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

Donald C. Cook Nuclear Plant Unit 1
CORE OPERATING LIMITS REPORT

Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant Unit 1, is submitting the Core Operating Limits Report (COLR) for Unit 1 Cycle 29 in accordance with Technical Specification 5.6.5. Revision 0 of the Unit 1 Cycle 29 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,

Michael K. Scarpello
Regulatory Affairs Director

MDS/mll

Enclosure: Donald C. Cook Nuclear Plant Unit 1 Cycle 29 Core Operating Limits Report, Revision 0

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A001
NRR

ENCLOSURE TO AEP-NRC-2019-27

Donald C. Cook Nuclear Plant Unit 1 Cycle 29

Core Operating Limits Report
Revision 0

Donald C. Cook Nuclear Plant
Unit 1 Cycle 29
Core Operating Limits Report

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Donald C. Cook Nuclear Plant Unit 1 Cycle 29 design 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 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 of WCAP-16009-P-A, Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM), as approved by NRC Safety Evaluation dated October 17, 2008

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 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 Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits
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 Technical Specifications 5.6.5.

2.1 SAFETY LIMITS

2.1.1 Reactor Core Safety Limits (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 Moderator Temperature Coefficient (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 –4.54E-4 **Δk/k/°F**.

This limit is based on a T_{avg} program with HFP vessel T_{avg} of 569.0 to 573.0 °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
–3.84E-4 **Δk/k/°F** at a HFP vessel T_{avg} of 569.0 to 573.0 °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 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
-4.41E-4 **Δk/k/°F** at a HFP vessel T_{avg} of 569.0 to 573.0 °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, but may be reduced to ±3%.

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. $\mathbf{CF_Q} = 2.09$

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 either Table 1 for the ±5% AFD target band or in Table 2 for the ±3% AFD target band.

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

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 29, FP = 1.02 for all burnups associated with Note 2a of SR 3.2.1.2. When no penalty is required, FP = 1.00.

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

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

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

a. $\mathbf{CF_{\Delta H}} = 1.53$

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 ≥ 2168 psig [+]

b. Reactor Coolant System T_{AVG} shall be ≤ 580.5°F [+]

c. Reactor Coolant System Total Flow Rate shall be ≥ 362,900 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 578.2°F for 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

