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U.S. Nuclear Regulatory Commission
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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 13, in accordance with Technical Specification 6.9.1.9.4.

The Unit 2 Cycle 13 COLR is provided as an attachment to this letter.

No new commitments are made in this submittal.

Should you have any questions, please contact Mr. Gordon P. Arent, Manager of Regulatory Affairs, at (616) 697-5553.

Sincerely,

A handwritten signature in cursive script, appearing to read "Scot A. Greenlee".

Scot A. Greenlee
Director of Nuclear Technical Services

attachment

/jen

c: K. D. Curry
J. E. Dyer
MDEQ – DW & RPD
NRC Resident Inspector
R. Whale

A001

Donald C. Cook Nuclear Plant Unit 2 Cycle 13

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 13 has been prepared in accordance with the requirements of Technical Specification 6.9.1.9.

The Technical Specifications affected by this report are listed below:

3/4.1.1.4	Moderator Temperature Coefficient (MTC)
3/4.1.3.1	Movable Control Assemblies Group Height
3/4.1.3.4	Rod Drop Time
3/4.1.3.5	Shutdown Rod Insertion Limit
3/4.1.3.6	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference (AFD)
3/4.2.2	Heat Flux Hot Channel Factor ($F_Q(Z)$)
3/4.2.3	Nuclear Enthalpy Hot Channel Factor - (F_{AH})
3/4.2.6	Allowable Power Level (APL)

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 6.9.1.9.

2.1 Moderator Temperature Coefficient (Technical Specification 3/4.1.1.4)

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:

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

The EOL/ARO/RTP-MTC shall be less negative than or equal to $-4.10\text{E-}4 \Delta\text{k/k/}^{\circ}\text{F}$.

This limit is based on a T_{avg} program with HFP vessel T_{avg} of 571 to 576 $^{\circ}\text{F}$ 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

2.1.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative or equal to $-3.20\text{E-}4 \Delta\text{k/k/}^{\circ}\text{F}$ at a HFP vessel T_{avg} of 571 to 576 $^{\circ}\text{F}$

2.2 Rod Drop Time Drop Height (Specification 3/4.1.3.4)

2.2.1 All rods shall be dropped from 228 steps.

2.3 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.3.1 The shutdown rods shall be withdrawn to at least 228 steps.

2.4 Control Rod Insertion Limits (Specifications 3/4.1.3.6 and 3/4.1.3.1)

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

2.4.2 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.

2.5 Axial Flux Difference (Specification 3/4.2.1)

2.5.1 The Allowable Operation Limits are provided in Figure 3.

2.5.2 The Axial Flux Difference (AFD) target band during base load operations is +3%, -3% (not applicable for this cycle).

2.5.3 The AFD target band is +5%, -5% for a cycle average accumulated burnup ≥ 0.0 MWD/MTU.

2.6 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specification 3.2.2)

$$F_Q(Z) \leq \frac{CF_Q}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq 2 * CF_Q * K(Z) \quad \text{for } P \leq 0.5$$

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

2.6.1 $CF_Q = 2.335$

2.6.2 $K(Z)$ is provided in Figure 4

2.7 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^N$ (Specification 3/4.2.3)

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

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

2.7.1 $CF_{\Delta H} = 1.58$

2.7.2 $PF_{\Delta H} = 0.3$

2.8 Allowable Power Level - APL (Specification 3.2.6)

$$\text{APL} = \min \text{ over } Z \text{ for } \frac{\text{CF}_Q * \text{K}(Z)}{\text{F}_Q(Z) * \text{V}(Z) * \text{F}_P} * 100\%$$

2.8.1 V(Z) is provided in Table 1 for 5% AFD target band

2.8.2 CF_Q and K(Z) are provided in COLR Sections 2.6.1 and 2.6.2, respectively

2.8.3 The following table shows F_P values which correspond to F_Q margin decreases that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to adjust APL as per Surveillance Requirement 4.2.6.2. A 1.02 penalty factor shall be used at all cycle burnups that are outside this range.

