall be greater than or equal to 1.3% Δk/k for $T_{avg} > 200°F$
Shutdown margin shall be greater than or equal to 1.0% Δk/k for $T_{avg} \leq 200°F$

2.2.2 Moderator Temperature Coefficient (MTC) (Specification 3.1.3)

a. The MTC limits are:

The BOL/ARO-MTC shall be less positive or equal to the value given in Figure 1.

The EOL/ARO/RTP-MTC shall be less negative or equal to -4.10E-4 **Δk/k/°F**.

This limit is based on a **T_{avg}** program with HFP vessel **T_{avg}** of 571.0 to 576.0 °F

Where: ARO stands for All Rods Out
BOL stands for Beginning of Cycle Life
EOL stands for End of Cycle Life
RTP stands for Rated Thermal Power
HFP stands for Hot Full Thermal Power

b. The MTC Surveillance limit is:
The 300 ppm/ARO/RTP-MTC should be less negative or equal to -3.20E-4 **Δk/k/°F** at a HFP vessel $\mathbf{T_{avg}}$ of 571.0 to 576.0 °F

c. The Revised Predicted near-EOL 300 ppm MTC shall be calculated using Figure 7 and the following algorithm:

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

* Predicted Correction is -0.30E-4 **Δk/k/°F**.

If the Revised Predicted MTC is less negative than the Surveillance Requirement (SR) 3.1.3.2 limit (COLR 2.2.2.b) and all of the benchmark data contained in the surveillance procedure are met, then a MTC measurement in accordance with SR 3.1.3.2 is not required.

d. The MTC Surveillance limit is:
The 60 ppm/ARO/RTP-MTC should be less negative or equal to -3.90E-4 **Δk/k/°F** at a HFP vessel $\mathbf{T_{avg}}$ of 571.0 to 576.0 °F

2.2.3 Shutdown Bank Insertion Limits (Specification 3.1.5)

The shutdown rods shall be withdrawn to at least 228 steps.

2.2.4 Control Bank Insertion Limits (Specifications 3.1.6)

a. The control rod banks shall be limited in physical insertion as shown in Figure 2.

b. Successive Control Banks shall overlap by 100 steps. The sequence for Control Bank withdrawal shall be Control Bank A, Control Bank B, Control Bank C, and Control Bank D.

2.3 POWER DISTRIBUTION LIMITS

2.3.1 AXIAL FLUX DIFFERENCE (AFD) (Specification 3.2.3)

a. The Allowable Operation Limits are provided in Figure 3.

b. The AFD target band is ±5% for a cycle average accumulated burnup ≥0.0 MWD/MTU [Megawatt Days/Metric Ton Uranium].

2.3.2 Heat Flux Hot Channel Factor ($F_Q(Z)$) (Specification 3.2.1)

$$F_Q^C(Z) \le \frac{CF_Q}{P} * K(Z) \qquad for\ P > 0.5$$

$$F_Q^C(Z) \le 2 * CF_Q * K(Z) \qquad for\ P \le 0.5$$

$$F_Q^W(Z) \le \frac{CF_Q}{P} * K(Z) \qquad for\ P > 0.5$$

$$F_Q^W(Z) \le 2 * CF_Q * K(Z) \qquad for\ P \le 0.5$$

Where: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

a. $\mathbf{CF_Q}$ = 2.335

b. **K(Z)** is provided in Figure 4

c. $\mathbf{F_Q^C(Z)}$ is the measured hot channel factor including a 3% manufacturing tolerance uncertainty and a 5% measurement uncertainty.

d. **W(Z)** is provided in Table 1 for ±5% AFD target band.

e. $\mathbf{F_Q^W(Z) = F_Q^C(Z)}$ x **W(Z)** x $\mathbf{F_P}$

The W(z) values are generated assuming that they will be used for a full power surveillance. When a part power surveillance is performed, the W(z) values should be multiplied by the factor 1/P, when P is > 0.5. When P is ≤ 0.5, the W(z) values should be multiplied by the factor 1/(0.5), or 2.0. This is consistent with the adjustment in the $F_Q(z)$ limit at part power conditions.

f. For Cycle 22, F_P = 1.02 for all burnups associated with Note 2a of SR 3.2.1.2, except as shown in the table below. When no penalty is required, F_P = 1.00.

Cycle Burnup (MWD/MTU)	**F_P Penalty Multiplier**
150	1.0200
317	1.0262
484	1.0421
651	1.0472
818	1.0490
984	1.0494
1151	1.0482
1318	1.0458
1485	1.0424
1652	1.0385
1819	1.0345
1986	1.0311
2153	1.0284
2320	1.0262
2486	1.0247
2653	1.0238
2820	1.0234
2987	1.0233
3154	1.0234
3321	1.0230
3488	1.0222
3655	1.0210
3822	1.0200

The burnup range only covers where F_P exceeds 1.02. Linear interpolation is adequate for intermediate cycle burnups.

2.3.3 Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$) (Specification 3.2.2)

$$F^N_{\Delta H} \leq CF_{\Delta H} * (1 + PF_{\Delta H} *(1-P))$$

Where: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

a. $\mathbf{CF_{\Delta H}} = 1.61$
b. $\mathbf{PF_{\Delta H}} = 0.3$
c. $\mathbf{F^N_{\Delta H}}$ is the measured Enthalpy Rise Hot Channel Factor including a 4% measurement uncertainty.

2.4 INSTRUMENTATION

2.4.1 Reactor Trip System (RTS) Instrumentation (Specification 3.3.1)

The Overtemperature **ΔT** and Overpower **ΔT** setpoints are as shown in Figure 5.