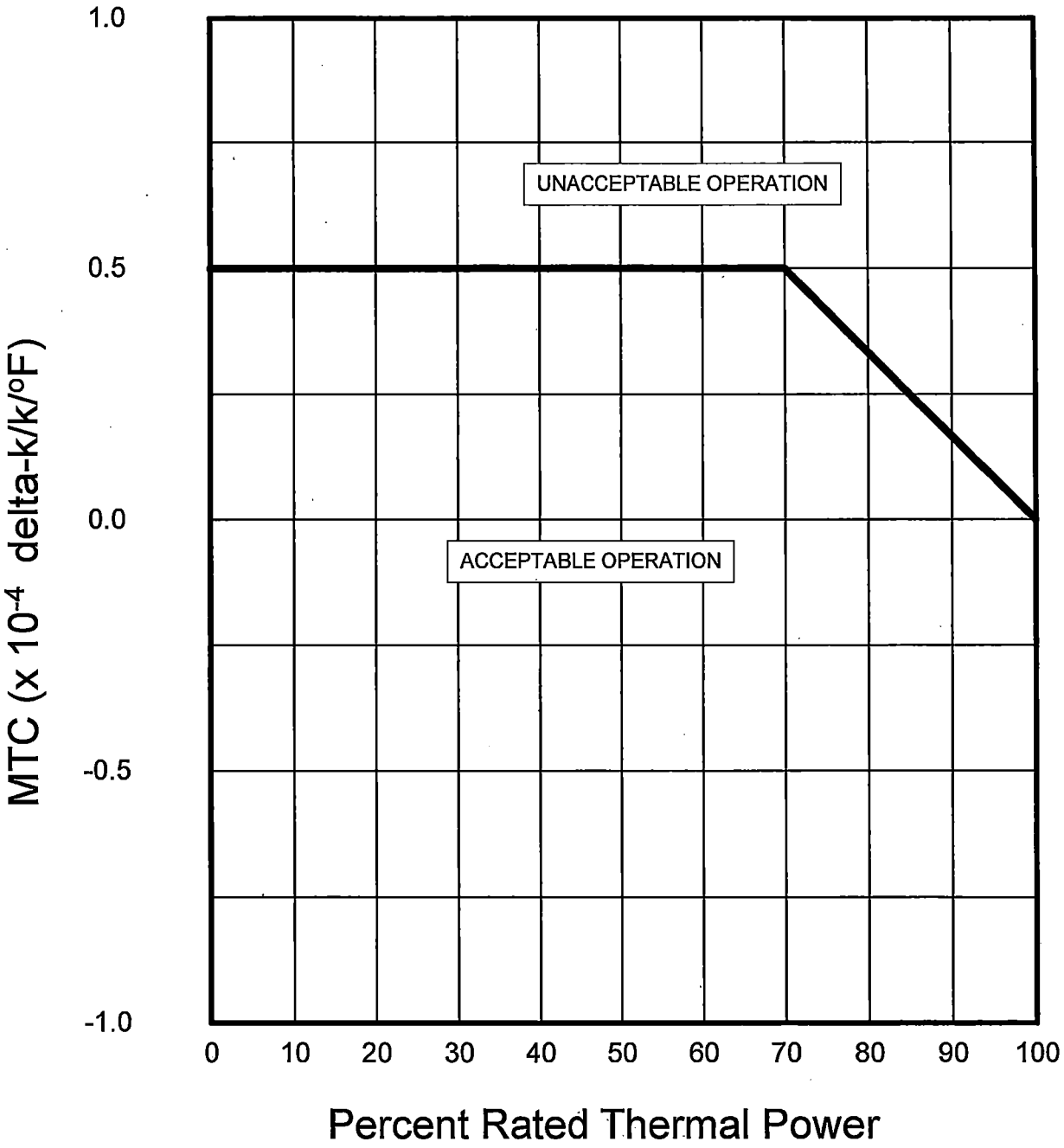


FIGURE 2

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

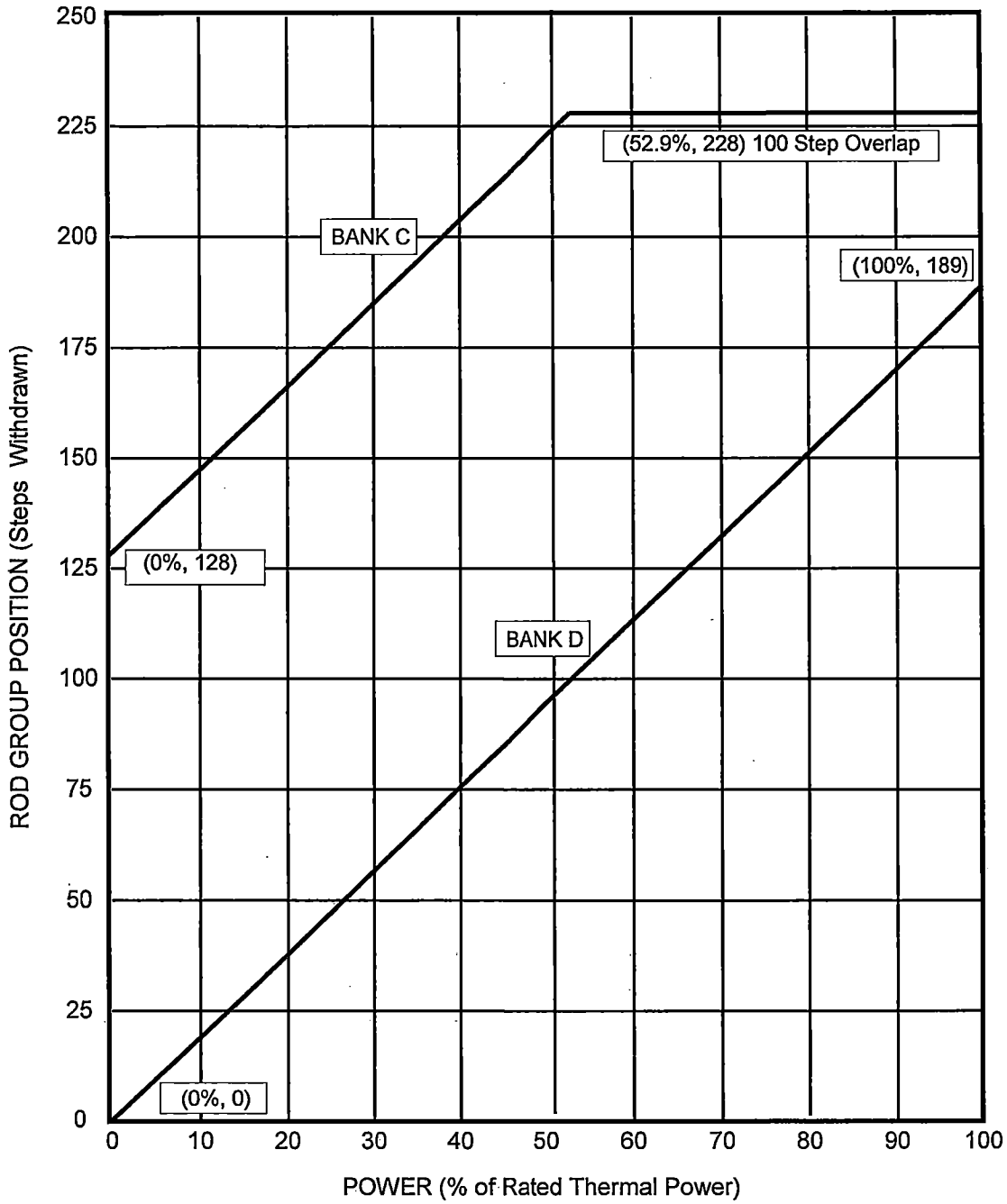


FIGURE 3

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

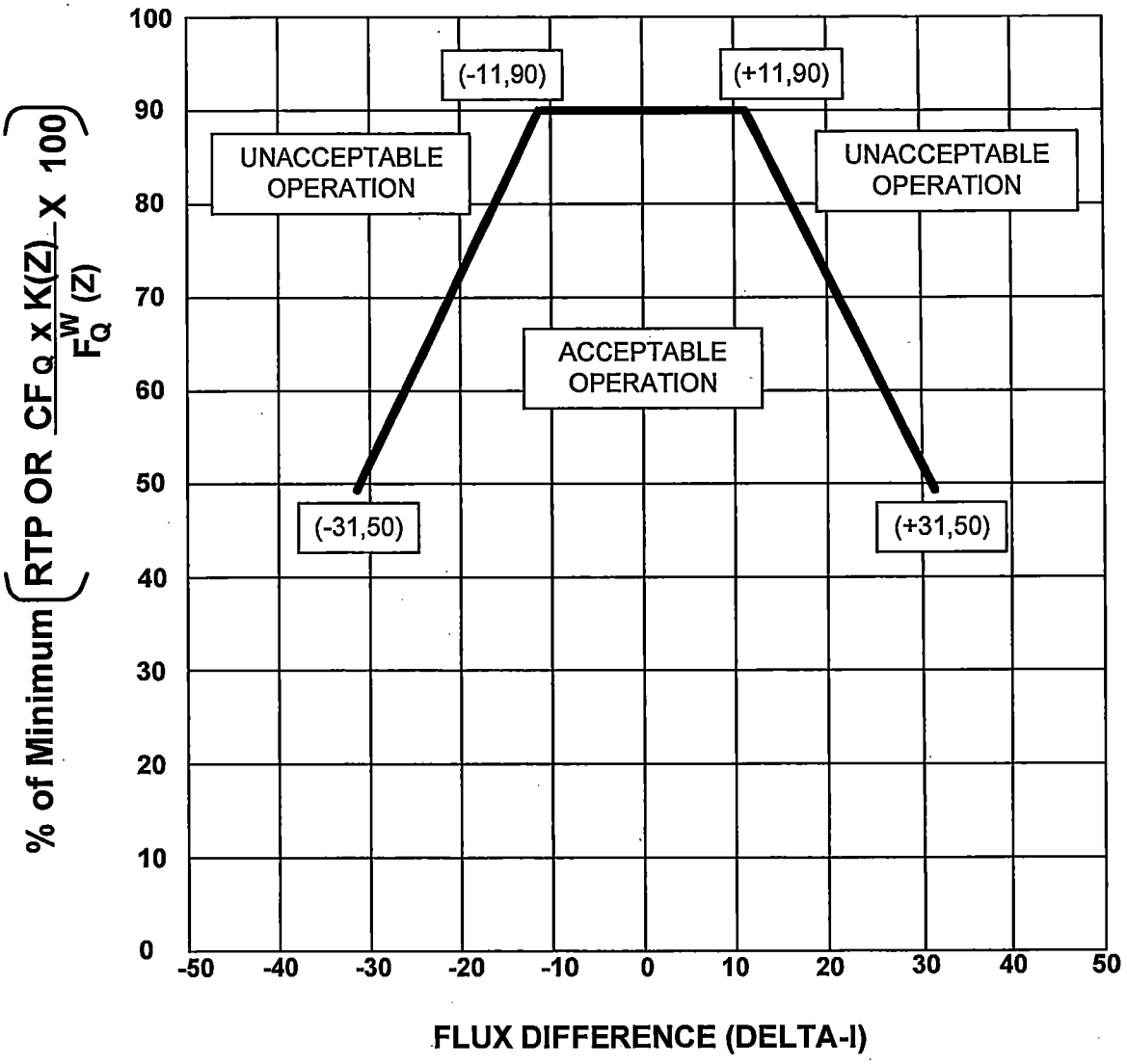


