FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

NOV 17 2003

Docket No. 50-443

NYN-03097

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

Seabrook Station
Cycle 10 Core Operating Limits Report

FPL Energy Seabrook, LLC (FPLE Seabrook) is enclosing the Cycle 10 Core Operating Limits Report (COLR) for Seabrook Station pursuant to Technical Specification 6.8.1.6.c. Cycle 10 operation of Seabrook Station commenced on October 26, 2003.

Should you require further information regarding this report, please contact Mr. Paul V. Gurney, Reactor Engineering Manager at (603) 773-7776.

Very truly yours,

FPL ENERGY SEABROOK, LLC

James M. Peschel
Regulatory Programs Manager

cc: H. J. Miller, NRC Region I Administrator
V. Nerses, NRC Project Manager, Project Directorate I-2
G. T. Dentel, NRC Senior Resident Inspector

A001

ENCLOSURE TO NYN-03097

CORE OPERATING LIMITS REPORT

SEABROOK STATION CYCLE 10

COLR

June 2003

RE Supervisor	Robert Lautner P.E.	10/4/03
Operations Manager	[signature]	10/4/03
	Signature	Date

1.0 Core Operating Limits Report

This Core Operating Limits Report for Seabrook Station Unit 1, Cycle 10 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are:

1) 2.2.1 Limiting Safety System Settings
2) 3.1.1.1 Shutdown Margin Limit for MODES 1, 2, 3, 4
3) 3.1.1.2 Shutdown Margin Limit for MODE 5
4) 3.1.1.3 Moderator Temperature Coefficient
5) 3.1.3.5 Shutdown Rod Insertion Limit
6) 3.1.3.6 Control Rod Insertion Limits
7) 3.2.1 Axial Flux Difference
8) 3.2.2 Heat Flux Hot Channel Factor
9) 3.2.3 Nuclear Enthalpy Rise Hot Channel Factor

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 Specification 6.8.1.6.

2.1 *Limiting Safety System Settings: (Specification 2.2.1)*

2.1.1 Cycle Dependent Overtemperature ΔT Trip Setpoint Parameters and Function Modifier:

2.1.1.1 K1 = 1.180

2.1.1.2 K2 = 0.021 / °F

2.1.1.3 K3 = 0.0011 / psig

T = Measured RCS T_{avg} (°F), and

T' = Indicated RCS T_{avg} at RATED THERMAL POWER (Calibration temperature for ΔT instrumentation, ≤ 588.5°F).

P' = Nominal RCS operating pressure, 2235 psig

2.1.1.4 Channel Total Allowance (TA) = N.A.

2.1.1.5 Channel Z = N.A.

2.1.1.6 Channel Sensor Error (S) = N.A.

2.1.1.7 Allowable Value – The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 0.5% of ΔT span. Note that 0.5% of ΔT span is applicable to OTΔT input channels ΔT, Tavg and Pressurizer Pressure; 0.25% of ΔT span is applicable to ΔI.

2.1.1.8 $f_1(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range neutron ion chambers; with nominal gains to be selected based on measured instrument response during plant startup tests calibrations such that:

(1) For $q_t - q_b$ between –20% and +4%, $f_1(\Delta I) \geq 0$; 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 the total THERMAL POWER in percent RATED THERMAL POWER;

(2) For each percent that the magnitude of $q_t - q_b$ exceeds –20%, the ΔT Trip Setpoint shall be automatically reduced by ≥ 3.1% of its value at RATED THERMAL POWER.

(3) For each percent that the magnitude of $q_t - q_b$ exceeds +4%, the ΔT Trip Setpoint shall be automatically reduced by ≥ 2.44% of its value at RATED THERMAL POWER.

See Figure 5.

2.1.1.9 $\tau_1 \geq 8$ seconds

2.1.1.10 $\tau_2 \leq 3$ seconds

2.1.1.11 $\tau_3 = 0$ seconds

2.1.1.12 $\tau_4 \geq 33$ seconds

2.1.1.13 $\tau_5 \leq 4$ seconds

2.1.1.14 $\tau_6 = 0$ seconds

2.1.2 Cycle Dependent Overpower ΔT Trip Setpoint Parameters and Function Modifier:

2.1.2.1 K_4 = 1.121

2.1.2.2 K_5 = 0.020 / °F for increasing average temperature and K_5 = 0.0 for decreasing average temperature.

2.1.2.3 K_6 = 0.00175 / °F for T > T" and K6 = 0.0 for T ≤ T", where:

T = Measured T_{avg} (°F), and

T" = Indicated T_{avg} at RATED THERMAL POWER (Calibration temperature for ΔT instrumentation, ≤ 587.5 °F).

2.1.2.4 Channel Total Allowance (TA) = N.A.

2.1.2.5 Channel Z = N.A.

2.1.2.6 Channel Sensor Error (S) = N.A.

2.1.2.7 Allowable Value – The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 0.5% of ΔT span. Note that 0.5% of ΔT span is applicable to OPΔT input channels ΔT and T_{avg}.

2.1.2.8 $f_2(\Delta I)$ is disabled.

2.1.2.9 τ_1 as defined in 2.1.1.9, above.

2.1.2.10 τ_2 as defined in 2.1.1.10, above.

2.1.2.11 τ_3 as defined in 2.1.1.11, above.

2.1.2.12 τ_6 as defined in 2.1.1.14, above.