2.5 REACTOR COOLANT SYSTEM

2.5.1 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits (Specification 3.4.1)

a. Pressurizer Pressure shall be ≥ 2172.4 psig [+]

b. RCS $\mathbf{T_{avg}}$ shall be ≤ 580.1 °F [+]

c. RCS Total Flow Rate shall be ≥ 366,400 gpm

2.6 REFUELING OPERATIONS

2.6.1 Boron Concentration (Specification 3.9.1)

The boron concentration of all filled portions of the Reactor Coolant System, the refueling canal and the refueling cavity shall be greater than or equal to 2400 ppm[++].

[+] These are Safety Analysis values. With readability allowance, the corresponding values are 577.8°F for $\mathbf{T_{avg}}$, and 2200 psig for Pressurizer Pressure.

[++] This concentration bounds the condition of $K_{eff} \leq 0.95$ which includes a 1% Δk/k conservative allowance for uncertainties. The boron concentration of 2400 ppm includes a 50 ppm conservative allowance for uncertainties.

FIGURE 1
MODERATOR TEMPERATURE COEFFICIENT (MTC) LIMITS

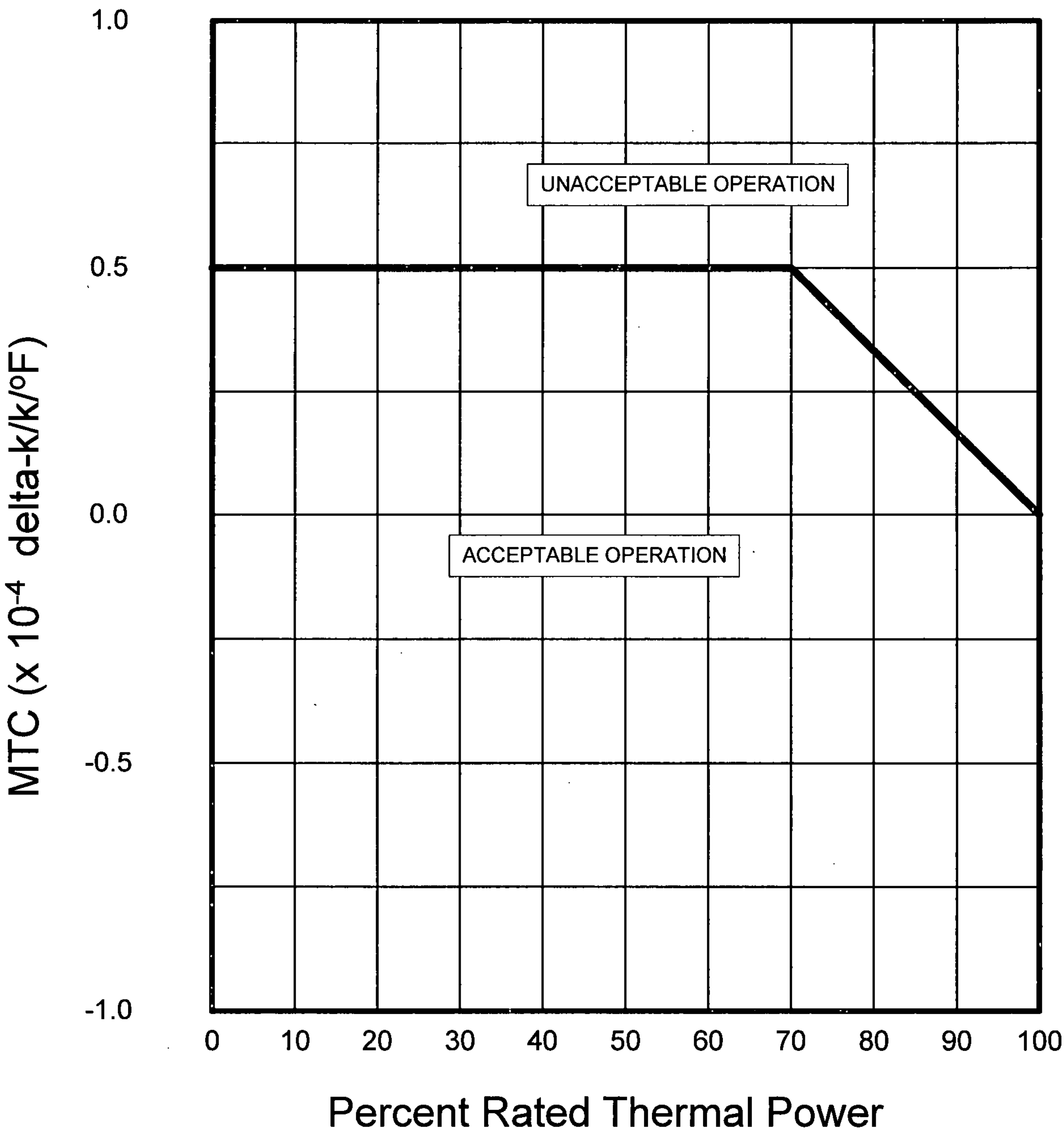


FIGURE 2
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

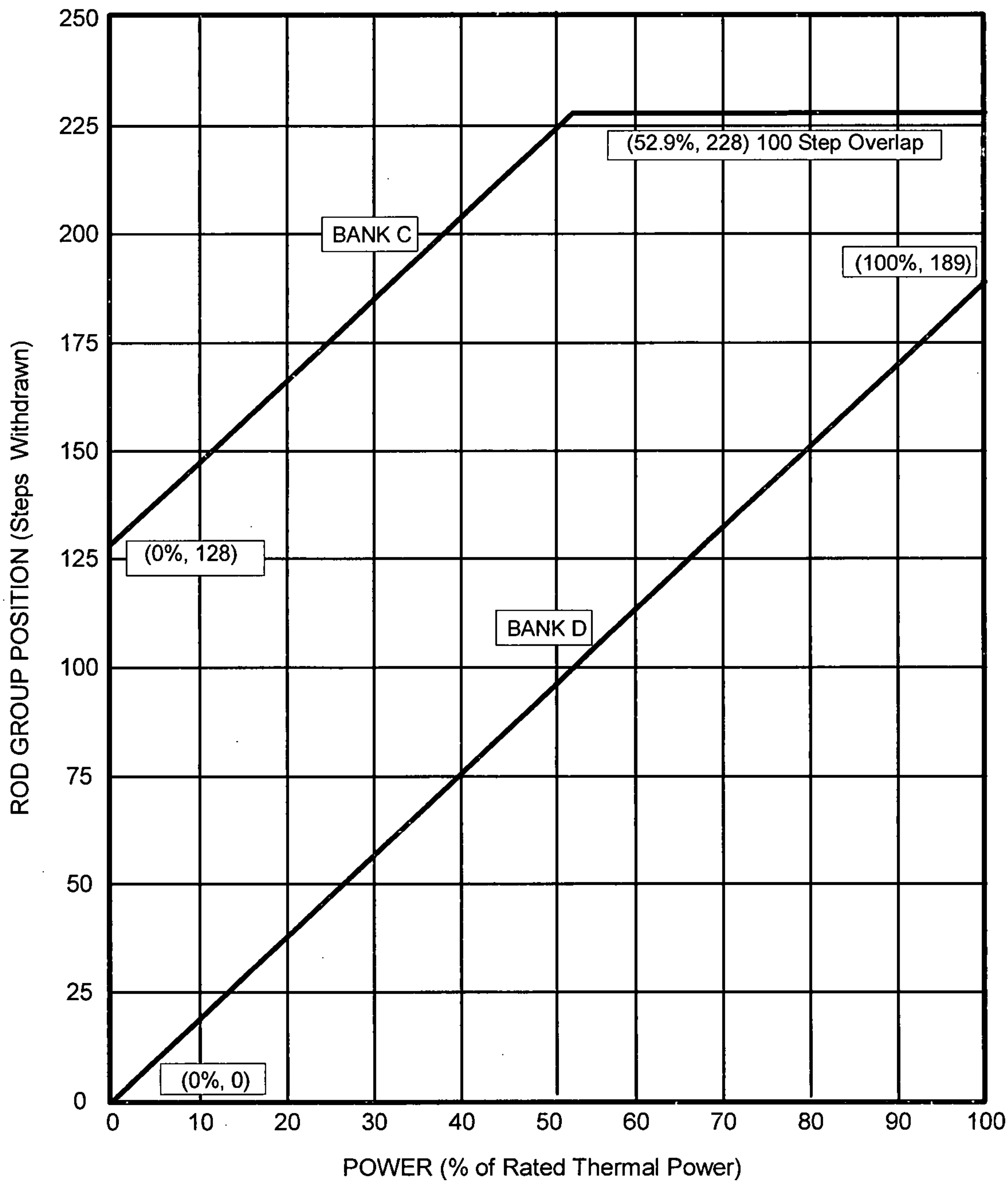


FIGURE 3

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER (RTP)