FIGURE 4

K(Z) – NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

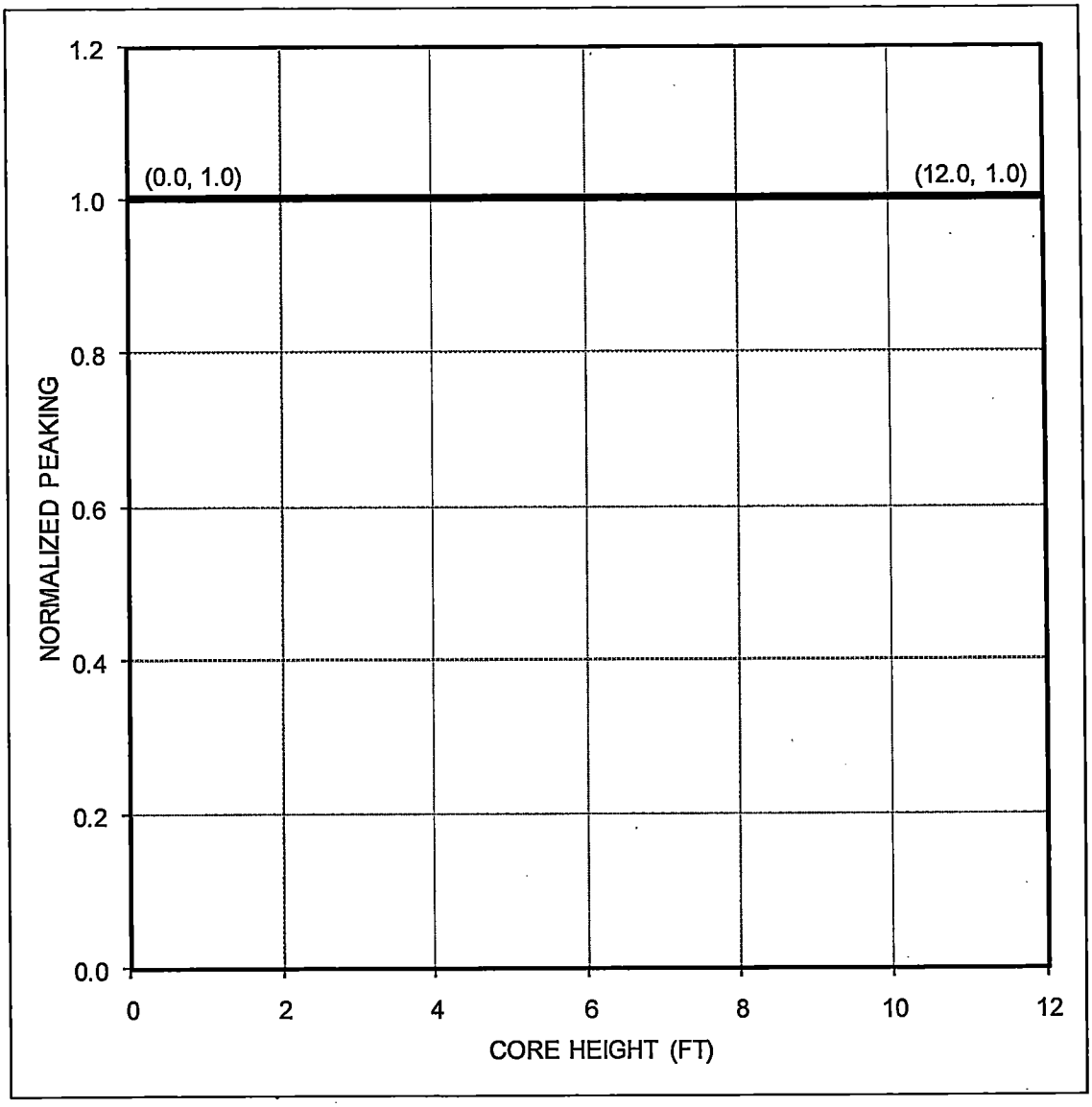


FIGURE 5
(Page 1 of 2)
Reactor Trip System Instrumentation Trip Setpoints
Overtemperature ΔT Trip Setpoint