2.1.2.13 $\tau_7 \geq 10$ seconds. It is recognized that exactly equal values cannot always be dialed into the numerator and denominator in the protection system hardware, even if the nominal values are the same (10 seconds). Thus given the inequality sign in the COLR (greater than or equal to) the intent of the definition of this time constant applies primarily to the rate time constant (i.e., the Tau value in the numerator). The lag time constant (denominator Tau value) may be less than 10 seconds or less than the value of the numerator Tau value (e.g., if the numerator is set at 10.5, the denominator may be set to 10 or 9.5) and still satisfy the intent of the anticipatory protective feature.

2.2 Shutdown Margin Limit for MODES 1, 2, 3, and 4: (Specification 3.1.1.1)

A) The Shutdown Margin shall be greater than or equal to 1.3% ΔK/K, in MODES 1, 2, 3.

B) The Shutdown Margin shall be greater than or equal to 2.2% ΔK/K, in MODE 4.

2.3 Shutdown Margin Limit for MODE 5: (Specification 3.1.1.2)

The Shutdown Margin shall be greater than or equal to 2.2% ΔK/K.

2.4 Moderator Temperature Coefficient: (Specification 3.1.1.3)

2.4.1 The Moderator Temperature Coefficient (MTC) shall be less positive than $+3.12 \times 10^{-5}$ ΔK/K/°F for Beginning of Cycle Life (BOL), All Rods Out (ARO), Hot Zero Thermal Power conditions.

2.4.2 MTC shall be less negative than -5.0×10^{-4} ΔK/K/°F for End of Cycle Life (EOL), ARO, Rated Thermal Power conditions.

2.4.3 The 300 ppm ARO, Rated Thermal Power MTC shall be less negative than -4.1×10^{-4} ΔK/K/°F (300 ppm Surveillance Limit).

2.5 Shutdown Rod Insertion Limit: (Specification 3.1.3.5)

2.5.1 The shutdown rods shall be fully withdrawn. The fully withdrawn position is defined as the interval within 225 steps withdrawn to the mechanical fully withdrawn position inclusive.

2.6 Control Rod Insertion Limits: (Specification 3.1.3.6)

2.6.1 The control rod banks shall be limited in physical insertion as specified in Figure 1. Control Bank A shall be at least 225 steps withdrawn.

2.7 Axial Flux Difference: (Specification 3.2.1)

2.7.1 The indicated AFD must be within the Acceptable Operation Limits specified in Figure 2.

2.8 Heat Flux Hot Channel Factor : (Specification 3.2.2)

2.8.1 $F^{RTP}_{Q} = 2.50$

2.8.2 K(Z) is specified in Figure 3.

2.8.3 W(Z) is specified in Figures 4.1 to 4.5 and in Table 1.

The W(Z) data is applied over the cycle as follows:

BU < 150 MWD/MTU,	linear extrapolation of 150 and 2000 MWD/MTU W(Z) data
150 ≤ BU < 4000 MWD/MTU,	quadratic interpolation of 150, 2000, and 6000 MWD/MTU W(Z) data
4000 ≤ BU < 8000 MWD/MTU,	quadratic interpolation of 2000, 6000, and 10000 MWD/MTU W(Z) data
8000 ≤ BU ≤ 17000 MWD/MTU,	quadratic interpolation of 6000, 10000, and 17000 MWD/MTU W(Z) data
BU > 17000 MWD/MTU,	linear extrapolation of 10000 and 17000 MWD/MTU W(Z) data

2.8.4 The $F^{M}_{Q}(Z)$ penalty factor is 1.02.

2.9 Nuclear Enthalpy Rise Hot Channel Factor: (Specification 3.2.3)

2.9.1 $F^N_{\Delta H} \leq F^N_{\Delta H}(RTP) \times (1 + PF \times (1 - P))$
where P = THERMAL POWER / RATED THERMAL POWER.

2.9.2.a For $F^N_{\Delta H}$ measured by the fixed incore detectors:
$F^N_{\Delta H}(RTP)$ = 1.536 for the VANTAGE+ (w/ IFMs) and RFA fuels.

2.9.2.b For $F^N_{\Delta H}$ measured by the movable incore detectors:
$F^N_{\Delta H}(RTP)$ = 1.540 for the VANTAGE+ (w/ IFMs) and RFA fuels.