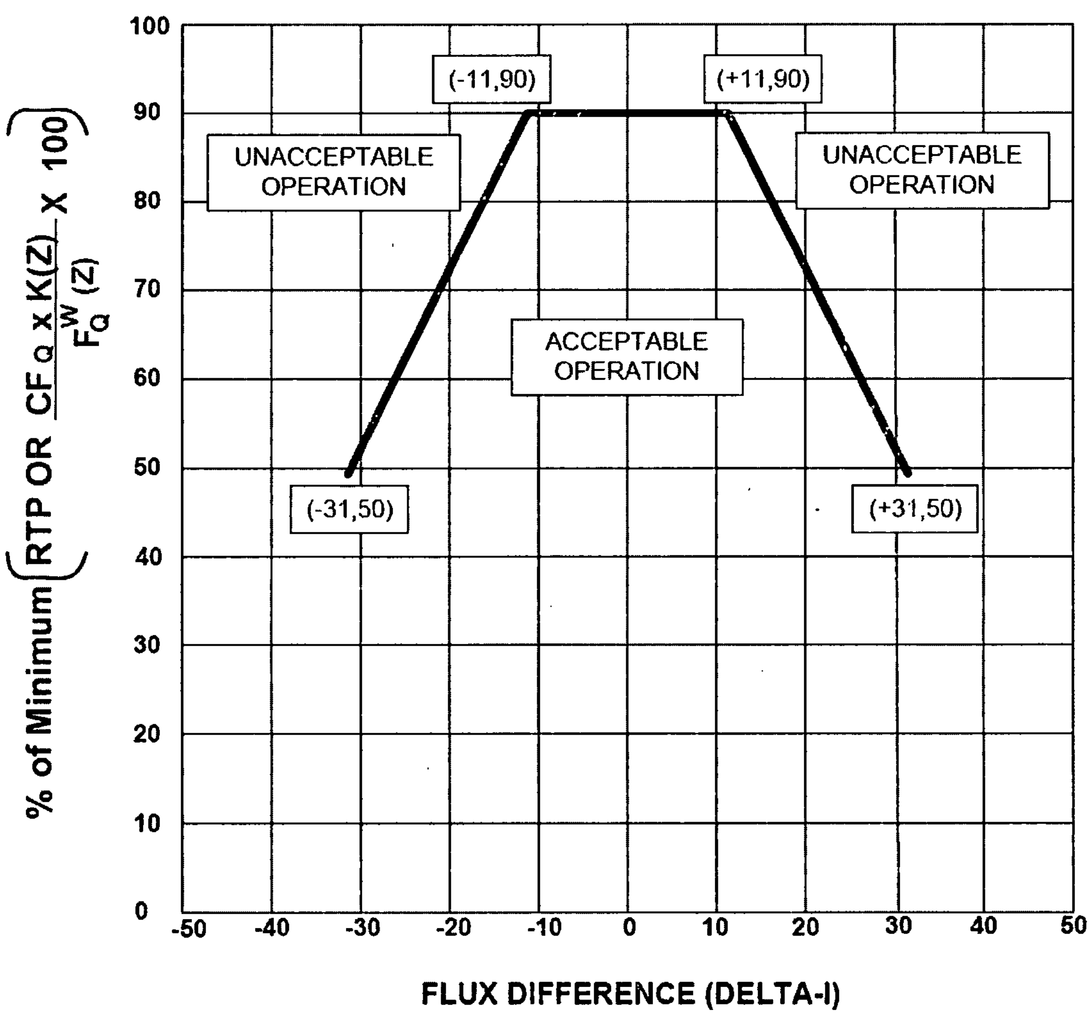


FIGURE 4
K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

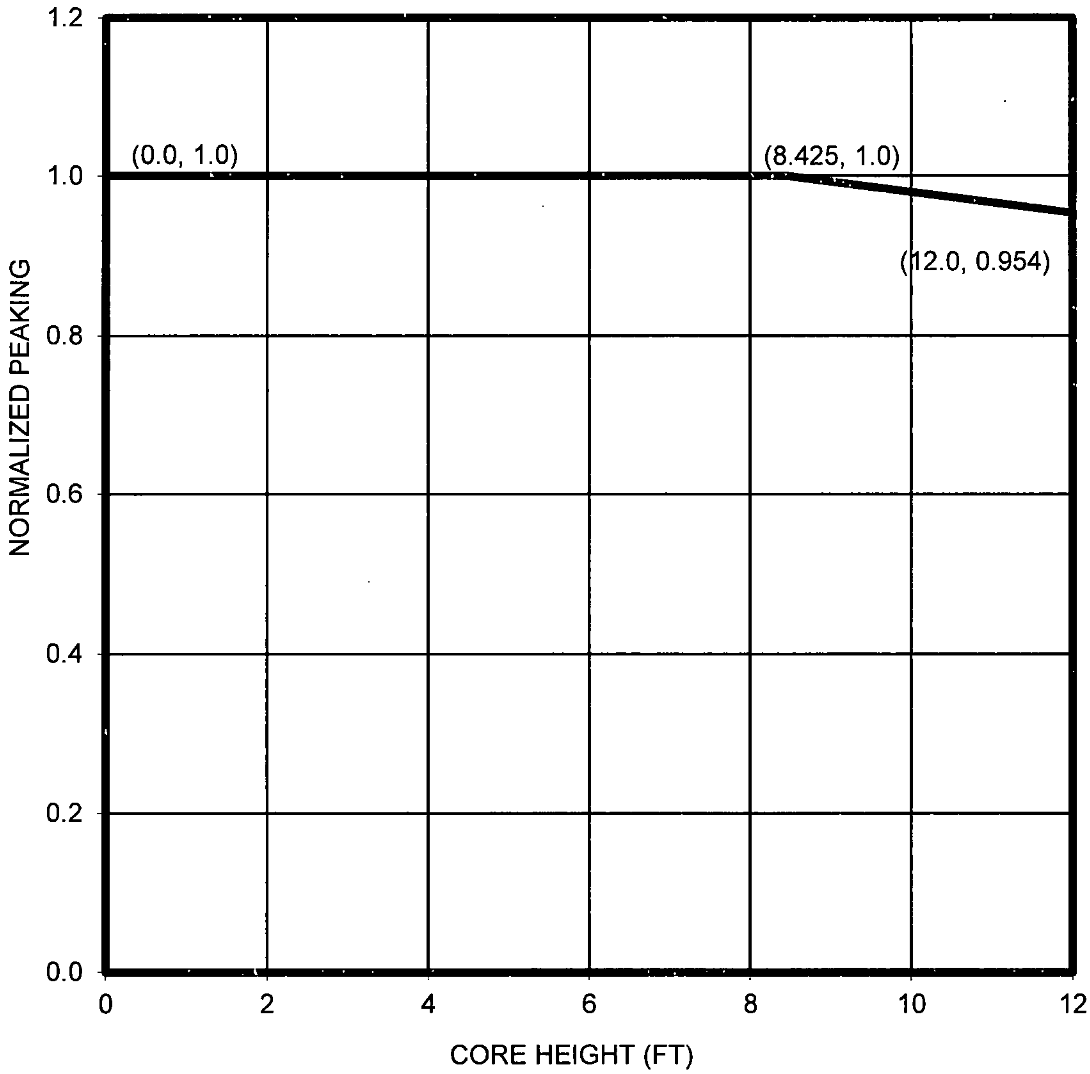


FIGURE 5

(Page 1 of 2)