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

Where:

ΔT	=	Measured RCS ΔT, °F
ΔT_o	=	Indicated ΔT at RATED THERMAL POWER, °F
T	=	Average temperature, °F
T'	=	Nominal T_{avg} at RATED THERMAL POWER (≤ 575.4 °F)
P	=	Pressurizer pressure, psig
P'	=	Nominal RCS operating pressure (2235 psig)
$\frac{1+\tau_1 S}{1+\tau_2 S}$	=	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} $\tau_1 \ge 22$ secs. $\tau_2 \le 4$ secs.
S	=	Laplace transform operator, sec^{-1}
K_1	≤	1.35 *
K_2	≥	0.0230/°F
K_3	≥	0.00110/psi
$f_1(\Delta I)$	=	$-0.33\ \{37\% + (q_t - q_b)\}$ when $q_t - q_b \le -37\%$ RTP 0% of RTP when $-37\% < q_t - q_b \le 3\%$ RTP $+2.34\ \{(q_t - q_b) - 3\%\}$ when $q_t - q_b > 3\%$ 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

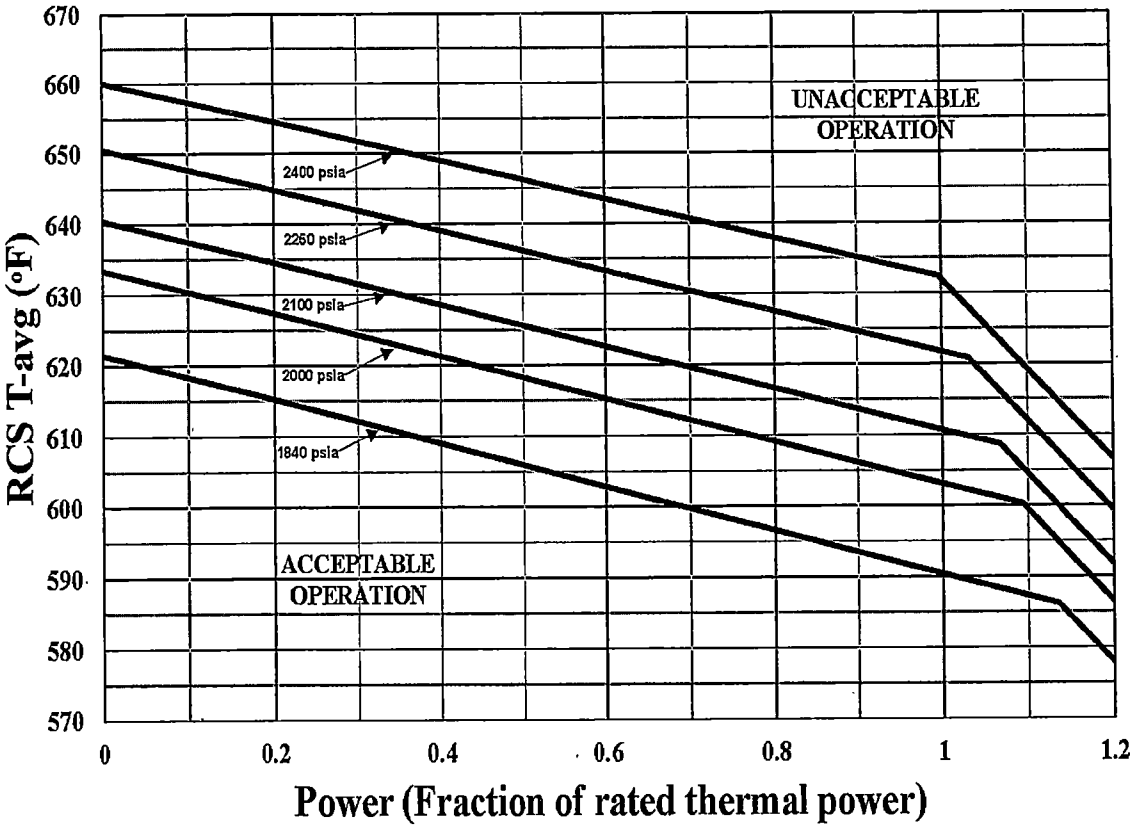
$$\text{Overpower } \Delta T \le \Delta T_o \left[K_4 - K_5 \left[\frac{\tau_3 S}{1+\tau_3 S}\right] T - K_6 (T - T'') - f_2(\Delta I)\right]$$

Where:

ΔT	=	Measured RCS ΔT, °F
ΔT_o	=	Indicated ΔT at RATED THERMAL POWER, °F
T	=	Average temperature, °F
T''	=	Nominal T_{avg} at RATED THERMAL POWER (≤ 575.4 °F)
K_4	≤	1.172 *
K_5	≥	0.0177/°F for increasing average temperature ; K_5 = 0 for decreasing average temperature
K_6	≥	0.0015/°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} $\tau_3 \ge$ 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