Cycle Burnup (MWD/MTU)	F _P Penalty Multiplier
475	1.0200
637	1.0292
800	1.0358
962	1.0400
1125	1.0425
1287	1.0405
1449	1.0383
1612	1.0357
1774	1.0327
1937	1.0293
2099	1.0255
2262	1.0213
2424	1.0200

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

Figure 1
MODERATOR TEMPERATURE COEFFICIENT (MTC) LIMITS

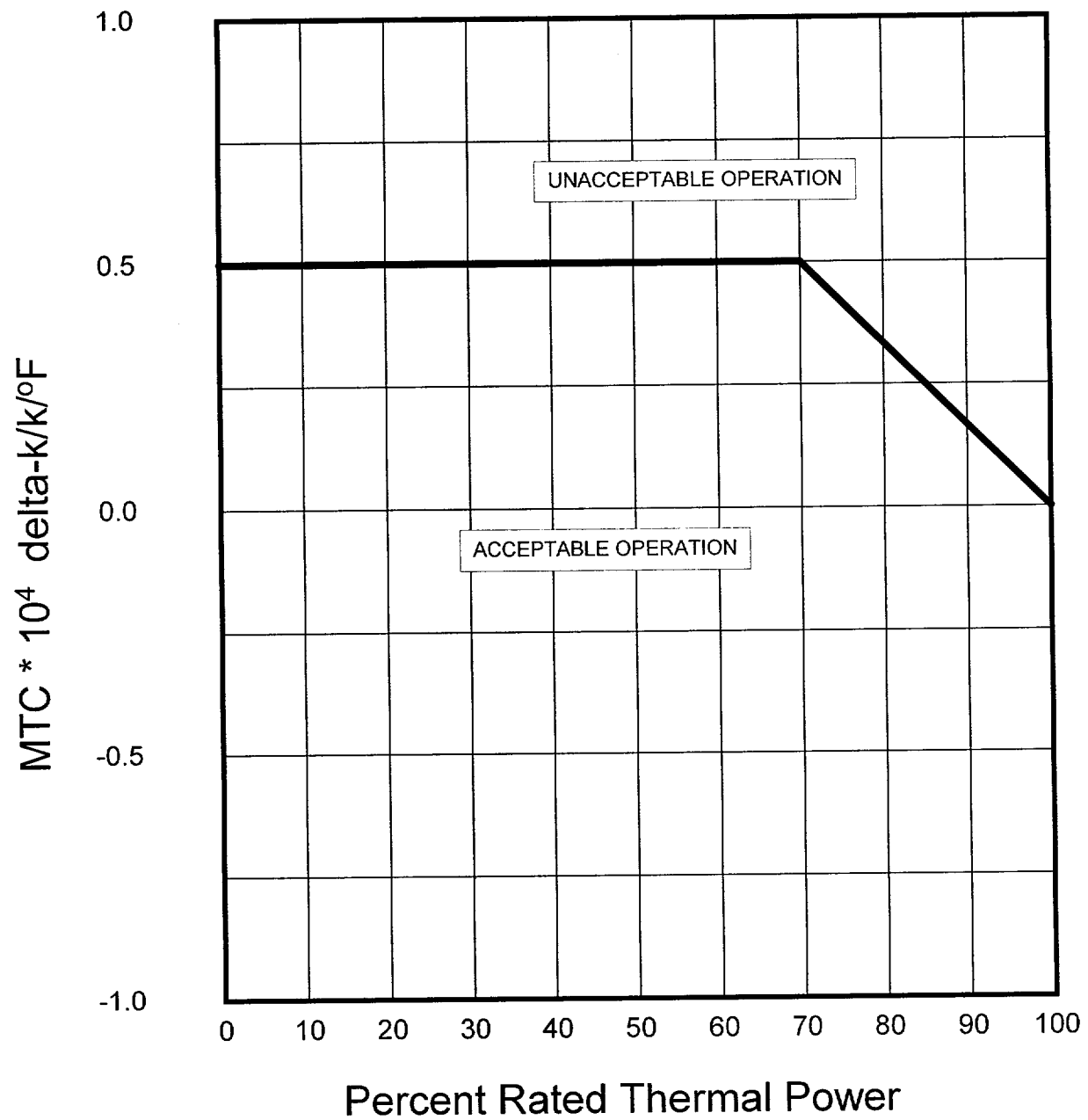


Figure 2
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER
FOUR-LOOP OPERATION