Reactor Trip System Instrumentation Trip Setpoints

Overtemperature ΔT Trip Setpoint

Overtemperature $\Delta T \leq \Delta T_0 \left[K_1 - K_2 \left[\frac{1+\tau_1 S}{1+\tau_2 S}\right](T-T') + K_3(P-P') - f_1(\Delta I)\right]$

Where:

ΔT	=	Measured RCS ΔT, °F
ΔT_0	=	Indicated ΔT at RATED THERMAL POWER, °F
T	=	Average temperature, °F
T'	=	Nominal T_{avg} at RATED THERMAL POWER, (≤ 576.0°F)
P	=	Pressurizer Pressure, psig
P'	=	Nominal RCS operating pressure (2235 psig)
$\left[\frac{1+\tau_1 S}{1+\tau_2 S}\right]$	=	The function generated by the lead-lag controller for T_{avg} dynamic compensation
τ_1, τ_2	=	Time constants utilized in the lead-lag controller for T_{avg} $\tau_1 \geq 28$ secs. $\tau_2 \leq 4$ secs.
S	=	Laplace transform operator, sec^{-1}
K_1	≤	1.19 *
K_2	≥	0.01331/°F
K_3	≥	0.00058/psig
$f_1(\Delta I)$	=	$-3.5\{33\% + (q_t - q_b)\}$ when $q_t - q_b \leq -33\%$ RTP 0% of RTP when -33% RTP $< q_t - q_b \leq 6\%$ RTP $+1.0\{(q_t - q_b) - 6\%\}$ when $q_t - q_b > 6\%$ RTP

where q_t and q_b are percent RATED THERMAL POWER in the upper and lower halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent RATED THERMAL POWER.

* This is a Safety Analysis value. Refer to Technical Requirements Manual for nominal value of this coefficient used in programming the trip setpoint.

FIGURE 5

(Page 2 of 2)

Overpower ΔT Trip Setpoint

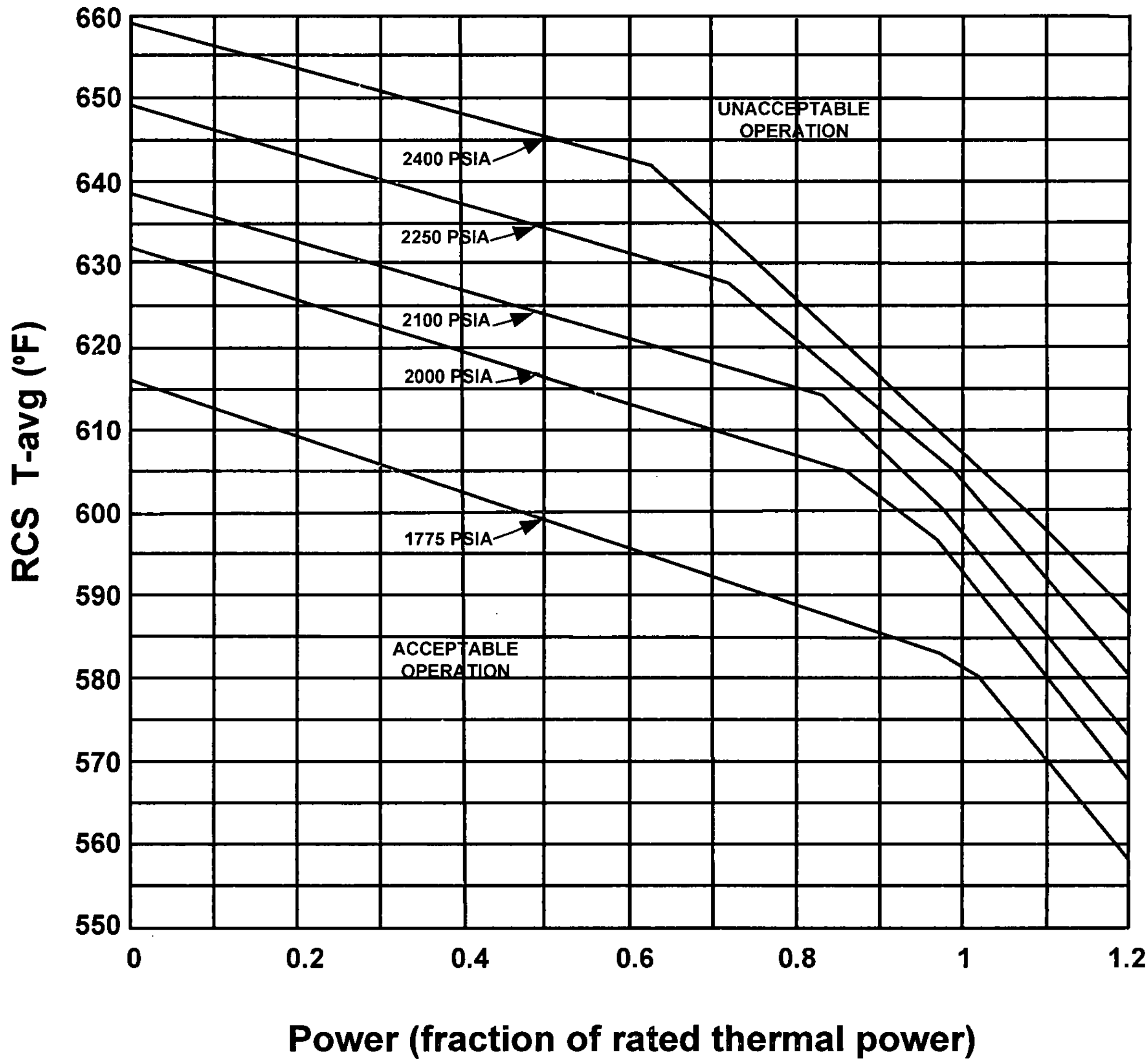
Overpower $\Delta T \leq \Delta T_0 \left[K_4 - K_5 \left[\frac{\tau_3 S}{1+\tau_3 S}\right] T - K_6 (T - T'') - f_2(\Delta I)\right]$