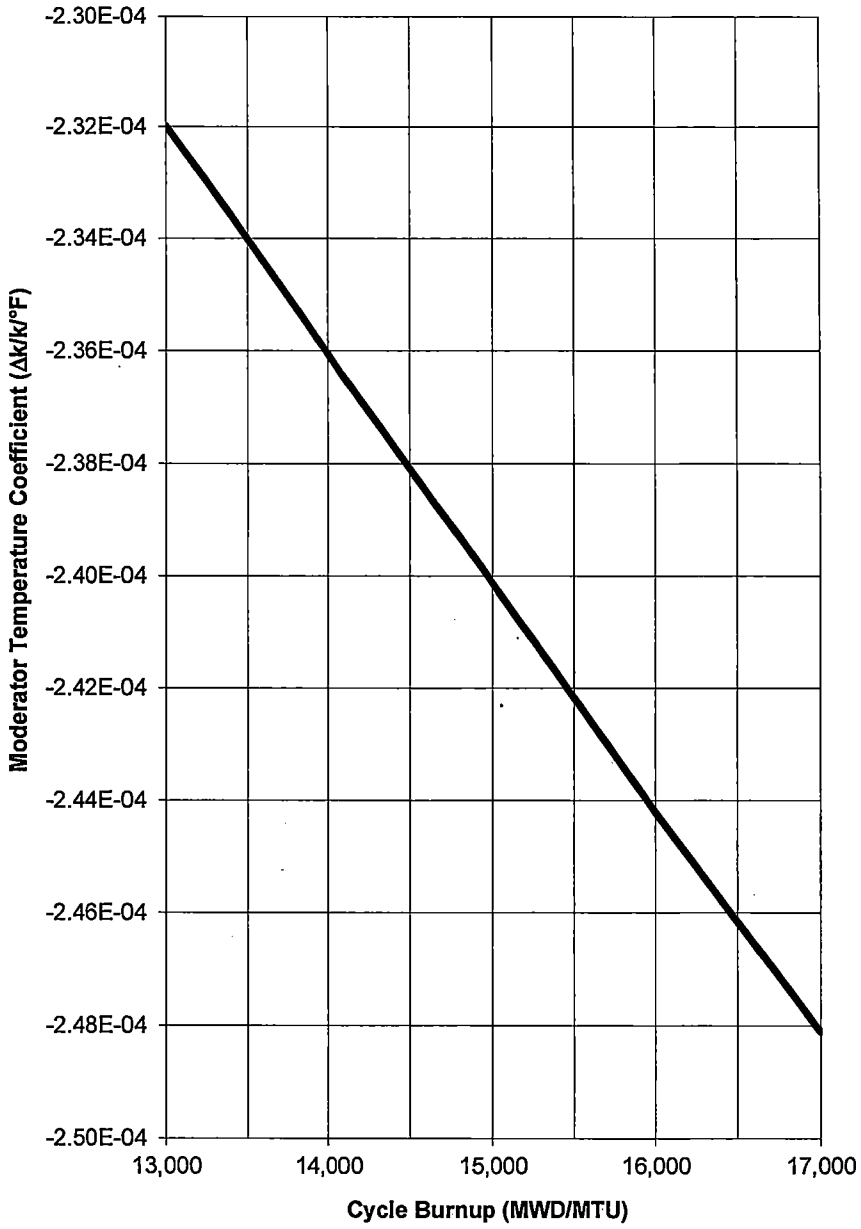


DESCRIPTION OF SAFETY LIMITS

Pressure (psia)	Power (frac)	Tavg (°F)	Power (frac)	Tavg (°F)	Power (frac)	Tavg (°F)	Power (frac)	Tavg (°F)
1840	0.0	621.48	0.02	620.86	1.136	586.17	1.2	577.94
2000	0.0	633.39	0.02	632.79	1.094	600.31	1.2	586.52
2100	0.0	640.44	0.02	639.85	1.068	608.72	1.2	591.77
2250	0.0	650.54	0.02	649.96	1.031	620.83	1.2	599.4
2400	0.0	660.08	0.02	659.52	0.996	632.42	1.2	606.63

UNIT 1 **Reactor Core Safety Limits**

FIGURE 7
Unit 1 Cycle 29 Predicted HFP ARO 300 PPM MTC Versus Burnup



Burnup (MWD/MTU)	MTC (pcm/°F)	MTC (Δk/k/°F)
13,000	-23.198	-2.3198E-04
14,000	-23.605	-2.3605E-04
15,000	-24.013	-2.4013E-04
16,000	-24.421	-2.4421E-04
17,000	-24.811	-2.4811E-04

TABLE 1

DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 5% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000
1	0.0	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
3	0.4	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
5	0.8	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
7	1.2	1.1060	1.1018	1.0981	1.0966	1.1005	1.1070
8	1.4	1.1054	1.1016	1.0984	1.0971	1.1008	1.1069
9	1.6	1.1047	1.1013	1.0984	1.0975	1.1009	1.1066
10	1.8	1.1036	1.1007	1.0982	1.0975	1.1007	1.1058
11	2.0	1.1022	1.0998	1.0978	1.0974	1.1002	1.1047
12	2.2	1.1005	1.0986	1.0971	1.0969	1.0994	1.1032
13	2.4	1.0985	1.0972	1.0962	1.0963	1.0984	1.1014
14	2.6	1.0963	1.0956	1.0950	1.0954	1.0970	1.0992
15	2.8	1.0939	1.0937	1.0936	1.0941	1.0953	1.0966
16	3.0	1.0912	1.0916	1.0920	1.0928	1.0934	1.0939
17	3.2	1.0884	1.0894	1.0904	1.0914	1.0915	1.0911
18	3.4	1.0863	1.0879	1.0892	1.0903	1.0898	1.0885
19	3.6	1.0851	1.0869	1.0886	1.0896	1.0886	1.0866
20	3.8	1.0844	1.0863	1.0880	1.0889	1.0875	1.0853
21	4.0	1.0840	1.0858	1.0874	1.0882	1.0869	1.0850
22	4.2	1.0838	1.0852	1.0866	1.0873	1.0865	1.0853
23	4.4	1.0840	1.0848	1.0855	1.0859	1.0855	1.0851
24	4.6	1.0841	1.0842	1.0844	1.0845	1.0845	1.0848
25	4.8	1.0840	1.0835	1.0832	1.0829	1.0832	1.0841
26	5.0	1.0838	1.0827	1.0817	1.0809	1.0815	1.0831
27	5.2	1.0836	1.0818	1.0801	1.0788	1.0796	1.0820
28	5.4	1.0831	1.0808	1.0787	1.0770	1.0779	1.0807
29	5.6	1.0823	1.0795	1.0770	1.0748	1.0757	1.0789
30	5.8	1.0813	1.0779	1.0749	1.0727	1.0743	1.0785

Top and bottom 10% of core excluded.