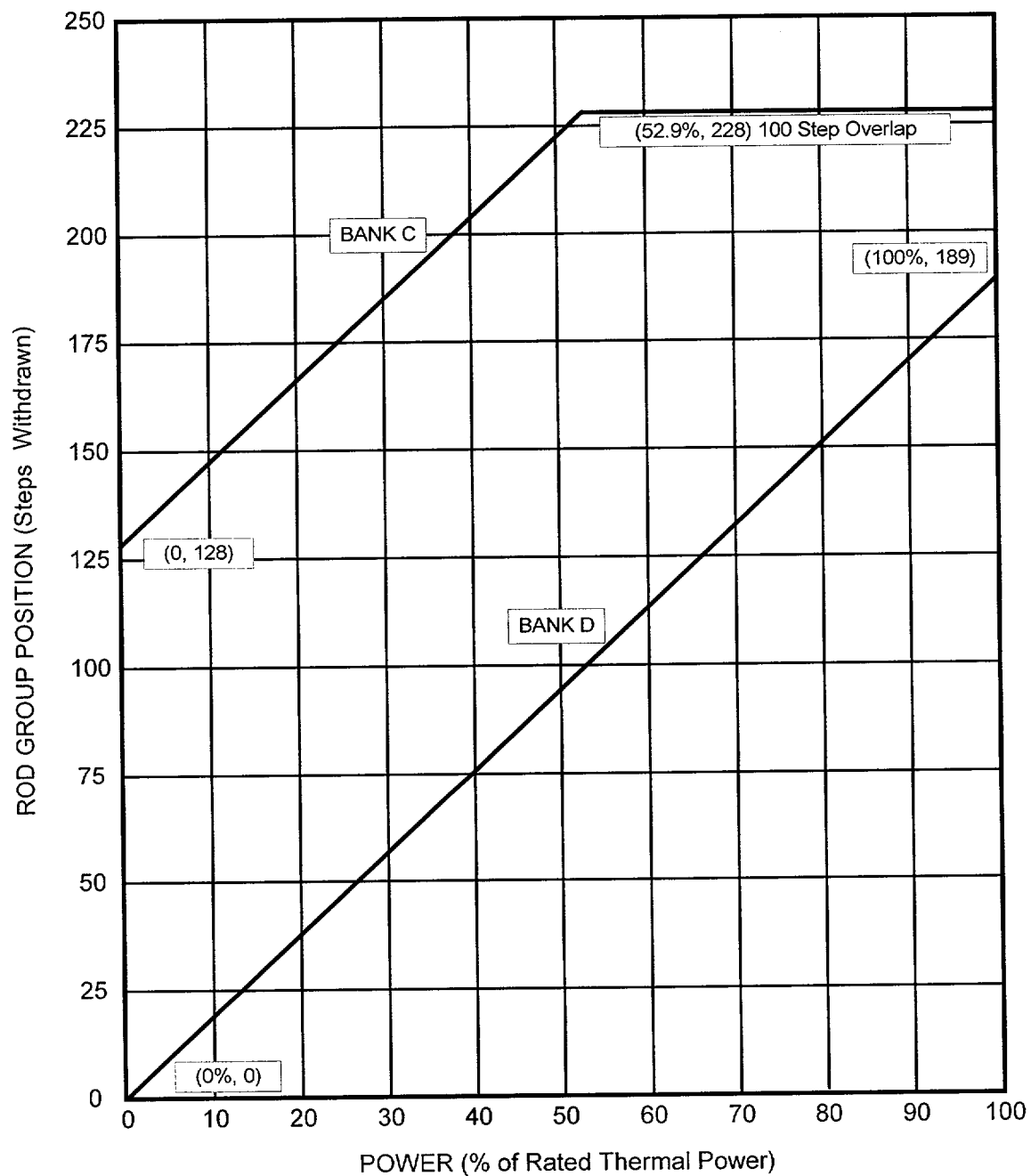


Figure 3
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF
RATED THERMAL POWER (RTP)