2.9.3 Power Factor Multiplier for $F^N_{\Delta H}$ = PF = 0.3 for all fuel types.

Figure 1
Control Bank Insertion Limits
Versus Thermal Power

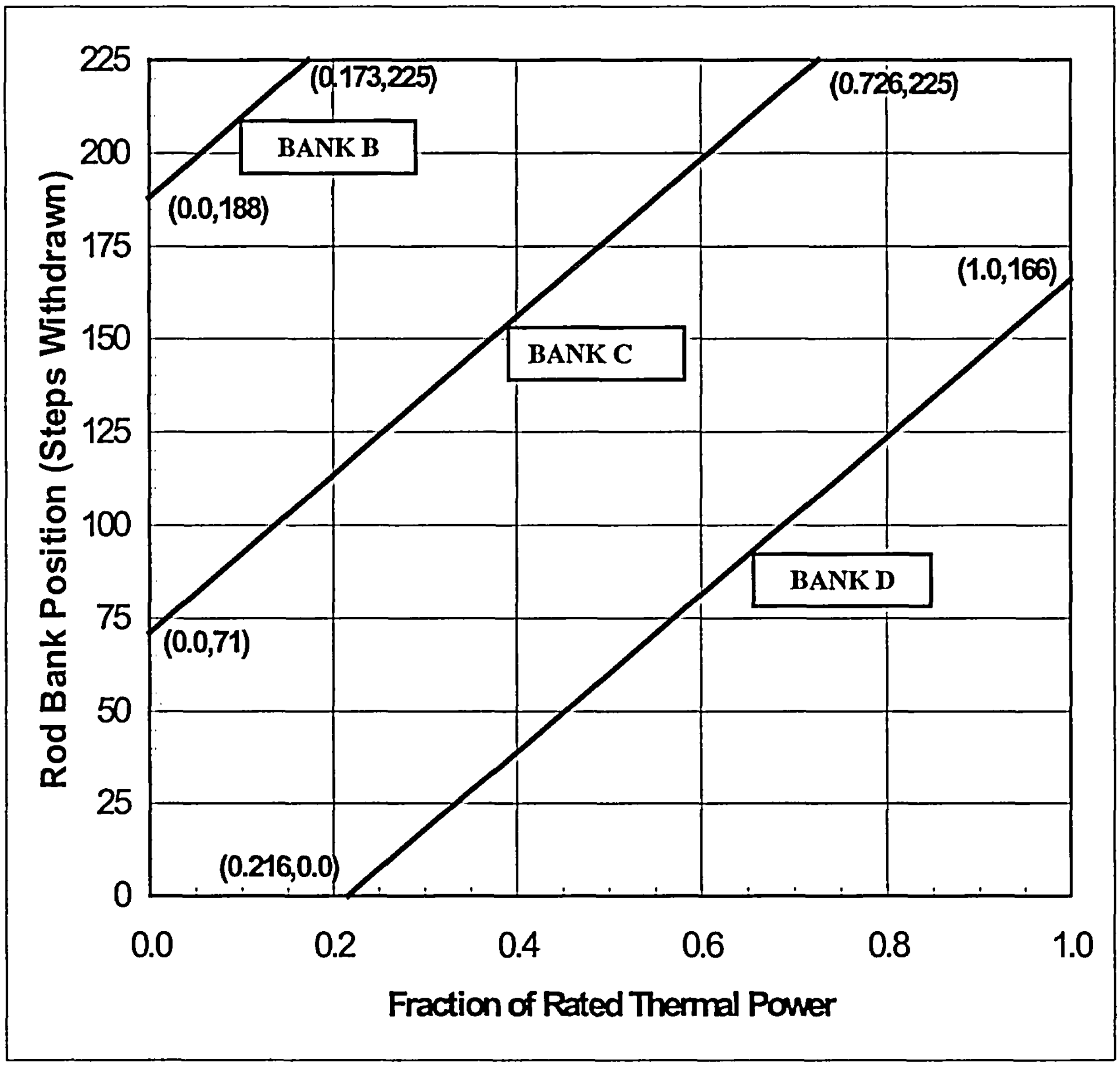
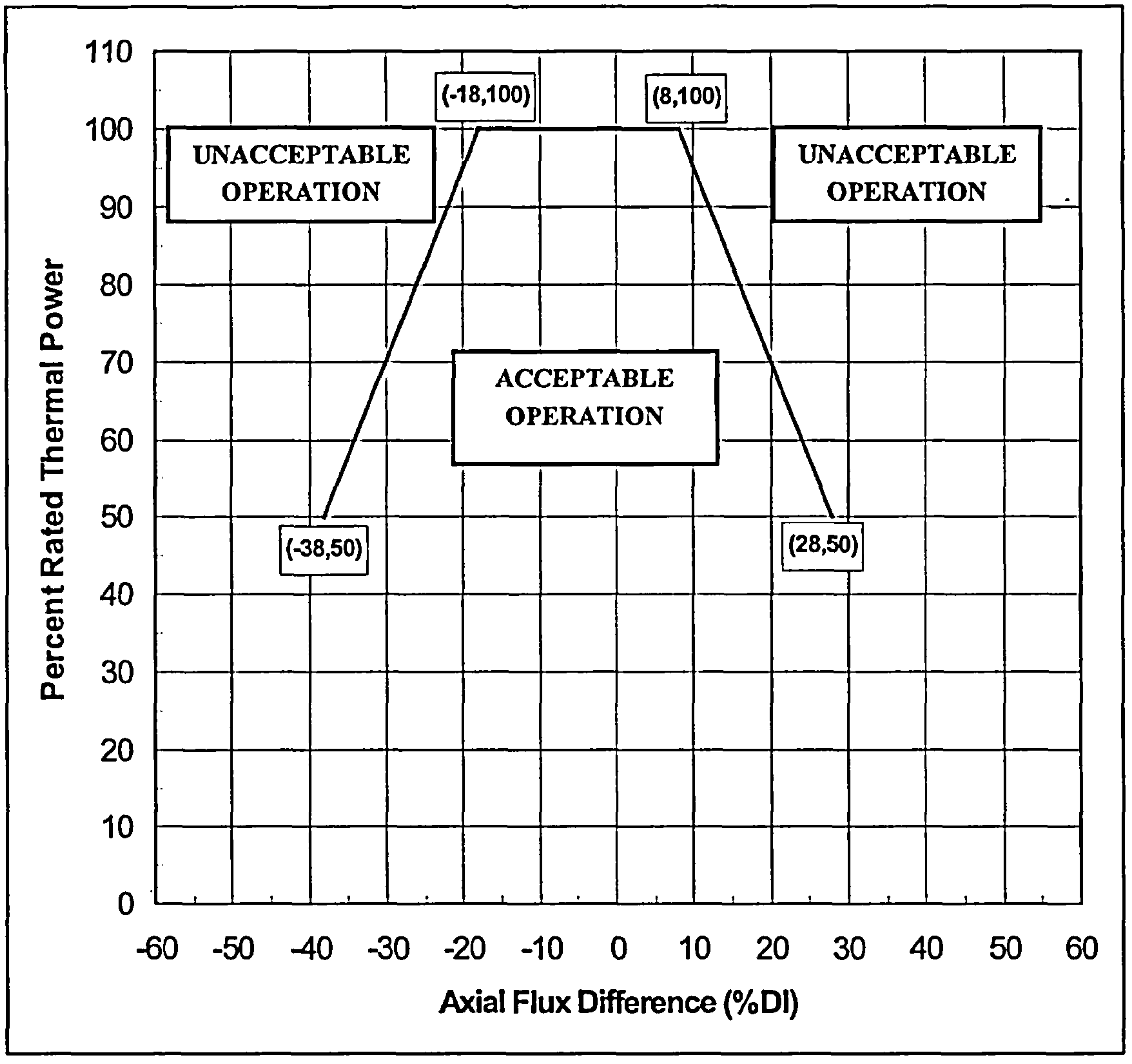