TABLE 1 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 5% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000
31	6.0	1.0799	1.0760	1.0726	1.0706	1.0732	1.0787
32	6.2	1.0780	1.0740	1.0705	1.0688	1.0722	1.0785
33	6.4	1.0758	1.0722	1.0692	1.0681	1.0719	1.0784
34	6.6	1.0738	1.0703	1.0674	1.0667	1.0709	1.0776
35	6.8	1.0723	1.0687	1.0657	1.0651	1.0694	1.0763
36	7.0	1.0708	1.0671	1.0641	1.0634	1.0677	1.0746
37	7.2	1.0699	1.0661	1.0628	1.0621	1.0667	1.0738
38	7.4	1.0717	1.0673	1.0637	1.0628	1.0678	1.0756
39	7.6	1.0755	1.0714	1.0679	1.0670	1.0718	1.0792
40	7.8	1.0796	1.0761	1.0731	1.0724	1.0766	1.0830
41	8.0	1.0832	1.0802	1.0776	1.0771	1.0807	1.0862
42	8.2	1.0866	1.0841	1.0821	1.0817	1.0847	1.0892
43	8.4	1.0896	1.0878	1.0863	1.0860	1.0883	1.0918
44	8.6	1.0923	1.0911	1.0902	1.0901	1.0916	1.0939
45	8.8	1.0946	1.0941	1.0938	1.0938	1.0947	1.0958
46	9.0	1.0966	1.0968	1.0970	1.0972	1.0973	1.0973
47	9.2	1.0981	1.0990	1.0998	1.1002	1.0995	1.0982
48	9.4	1.0992	1.1009	1.1023	1.1026	1.1009	1.0984
49	9.6	1.1004	1.1027	1.1046	1.1048	1.1020	1.0984
50	9.8	1.1012	1.1041	1.1066	1.1071	1.1038	1.0995
51	10.0	1.1017	1.1054	1.1086	1.1100	1.1070	1.1028
52	10.2	1.1016	1.1059	1.1097	1.1120	1.1096	1.1056
53	10.4	1.1022	1.1065	1.1105	1.1131	1.1112	1.1078
54	10.6	1.1082	1.1134	1.1181	1.1206	1.1171	1.1116
55	10.8	1.1060	1.1113	1.1161	1.1193	1.1169	1.1124
56	11.0	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
58	11.4	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
60	11.8	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

Top and bottom 10% of core excluded.

TABLE 1 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 5% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 10000	12000	14000	16000	18000	18964
1	0.0	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
3	0.4	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
5	0.8	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
7	1.2	1.1138	1.1191	1.1236	1.1282	1.1330	1.1353
8	1.4	1.1133	1.1182	1.1223	1.1266	1.1311	1.1332
9	1.6	1.1124	1.1169	1.1207	1.1245	1.1286	1.1305
10	1.8	1.1110	1.1150	1.1184	1.1217	1.1253	1.1271
11	2.0	1.1092	1.1127	1.1155	1.1183	1.1214	1.1229
12	2.2	1.1069	1.1098	1.1121	1.1144	1.1169	1.1181
13	2.4	1.1043	1.1066	1.1083	1.1100	1.1118	1.1127
14	2.6	1.1013	1.1029	1.1040	1.1051	1.1063	1.1069
15	2.8	1.0979	1.0987	1.0994	1.0998	1.1005	1.1008
16	3.0	1.0942	1.0944	1.0943	1.0941	1.0940	1.0940
17	3.2	1.0905	1.0899	1.0892	1.0883	1.0876	1.0872
18	3.4	1.0871	1.0861	1.0854	1.0846	1.0837	1.0833
19	3.6	1.0850	1.0846	1.0851	1.0860	1.0864	1.0865
20	3.8	1.0838	1.0840	1.0854	1.0876	1.0891	1.0897
21	4.0	1.0838	1.0844	1.0864	1.0891	1.0911	1.0920
22	4.2	1.0847	1.0856	1.0878	1.0907	1.0928	1.0938
23	4.4	1.0852	1.0866	1.0889	1.0919	1.0943	1.0954
24	4.6	1.0856	1.0874	1.0899	1.0930	1.0956	1.0968
25	4.8	1.0859	1.0885	1.0919	1.0962	1.0998	1.1015
26	5.0	1.0858	1.0895	1.0943	1.1000	1.1050	1.1073
27	5.2	1.0855	1.0902	1.0959	1.1029	1.1090	1.1118
28	5.4	1.0850	1.0905	1.0972	1.1053	1.1125	1.1158
29	5.6	1.0838	1.0901	1.0977	1.1070	1.1152	1.1190
30	5.8	1.0842	1.0909	1.0988	1.1082	1.1166	1.1205

Top and bottom 10% of core excluded.