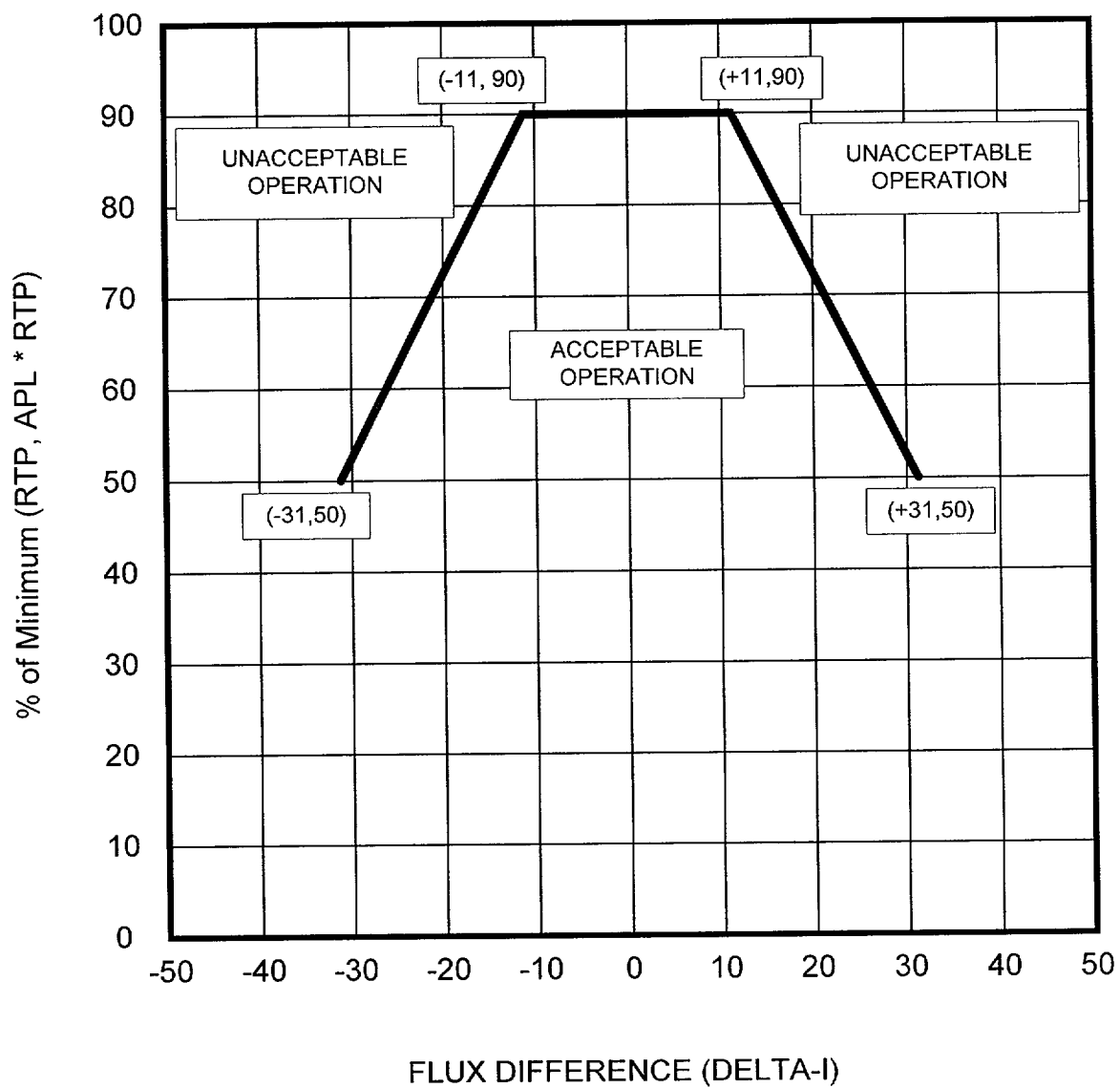