Where:

ΔT	=	Measured RCS **ΔT**, °F
ΔT_0	=	Indicated **ΔT** at RATED THERMAL POWER, °F
T	=	Average temperature, °F
T''	=	Nominal T_{avg} at RATED THERMAL POWER, (≤ 576.0 °F)
K_4	≤	1.16 *
K_5	≥	0.02/°F for increasing average temperature; $K_5 = 0$ for decreasing average temperature
K_6	≥	0.00197/°F for **T** greater than **T''** ; K_6=0 for **T** less than or equal to **T''**
$\frac{\tau_3 S}{1+\tau_3 S}$	=	The function generated by the rate lag controller for T_{avg} dynamic compensation
τ_3	=	Time constant utilized in the rate lag controller for T_{avg}; $\tau_3 \geq 10$ secs.
S	=	Laplace transform operator, sec^{-1}
$f_2(\Delta I)$	=	0.0

* This is a Safety Analysis value. Refer to Technical Requirements Manual for nominal value of this coefficient used in programming the trip setpoint.

FIGURE 6
Reactor Core Safety Limits

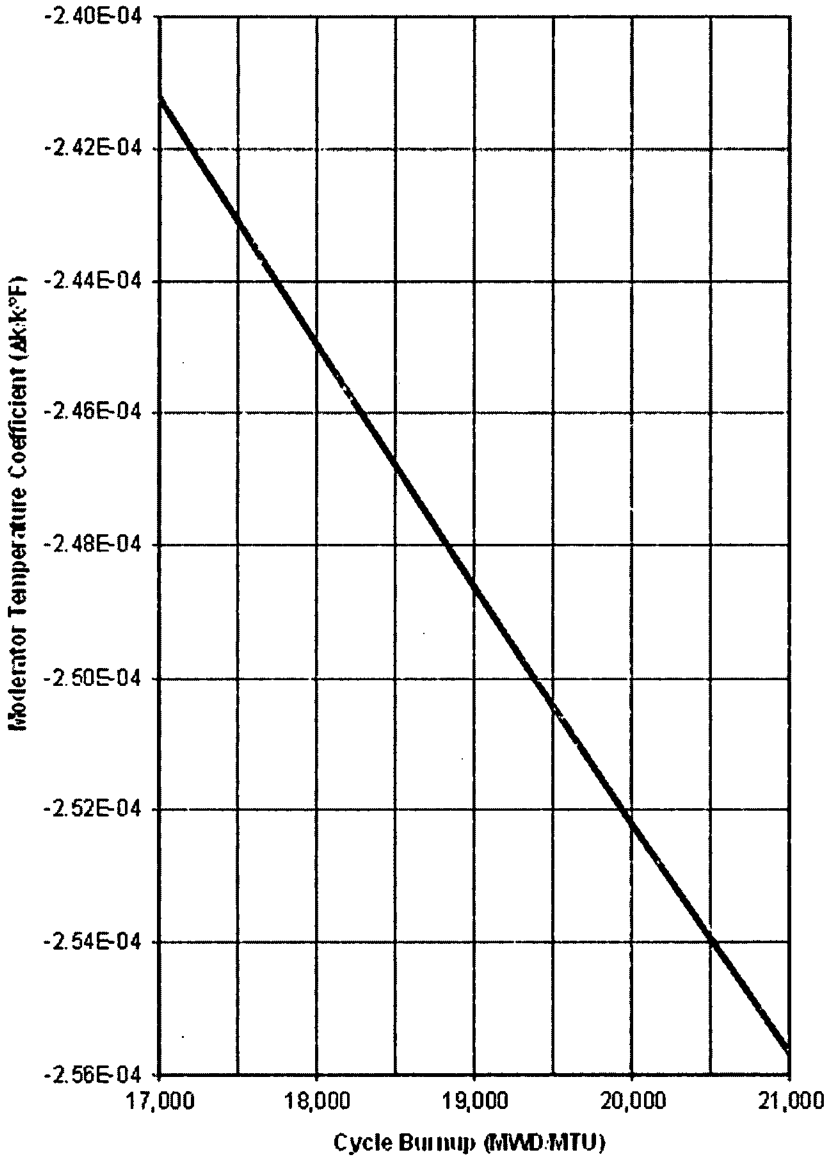


DESCRIPTION OF SAFETY LIMITS

PRESSURE (psia)	Power (frac)	Tavg (° F)	Power (frac)	Tavg (° F)	Power (frac)	Tavg (° F)	Power (frac)	Tavg (° F)
1775	0.00	615.4	0.98	583.8	1.02	580.9	1.2	558.1
2000	0.00	631.8	0.86	605.8	0.96	597.5	1.2	568.5
2100	0.00	639.1	0.82	614.0	0.96	601.6	1.2	573.1
2250	0.00	649.2	0.72	628.6	0.98	605.2	1.2	580.4
2400	0.00	659.0	0.62	642.0	1.1	599.0	1.2	588.1

FIGURE 7

Unit 2 Cycle 22 Predicted HFP ARO 300 PPM MTC Versus Burnup



Burnup (MWD/MTU)	MTC (pcm/°F)	MTC (Δk/k/°F)
17000	-24.123	-2.4123E-04
18000	-24.496	-2.4496E-04
19000	-24.862	-2.4862E-04
20000	-25.221	-2.5221E-04
21000	-25.567	-2.5567E-04