TABLE 1 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 5% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 10000	12000	14000	16000	18000	18964
31	6.0	1.0854	1.0924	1.0999	1.1087	1.1167	1.1205
32	6.2	1.0858	1.0929	1.1001	1.1083	1.1161	1.1197
33	6.4	1.0857	1.0926	1.0995	1.1071	1.1145	1.1179
34	6.6	1.0850	1.0917	1.0981	1.1051	1.1119	1.1151
35	6.8	1.0836	1.0900	1.0958	1.1020	1.1083	1.1113
36	7.0	1.0818	1.0877	1.0929	1.0984	1.1040	1.1066
37	7.2	1.0812	1.0869	1.0916	1.0964	1.1015	1.1040
38	7.4	1.0834	1.0893	1.0940	1.0985	1.1035	1.1060
39	7.6	1.0865	1.0920	1.0961	1.1001	1.1046	1.1068
40	7.8	1.0894	1.0940	1.0975	1.1009	1.1047	1.1066
41	8.0	1.0917	1.0956	1.0985	1.1012	1.1044	1.1059
42	8.2	1.0936	1.0967	1.0989	1.1010	1.1034	1.1046
43	8.4	1.0951	1.0973	1.0989	1.1002	1.1019	1.1027
44	8.6	1.0960	1.0974	1.0983	1.0990	1.0999	1.1004
45	8.8	1.0967	1.0972	1.0974	1.0973	1.0975	1.0976
46	9.0	1.0971	1.0967	1.0962	1.0955	1.0949	1.0947
47	9.2	1.0970	1.0962	1.0957	1.0953	1.0948	1.0945
48	9.4	1.0966	1.0964	1.0975	1.0994	1.1005	1.1010
49	9.6	1.0960	1.0965	1.0993	1.1034	1.1063	1.1075
50	9.8	1.0968	1.0977	1.1014	1.1068	1.1107	1.1123
51	10.0	1.1000	1.1009	1.1048	1.1102	1.1141	1.1158
52	10.2	1.1030	1.1040	1.1078	1.1132	1.1169	1.1186
53	10.4	1.1056	1.1067	1.1105	1.1156	1.1193	1.1210
54	10.6	1.1076	1.1081	1.1119	1.1174	1.1211	1.1228
55	10.8	1.1092	1.1100	1.1137	1.1189	1.1225	1.1241
56	11.0	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
58	11.4	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
60	11.8	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

Top and bottom 10% of core excluded.

TABLE 2
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 3% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000
1	0.0	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
3	0.4	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
5	0.8	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
7	1.2	1.0754	1.0803	1.0848	1.0882	1.0869	1.0839
8	1.4	1.0753	1.0791	1.0826	1.0856	1.0848	1.0829
9	1.6	1.0750	1.0778	1.0804	1.0828	1.0826	1.0818
10	1.8	1.0745	1.0763	1.0781	1.0799	1.0803	1.0803
11	2.0	1.0737	1.0747	1.0757	1.0770	1.0778	1.0786
12	2.2	1.0728	1.0730	1.0733	1.0741	1.0753	1.0767
13	2.4	1.0717	1.0712	1.0709	1.0713	1.0727	1.0747
14	2.6	1.0704	1.0697	1.0692	1.0694	1.0708	1.0727
15	2.8	1.0688	1.0686	1.0684	1.0688	1.0699	1.0713
16	3.0	1.0674	1.0675	1.0677	1.0683	1.0690	1.0698
17	3.2	1.0661	1.0665	1.0670	1.0676	1.0679	1.0680
18	3.4	1.0649	1.0659	1.0668	1.0675	1.0672	1.0663
19	3.6	1.0644	1.0658	1.0671	1.0679	1.0669	1.0652
20	3.8	1.0640	1.0658	1.0673	1.0681	1.0667	1.0647
21	4.0	1.0636	1.0655	1.0673	1.0680	1.0666	1.0646
22	4.2	1.0636	1.0654	1.0671	1.0680	1.0669	1.0655
23	4.4	1.0640	1.0654	1.0668	1.0677	1.0672	1.0666
24	4.6	1.0643	1.0653	1.0663	1.0672	1.0673	1.0676
25	4.8	1.0645	1.0650	1.0656	1.0665	1.0672	1.0684
26	5.0	1.0645	1.0646	1.0648	1.0656	1.0670	1.0690
27	5.2	1.0645	1.0640	1.0637	1.0644	1.0664	1.0694
28	5.4	1.0647	1.0634	1.0624	1.0628	1.0654	1.0694
29	5.6	1.0647	1.0627	1.0612	1.0613	1.0644	1.0693
30	5.8	1.0645	1.0622	1.0604	1.0603	1.0638	1.0691

Top and bottom 10% of core excluded.

TABLE 2 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 3% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000
31	6.0	1.0641	1.0616	1.0596	1.0595	1.0631	1.0687
32	6.2	1.0634	1.0608	1.0586	1.0584	1.0621	1.0679
33	6.4	1.0625	1.0596	1.0573	1.0570	1.0608	1.0667
34	6.6	1.0612	1.0583	1.0558	1.0554	1.0592	1.0651
35	6.8	1.0596	1.0566	1.0540	1.0535	1.0573	1.0631
36	7.0	1.0576	1.0546	1.0520	1.0514	1.0549	1.0604
37	7.2	1.0553	1.0522	1.0496	1.0488	1.0522	1.0576
38	7.4	1.0541	1.0505	1.0475	1.0467	1.0506	1.0568
39	7.6	1.0555	1.0523	1.0495	1.0488	1.0524	1.0581
40	7.8	1.0581	1.0553	1.0529	1.0522	1.0554	1.0603
41	8.0	1.0603	1.0579	1.0559	1.0554	1.0581	1.0623
42	8.2	1.0624	1.0605	1.0588	1.0584	1.0607	1.0641
43	8.4	1.0643	1.0629	1.0617	1.0614	1.0631	1.0657
44	8.6	1.0661	1.0652	1.0644	1.0643	1.0655	1.0671
45	8.8	1.0677	1.0673	1.0670	1.0669	1.0674	1.0681
46	9.0	1.0691	1.0693	1.0694	1.0694	1.0693	1.0693
47	9.2	1.0703	1.0710	1.0716	1.0723	1.0723	1.0722
48	9.4	1.0711	1.0724	1.0737	1.0751	1.0754	1.0754
49	9.6	1.0733	1.0744	1.0755	1.0769	1.0776	1.0780
50	9.8	1.0762	1.0767	1.0773	1.0783	1.0793	1.0801
51	10.0	1.0789	1.0790	1.0792	1.0800	1.0810	1.0821
52	10.2	1.0814	1.0810	1.0807	1.0810	1.0821	1.0836
53	10.4	1.0837	1.0827	1.0819	1.0818	1.0830	1.0849
54	10.6	1.0856	1.0870	1.0884	1.0894	1.0890	1.0881
55	10.8	1.0872	1.0866	1.0861	1.0861	1.0868	1.0881
56	11.0	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
58	11.4	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
60	11.8	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

Top and bottom 10% of core excluded.