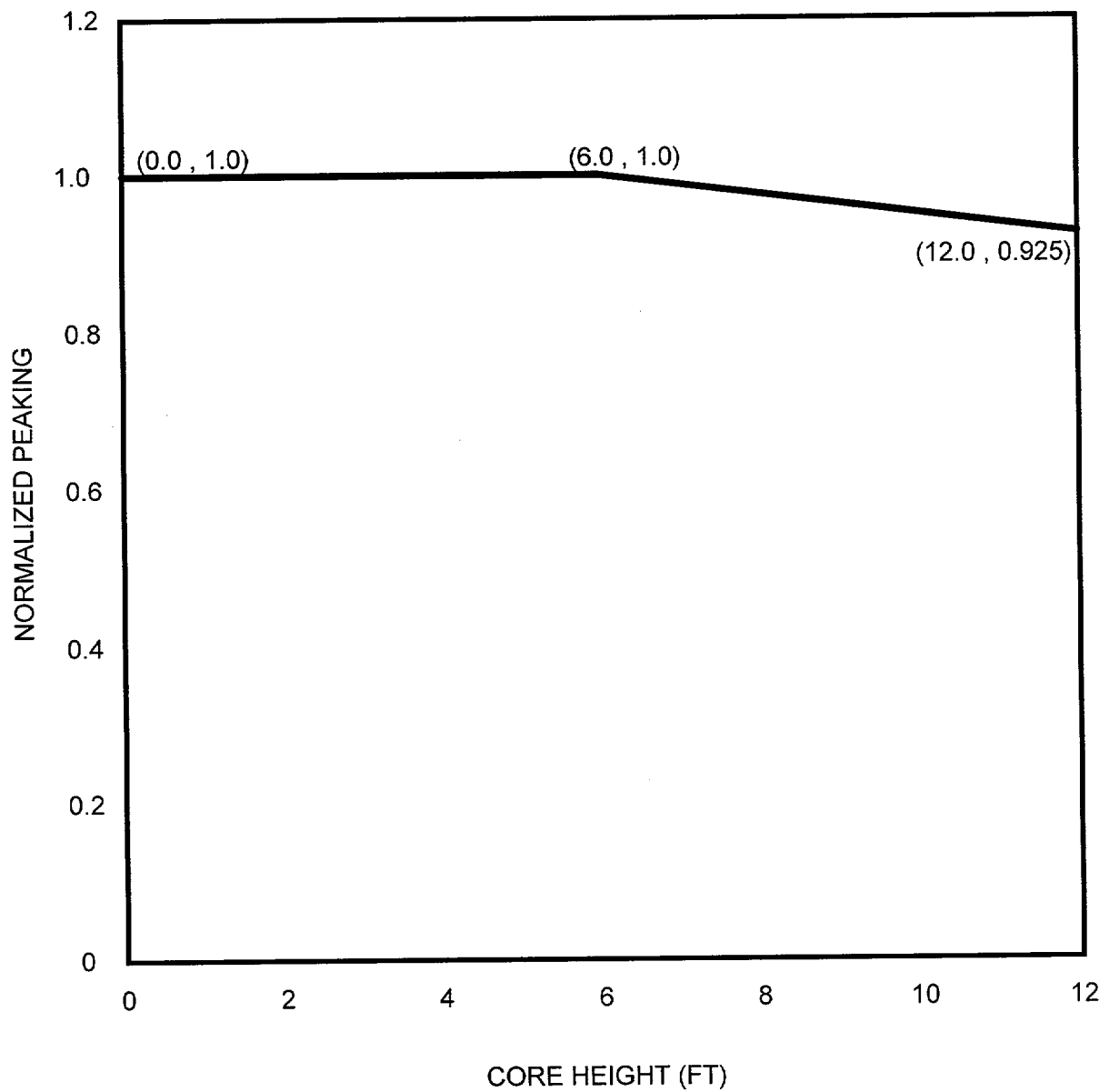