Table 1

D. C. Cook Unit 2 Cycle 22

W(Z) Function

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000	10000
1	0.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	0.6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0.8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2	1.1189	1.1167	1.1145	1.1113	1.1098	1.1099	1.1116
8	1.4	1.1173	1.1145	1.1117	1.1079	1.1069	1.1084	1.1114
9	1.6	1.1153	1.1120	1.1087	1.1046	1.1041	1.1068	1.1109
10	1.8	1.1128	1.1090	1.1054	1.1010	1.1010	1.1048	1.1100
11	2.0	1.1099	1.1066	1.1034	1.0996	1.0999	1.1037	1.1087
12	2.2	1.1066	1.1041	1.1018	1.0991	1.0996	1.1028	1.1070
13	2.4	1.1030	1.1013	1.0998	1.0982	1.0989	1.1016	1.1049
14	2.6	1.0990	1.0982	1.0976	1.0971	1.0980	1.1000	1.1024
15	2.8	1.0947	1.0948	1.0951	1.0957	1.0968	1.0982	1.0995
16	3.0	1.0903	1.0913	1.0923	1.0941	1.0953	1.0960	1.0964
17	3.2	1.0864	1.0880	1.0898	1.0923	1.0934	1.0933	1.0927
18	3.4	1.0842	1.0862	1.0883	1.0910	1.0916	1.0905	1.0889
19	3.6	1.0853	1.0871	1.0889	1.0911	1.0910	1.0892	1.0871
20	3.8	1.0868	1.0883	1.0897	1.0913	1.0906	1.0882	1.0858
21	4.0	1.0889	1.0898	1.0906	1.0913	1.0901	1.0876	1.0854
22	4.2	1.0916	1.0917	1.0917	1.0911	1.0895	1.0872	1.0855
23	4.4	1.0942	1.0934	1.0925	1.0908	1.0889	1.0871	1.0863
24	4.6	1.0966	1.0949	1.0931	1.0902	1.0881	1.0869	1.0868
25	4.8	1.0986	1.0961	1.0935	1.0894	1.0871	1.0865	1.0872
26	5.0	1.1003	1.0969	1.0935	1.0883	1.0859	1.0858	1.0873
27	5.2	1.1017	1.0974	1.0932	1.0870	1.0843	1.0848	1.0872
28	5.4	1.1025	1.0975	1.0925	1.0853	1.0825	1.0836	1.0867
29	5.6	1.1029	1.0972	1.0914	1.0833	1.0806	1.0825	1.0866
30	5.8	1.1028	1.0962	1.0896	1.0807	1.0784	1.0816	1.0870

Top and bottom 10% of core excluded.

Table 1 (Continued)

D. C. Cook Unit 2 Cycle 22

W(Z) Function

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000	10000
31	6.0	1.1020	1.0949	1.0878	1.0784	1.0765	1.0809	1.0874
32	6.2	1.1007	1.0934	1.0862	1.0768	1.0752	1.0801	1.0871
33	6.4	1.0987	1.0915	1.0843	1.0750	1.0737	1.0789	1.0863
34	6.6	1.0961	1.0889	1.0819	1.0728	1.0717	1.0771	1.0848
35	6.8	1.0929	1.0858	1.0789	1.0701	1.0692	1.0749	1.0828
36	7.0	1.0883	1.0818	1.0754	1.0673	1.0665	1.0718	1.0794
37	7.2	1.0853	1.0788	1.0724	1.0643	1.0636	1.0691	1.0770
38	7.4	1.0887	1.0805	1.0725	1.0626	1.0623	1.0699	1.0802
39	7.6	1.0916	1.0837	1.0760	1.0665	1.0663	1.0738	1.0837
40	7.8	1.0938	1.0869	1.0803	1.0720	1.0718	1.0782	1.0868
41	8.0	1.0957	1.0897	1.0839	1.0766	1.0764	1.0821	1.0895
42	8.2	1.0972	1.0922	1.0873	1.0813	1.0811	1.0857	1.0918
43	8.4	1.0982	1.0943	1.0905	1.0857	1.0855	1.0890	1.0936
44	8.6	1.0988	1.0960	1.0933	1.0899	1.0896	1.0920	1.0951
45	8.8	1.0989	1.0974	1.0958	1.0938	1.0935	1.0945	1.0960
46	9.0	1.0986	1.0983	1.0980	1.0974	1.0970	1.0968	1.0966
47	9.2	1.0977	1.0987	1.0997	1.1007	1.1002	1.0986	1.0970
48	9.4	1.0971	1.0993	1.1013	1.1037	1.1030	1.1000	1.0969
49	9.6	1.1009	1.1030	1.1050	1.1070	1.1057	1.1020	1.0983
50	9.8	1.1065	1.1079	1.1091	1.1101	1.1085	1.1049	1.1016
51	10.0	1.1110	1.1119	1.1126	1.1130	1.1113	1.1082	1.1054
52	10.2	1.1154	1.1156	1.1156	1.1150	1.1132	1.1107	1.1086
53	10.4	1.1194	1.1186	1.1177	1.1160	1.1142	1.1125	1.1115
54	10.6	1.1227	1.1236	1.1244	1.1245	1.1220	1.1176	1.1137
55	10.8	1.1255	1.1249	1.1242	1.1225	1.1201	1.1175	1.1154
56	11.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	12.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Top and bottom 10% of core excluded.