TABLE 2 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 3% ΔI

Node #	Height (ft)	Burnup (MWD/MTU) 10000	12000	14000	16000	18000	18964
1	0.0	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
3	0.4	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
5	0.8	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
7	1.2	1.0824	1.0848	1.0900	1.0969	1.1021	1.1045
8	1.4	1.0823	1.0847	1.0896	1.0957	1.1006	1.1027
9	1.6	1.0819	1.0844	1.0887	1.0941	1.0985	1.1005
10	1.8	1.0811	1.0836	1.0873	1.0919	1.0958	1.0975
11	2.0	1.0800	1.0823	1.0855	1.0893	1.0925	1.0940
12	2.2	1.0785	1.0807	1.0833	1.0862	1.0888	1.0900
13	2.4	1.0768	1.0787	1.0806	1.0826	1.0846	1.0856
14	2.6	1.0747	1.0762	1.0775	1.0788	1.0802	1.0808
15	2.8	1.0726	1.0735	1.0742	1.0748	1.0755	1.0759
16	3.0	1.0703	1.0706	1.0706	1.0704	1.0704	1.0704
17	3.2	1.0678	1.0675	1.0669	1.0662	1.0656	1.0653
18	3.4	1.0654	1.0648	1.0644	1.0640	1.0635	1.0633
19	3.6	1.0640	1.0639	1.0647	1.0659	1.0667	1.0670
20	3.8	1.0635	1.0641	1.0661	1.0690	1.0711	1.0720
21	4.0	1.0637	1.0650	1.0683	1.0726	1.0759	1.0774
22	4.2	1.0652	1.0672	1.0710	1.0761	1.0800	1.0818
23	4.4	1.0671	1.0697	1.0740	1.0793	1.0837	1.0857
24	4.6	1.0689	1.0721	1.0766	1.0823	1.0871	1.0892
25	4.8	1.0706	1.0742	1.0791	1.0849	1.0900	1.0923
26	5.0	1.0720	1.0761	1.0812	1.0871	1.0924	1.0949
27	5.2	1.0732	1.0777	1.0829	1.0889	1.0943	1.0968
28	5.4	1.0741	1.0790	1.0842	1.0901	1.0956	1.0982
29	5.6	1.0747	1.0799	1.0851	1.0908	1.0963	1.0989
30	5.8	1.0749	1.0802	1.0853	1.0909	1.0963	1.0989

Top and bottom 10% of core excluded.

TABLE 2 (continued)
DONALD C. COOK UNIT 1 CYCLE 29
W(Z) FUNCTION for +/- 3% ΔI

Node #	Height (ft)	Burnup (MWD/MTU)					
		10000	12000	14000	16000	18000	18964
31	6.0	1.0746	1.0800	1.0850	1.0903	1.0956	1.0982
32	6.2	1.0740	1.0792	1.0840	1.0891	1.0943	1.0967
33	6.4	1.0728	1.0780	1.0825	1.0873	1.0922	1.0945
34	6.6	1.0712	1.0761	1.0804	1.0848	1.0893	1.0915
35	6.8	1.0691	1.0737	1.0776	1.0814	1.0856	1.0876
36	7.0	1.0661	1.0705	1.0742	1.0778	1.0818	1.0836
37	7.2	1.0632	1.0677	1.0715	1.0754	1.0794	1.0814
38	7.4	1.0631	1.0678	1.0714	1.0751	1.0790	1.0810
39	7.6	1.0639	1.0680	1.0712	1.0743	1.0778	1.0794
40	7.8	1.0652	1.0686	1.0710	1.0733	1.0760	1.0773
41	8.0	1.0664	1.0692	1.0710	1.0726	1.0747	1.0757
42	8.2	1.0674	1.0695	1.0709	1.0721	1.0736	1.0744
43	8.4	1.0681	1.0696	1.0705	1.0712	1.0722	1.0727
44	8.6	1.0687	1.0694	1.0697	1.0698	1.0701	1.0703
45	8.8	1.0688	1.0692	1.0695	1.0697	1.0700	1.0702
46	9.0	1.0694	1.0699	1.0707	1.0718	1.0727	1.0731
47	9.2	1.0723	1.0728	1.0737	1.0748	1.0756	1.0760
48	9.4	1.0754	1.0759	1.0766	1.0775	1.0782	1.0786
49	9.6	1.0783	1.0789	1.0796	1.0803	1.0810	1.0813
50	9.8	1.0809	1.0816	1.0823	1.0829	1.0836	1.0839
51	10.0	1.0832	1.0840	1.0848	1.0854	1.0861	1.0865
52	10.2	1.0851	1.0863	1.0872	1.0880	1.0890	1.0895
53	10.4	1.0868	1.0881	1.0892	1.0902	1.0914	1.0920
54	10.6	1.0877	1.0883	1.0898	1.0918	1.0933	1.0940
55	10.8	1.0894	1.0907	1.0919	1.0932	1.0945	1.0952
56	11.0	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
58	11.4	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
60	11.8	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

Top and bottom 10% of core excluded.