Figure 2
Axial Flux Difference Operating Limits Versus Thermal Power



Note: %DI = %ΔI

Figure 3
K(Z) Versus Core Height

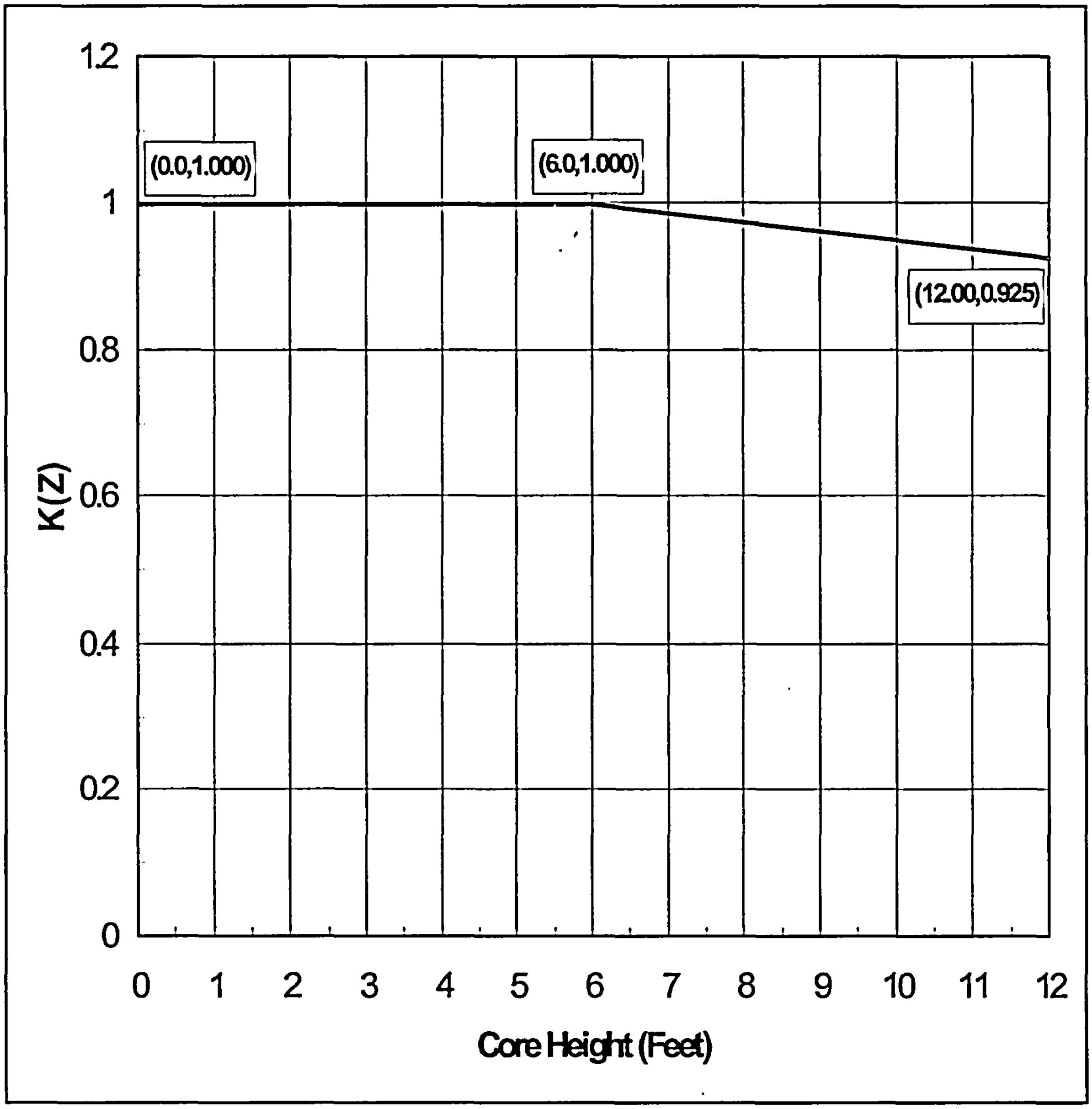


Figure 4.1
W(Z) Versus Core Height
150 MWD/MTU

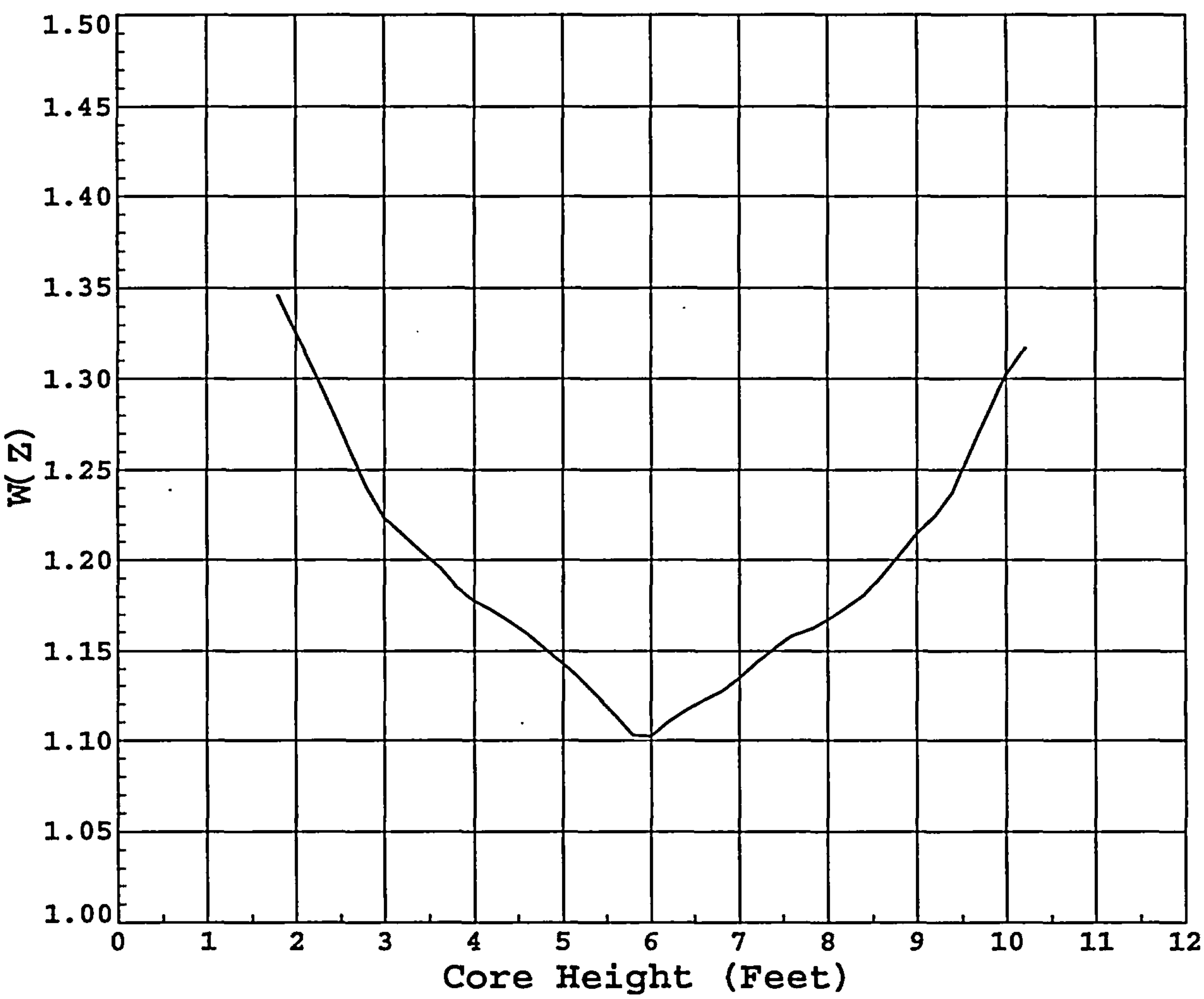


Figure 4.2
W(Z) Versus Core Height
2,000 MWD/MTU

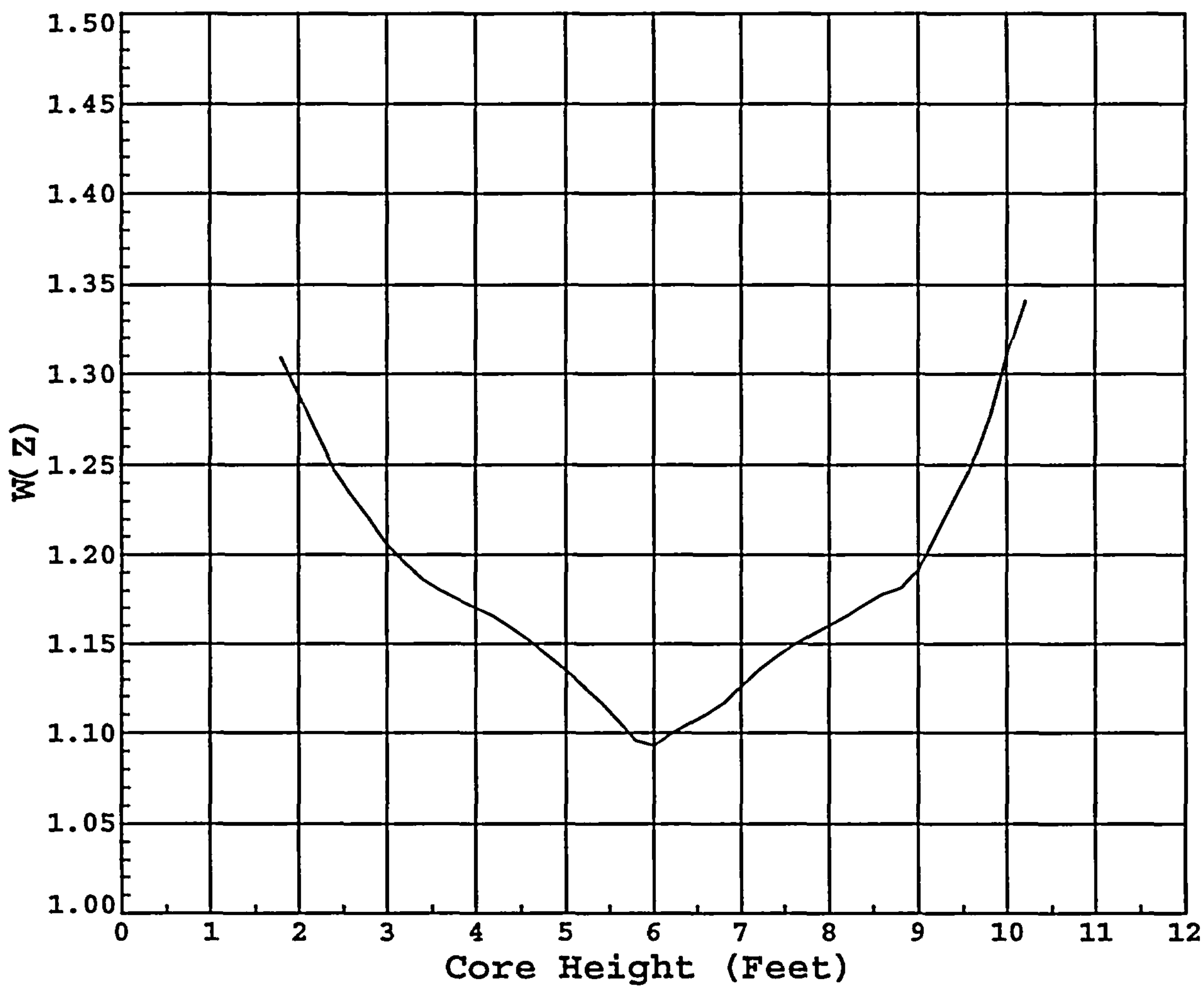


Figure 4.3
W(Z) Versus Core Height
6,000 MWD/MTU

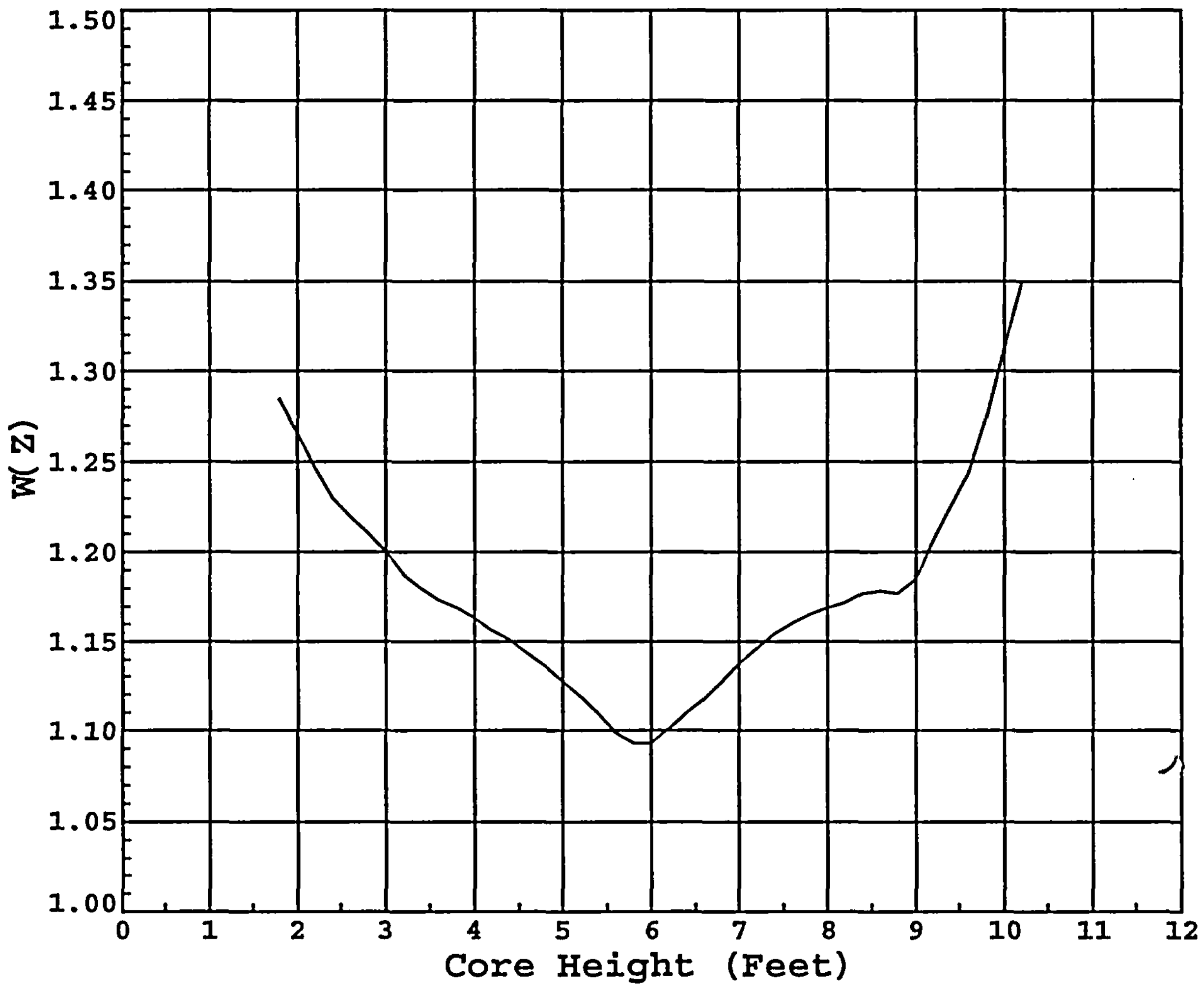


Figure 4.4
W(Z) Versus Core Height