Figure 4
K(Z) - NORMALIZED $F_q(Z)$ AS A FUNCTION OF CORE HEIGHT



COLR for DONALD C. COOK NUCLEAR PLANT UNIT 2 CYCLE 13 - JANUARY 2002

Table 1
 Donald C. Cook Unit 2 Cycle 13
 IRI Mitigation LP, 3411 MWt, As-Burned Cycle 12
 V(Z) Function

PT	HEIGHT (FT.)	BURNUP MWD/MTU												
		150.	1000.	2000.	3000.	4000.	6000.	8000.	10000.	12000.	14000.	16000.	16670.	16795.
1	.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2000	1.1318	1.1217	1.1123	1.1058	1.1026	1.1062	1.1157	1.1239	1.1309	1.1382	1.1458	1.1483	1.1488
8	1.4000	1.1289	1.1198	1.1113	1.1055	1.1028	1.1063	1.1152	1.1228	1.1293	1.1361	1.1431	1.1454	1.1459
9	1.6000	1.1254	1.1174	1.1100	1.1050	1.1026	1.1061	1.1143	1.1213	1.1273	1.1333	1.1397	1.1419	1.1423
10	1.8000	1.1214	1.1146	1.1083	1.1040	1.1022	1.1055	1.1129	1.1193	1.1245	1.1298	1.1355	1.1374	1.1377
11	2.0000	1.1169	1.1113	1.1062	1.1028	1.1014	1.1045	1.1111	1.1166	1.1212	1.1256	1.1305	1.1321	1.1324
12	2.2000	1.1120	1.1077	1.1037	1.1011	1.1002	1.1032	1.1089	1.1136	1.1173	1.1208	1.1247	1.1261	1.1263
13	2.4000	1.1066	1.1036	1.1008	1.0992	1.0988	1.1016	1.1065	1.1102	1.1130	1.1154	1.1183	1.1193	1.1194
14	2.6000	1.1008	1.0990	1.0976	1.0968	1.0970	1.0998	1.1037	1.1065	1.1082	1.1094	1.1111	1.1118	1.1119
15	2.8000	1.0949	1.0944	1.0941	1.0942	1.0948	1.0976	1.1007	1.1026	1.1032	1.1029	1.1035	1.1037	1.1038
16	3.0000	1.0874	1.0885	1.0898	1.0911	1.0924	1.0953	1.0976	1.0984	1.0977	1.0958	1.0950	1.0948	1.0948
17	3.2000	1.0844	1.0858	1.0873	1.0887	1.0901	1.0926	1.0942	1.0941	1.0925	1.0894	1.0876	1.0870	1.0869
18	3.4000	1.0880	1.0878	1.0877	1.0878	1.0881	1.0894	1.0905	1.0904	1.0892	1.0871	1.0858	1.0854	1.0853
19	3.6000	1.0942	1.0919	1.0897	1.0880	1.0870	1.0870	1.0881	1.0892	1.0903	1.0916	1.0928	1.0932	1.0933
20	3.8000	1.1002	1.0959	1.0917	1.0885	1.0865	1.0858	1.0876	1.0901	1.0934	1.0977	1.1012	1.1024	1.1026
21	4.0000	1.1059	1.0995	1.0933	1.0886	1.0856	1.0849	1.0879	1.0920	1.0970	1.1034	1.1089	1.1106	1.1110
22	4.2000	1.1112	1.1029	1.0948	1.0888	1.0851	1.0846	1.0891	1.0946	1.1010	1.1090	1.1159	1.1182	1.1186
23	4.4000	1.1161	1.1063	1.0968	1.0898	1.0854	1.0848	1.0900	1.0966	1.1043	1.1141	1.1225	1.1252	1.1257
24	4.6000	1.1205	1.1095	1.0988	1.0908	1.0859	1.0850	1.0908	1.0982	1.1071	1.1186	1.1284	1.1315	1.1321
25	4.8000	1.1243	1.1122	1.1005	1.0918	1.0863	1.0851	1.0913	1.0995	1.1095	1.1225	1.1334	1.1370	1.1376
26	5.0000	1.1275	1.1144	1.1018	1.0924	1.0865	1.0853	1.0920	1.1009	1.1117	1.1257	1.1375	1.1413	1.1420
27	5.2000	1.1299	1.1160	1.1026	1.0926	1.0865	1.0855	1.0929	1.1024	1.1136	1.1281	1.1404	1.1443	1.1451
28	5.4000	1.1315	1.1170	1.1030	1.0925	1.0861	1.0853	1.0934	1.1033	1.1149	1.1296	1.1422	1.1463	1.1471
29	5.6000	1.1323	1.1173	1.1028	1.0920	1.0854	1.0849	1.0934	1.1036	1.1153	1.1301	1.1429	1.1470	1.1478