Table 1 (Continued)

D. C. Cook Unit 2 Cycle 22

W(Z) Function

Node #	Height (ft)	Burnup (MWD/MTU) 12000	14000	16000	18000	20000	22000	22956
1	0.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	0.6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0.8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2	1.1148	1.1196	1.1257	1.1332	1.1422	1.1485	1.1514
8	1.4	1.1154	1.1201	1.1256	1.1320	1.1396	1.1454	1.1481
9	1.6	1.1154	1.1200	1.1248	1.1302	1.1363	1.1415	1.1439
10	1.8	1.1149	1.1193	1.1235	1.1277	1.1323	1.1368	1.1390
11	2.0	1.1132	1.1170	1.1206	1.1240	1.1277	1.1315	1.1333
12	2.2	1.1107	1.1138	1.1167	1.1195	1.1224	1.1254	1.1269
13	2.4	1.1078	1.1102	1.1123	1.1144	1.1164	1.1187	1.1198
14	2.6	1.1044	1.1060	1.1074	1.1087	1.1098	1.1113	1.1120
15	2.8	1.1006	1.1014	1.1021	1.1026	1.1029	1.1035	1.1038
16	3.0	1.0965	1.0964	1.0961	1.0957	1.0949	1.0946	1.0944
17	3.2	1.0919	1.0912	1.0904	1.0894	1.0882	1.0872	1.0868
18	3.4	1.0878	1.0871	1.0867	1.0864	1.0863	1.0858	1.0855
19	3.6	1.0860	1.0858	1.0863	1.0875	1.0890	1.0895	1.0897
20	3.8	1.0849	1.0854	1.0870	1.0895	1.0929	1.0944	1.0951
21	4.0	1.0849	1.0860	1.0884	1.0919	1.0966	1.0990	1.1001
22	4.2	1.0855	1.0872	1.0902	1.0945	1.1000	1.1031	1.1045
23	4.4	1.0870	1.0891	1.0926	1.0972	1.1031	1.1066	1.1082
24	4.6	1.0882	1.0908	1.0946	1.0995	1.1057	1.1096	1.1114
25	4.8	1.0891	1.0922	1.0962	1.1014	1.1078	1.1120	1.1140
26	5.0	1.0899	1.0933	1.0976	1.1028	1.1093	1.1138	1.1160
27	5.2	1.0903	1.0940	1.0984	1.1038	1.1103	1.1150	1.1172
28	5.4	1.0903	1.0943	1.0989	1.1042	1.1105	1.1154	1.1177
29	5.6	1.0908	1.0949	1.0993	1.1043	1.1101	1.1149	1.1171
30	5.8	1.0919	1.0961	1.1002	1.1043	1.1090	1.1135	1.1156

Top and bottom 10% of core excluded.

Table 1 (Continued)

D. C. Cook Unit 2 Cycle 22

W(Z) Function

Node #	Height (ft)	Burnup (MWD/MTU) 12000	14000	16000	18000	20000	22000	22956
31	6.0	1.0928	1.0969	1.1003	1.1034	1.1066	1.1105	1.1123
32	6.2	1.0927	1.0968	1.0998	1.1024	1.1050	1.1086	1.1103
33	6.4	1.0923	1.0967	1.1003	1.1033	1.1064	1.1104	1.1123
34	6.6	1.0912	1.0963	1.1005	1.1044	1.1085	1.1132	1.1155
35	6.8	1.0897	1.0953	1.1003	1.1050	1.1099	1.1154	1.1180
36	7.0	1.0864	1.0925	1.0983	1.1041	1.1104	1.1166	1.1196
37	7.2	1.0843	1.0909	1.0971	1.1035	1.1105	1.1173	1.1205
38	7.4	1.0887	1.0955	1.1011	1.1061	1.1112	1.1174	1.1203
39	7.6	1.0918	1.0980	1.1029	1.1071	1.1111	1.1166	1.1192
40	7.8	1.0937	1.0990	1.1032	1.1068	1.1104	1.1150	1.1173
41	8.0	1.0955	1.0999	1.1034	1.1063	1.1090	1.1128	1.1147
42	8.2	1.0966	1.1001	1.1028	1.1050	1.1070	1.1100	1.1115
43	8.4	1.0973	1.0999	1.1018	1.1032	1.1046	1.1067	1.1078
44	8.6	1.0974	1.0990	1.1001	1.1008	1.1014	1.1027	1.1033
45	8.8	1.0971	1.0978	1.0983	1.0987	1.0990	1.0996	1.0999
46	9.0	1.0967	1.0970	1.0975	1.0981	1.0989	1.0993	1.0996
47	9.2	1.0963	1.0965	1.0974	1.0989	1.1009	1.1018	1.1022
48	9.4	1.0955	1.0957	1.0972	1.0998	1.1033	1.1047	1.1053
49	9.6	1.0967	1.0972	1.0993	1.1029	1.1077	1.1097	1.1106
50	9.8	1.1003	1.1011	1.1035	1.1073	1.1124	1.1147	1.1157
51	10.0	1.1045	1.1054	1.1077	1.1113	1.1162	1.1184	1.1195
52	10.2	1.1082	1.1092	1.1115	1.1150	1.1195	1.1218	1.1229
53	10.4	1.1116	1.1129	1.1151	1.1182	1.1223	1.1246	1.1256
54	10.6	1.1120	1.1126	1.1150	1.1189	1.1243	1.1266	1.1276
55	10.8	1.1150	1.1159	1.1181	1.1215	1.1259	1.1282	1.1292
56	11.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	12.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Top and bottom 10% of core excluded.