10,000 MWD/MTU

Figure 4.5
W(Z) Versus Core Height
17,000 MWD/MTU

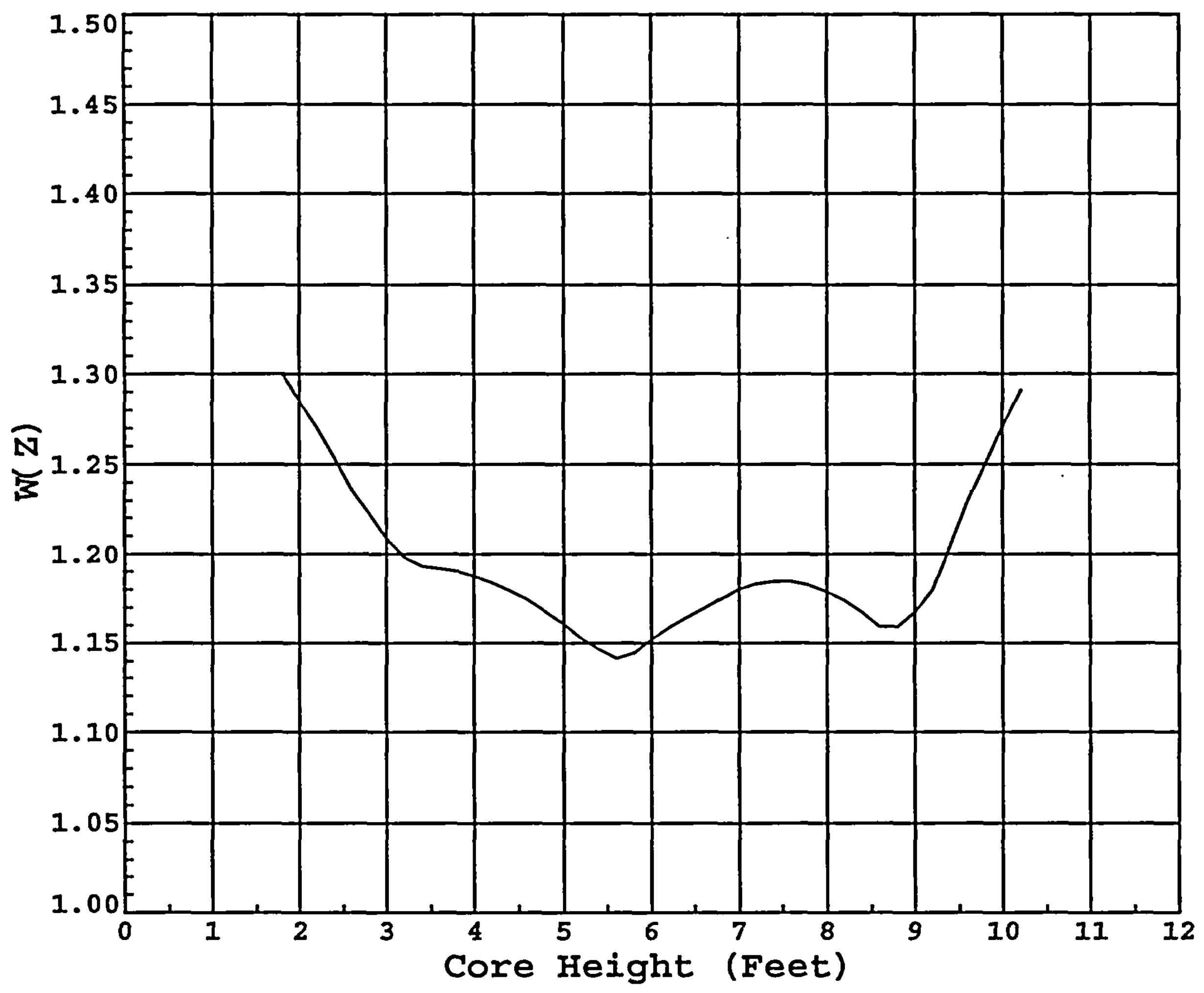


Figure 5

$f_1(\Delta I)$ Function

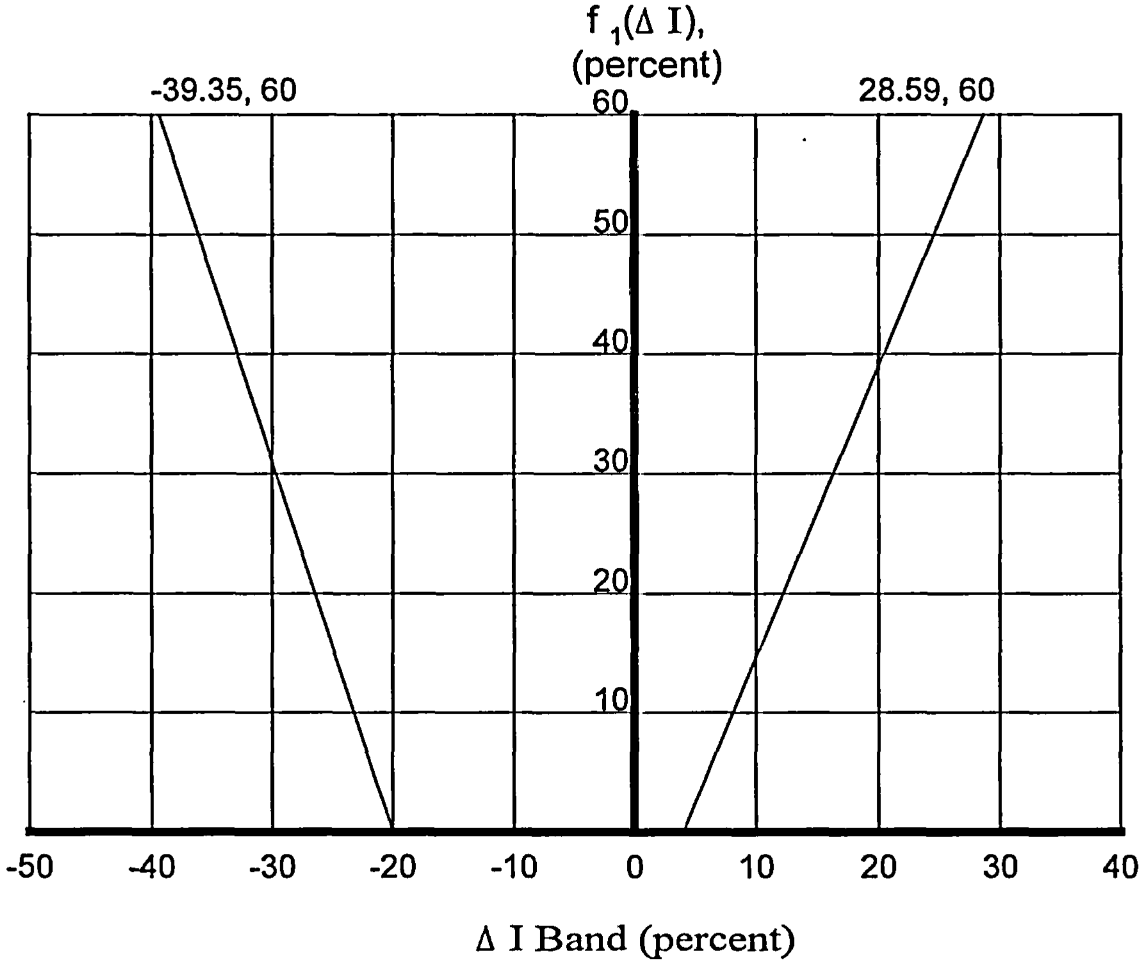


Table 1
W(Z, BU) versus Axial Height

HEIGHT (Z) (Feet)	W(Z,BU) 150 MWD/MTU	2000 MWD/MTU	6000 MWD/MTU	10000 MWD/MTU	17000 MWD/MTU
≤ 1.60	1.0000	1.0000	1.0000	1.0000	1.0000
1.80	1.3452	1.3085	1.2840	1.2931	1.3000
2.00	1.3255	1.2884	1.2659	1.2780	1.2852
2.20	1.3048	1.2671	1.2472	1.2629	1.2696