30	5.8000	1.1323	1.1168	1.1020	1.0910	1.0844	1.0840	1.0929	1.1034	1.1150	1.1296	1.1424	1.1465	1.1473
31	6.0000	1.1312	1.1157	1.1007	1.0896	1.0830	1.0828	1.0919	1.1024	1.1138	1.1281	1.1406	1.1447	1.1455
32	6.2000	1.1293	1.1137	1.0986	1.0875	1.0809	1.0810	1.0904	1.1007	1.1118	1.1254	1.1376	1.1415	1.1423
33	6.4000	1.1263	1.1108	1.0959	1.0850	1.0785	1.0788	1.0882	1.0982	1.1088	1.1217	1.1333	1.1370	1.1377
34	6.6000	1.1219	1.1078	1.0943	1.0843	1.0781	1.0775	1.0852	1.0943	1.1044	1.1172	1.1283	1.1319	1.1326
35	6.8000	1.1202	1.1070	1.0941	1.0843	1.0782	1.0763	1.0825	1.0909	1.1014	1.1151	1.1266	1.1303	1.1310
36	7.0000	1.1200	1.1072	1.0947	1.0852	1.0790	1.0766	1.0819	1.0899	1.1002	1.1140	1.1254	1.1290	1.1297
37	7.2000	1.1202	1.1078	1.0957	1.0865	1.0805	1.0779	1.0828	1.0899	1.0991	1.1115	1.1216	1.1249	1.1255
38	7.4000	1.1194	1.1074	1.0958	1.0869	1.0812	1.0793	1.0842	1.0906	1.0983	1.1084	1.1168	1.1196	1.1201
39	7.6000	1.1178	1.1063	1.0950	1.0866	1.0813	1.0802	1.0855	1.0915	1.0979	1.1060	1.1132	1.1155	1.1159
40	7.8000	1.1154	1.1044	1.0936	1.0857	1.0809	1.0806	1.0864	1.0918	1.0970	1.1031	1.1089	1.1108	1.1111
41	8.0000	1.1121	1.1016	1.0914	1.0839	1.0796	1.0804	1.0866	1.0917	1.0956	1.0997	1.1041	1.1055	1.1058
42	8.2000	1.1081	1.0981	1.0885	1.0816	1.0779	1.0795	1.0862	1.0908	1.0933	1.0953	1.0982	1.0993	1.0994
43	8.4000	1.1031	1.0946	1.0864	1.0805	1.0774	1.0792	1.0852	1.0887	1.0899	1.0902	1.0917	1.0923	1.0924
44	8.6000	1.0968	1.0911	1.0857	1.0819	1.0800	1.0816	1.0862	1.0896	1.0917	1.0934	1.0958	1.0966	1.0967
45	8.8000	1.0945	1.0910	1.0878	1.0857	1.0847	1.0864	1.0902	1.0934	1.0962	1.0990	1.1019	1.1029	1.1031
46	9.0000	1.0956	1.0934	1.0914	1.0901	1.0898	1.0917	1.0952	1.0982	1.1007	1.1032	1.1058	1.1067	1.1068
47	9.2000	1.1018	1.0992	1.0967	1.0952	1.0946	1.0963	1.0998	1.1026	1.1049	1.1071	1.1095	1.1103	1.1105
48	9.4000	1.1080	1.1049	1.1020	1.1001	1.0992	1.1008	1.1042	1.1069	1.1090	1.1110	1.1133	1.1141	1.1142
49	9.6000	1.1139	1.1103	1.1070	1.1047	1.1036	1.1048	1.1081	1.1109	1.1133	1.1158	1.1185	1.1193	1.1195
50	9.8000	1.1194	1.1155	1.1118	1.1092	1.1079	1.1088	1.1121	1.1151	1.1179	1.1210	1.1240	1.1250	1.1252
51	10.000	1.1244	1.1203	1.1163	1.1135	1.1120	1.1129	1.1162	1.1194	1.1223	1.1257	1.1289	1.1299	1.1301
52	10.200	1.1289	1.1246	1.1204	1.1175	1.1159	1.1166	1.1200	1.1231	1.1262	1.1296	1.1329	1.1340	1.1342
53	10.4000	1.1328	1.1283	1.1241	1.1210	1.1193	1.1199	1.1231	1.1263	1.1294	1.1329	1.1363	1.1374	1.1376
54	10.6000	1.1359	1.1314	1.1270	1.1239	1.1221	1.1225	1.1256	1.1287	1.1318	1.1354	1.1387	1.1398	1.1400
55	10.8000	1.1385	1.1339	1.1295	1.1263	1.1244	1.1247	1.1276	1.1306	1.1336	1.1372	1.1405	1.1416	1.1418
56	11.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	12.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000