2.40	1.2836	1.2469	1.2299	1.2481	1.2534
2.60	1.2623	1.2333	1.2197	1.2334	1.2365
2.80	1.2396	1.2198	1.2112	1.2216	1.2226
3.00	1.2232	1.2062	1.1999	1.2098	1.2091
3.20	1.2139	1.1950	1.1880	1.1990	1.1979
3.40	1.2055	1.1865	1.1799	1.1918	1.1931
3.60	1.1965	1.1797	1.1733	1.1840	1.1916
3.80	1.1861	1.1749	1.1690	1.1753	1.1898
4.00	1.1781	1.1703	1.1636	1.1663	1.1870
4.20	1.1726	1.1646	1.1566	1.1586	1.1836
4.40	1.1661	1.1582	1.1504	1.1528	1.1793
4.60	1.1590	1.1512	1.1435	1.1462	1.1741
4.80	1.1512	1.1435	1.1359	1.1389	1.1679
5.00	1.1427	1.1351	1.1278	1.1309	1.1605
5.20	1.1336	1.1261	1.1191	1.1226	1.1528
5.40	1.1239	1.1165	1.1096	1.1134	1.1462
5.60	1.1137	1.1065	1.0991	1.1028	1.1408
5.80	1.1032	1.0958	1.0927	1.1025	1.1442
6.00	1.1021	1.0932	1.0930	1.1081	1.1523
6.20	1.1105	1.0998	1.1013	1.1200	1.1587
6.40	1.1166	1.1053	1.1100	1.1321	1.1641
6.60	1.1222	1.1100	1.1176	1.1435	1.1693
6.80	1.1275	1.1169	1.1273	1.1541	1.1748
7.00	1.1345	1.1259	1.1376	1.1635	1.1797
7.20	1.1435	1.1348	1.1465	1.1715	1.1827
7.40	1.1511	1.1427	1.1542	1.1780	1.1843
7.60	1.1575	1.1494	1.1606	1.1829	1.1842
7.80	1.1617	1.1546	1.1656	1.1862	1.1824
8.00	1.1669	1.1596	1.1691	1.1872	1.1789
8.20	1.1743	1.1659	1.1723	1.1871	1.1737
8.40	1.1809	1.1720	1.1769	1.1890	1.1668
8.60	1.1909	1.1776	1.1787	1.1897	1.1589
8.80	1.2030	1.1813	1.1774	1.1910	1.1595
9.00	1.2144	1.1915	1.1853	1.1973	1.1672
9.20	1.2247	1.2119	1.2065	1.2090	1.1800
9.40	1.2378	1.2306	1.2250	1.2231	1.2045
9.60	1.2597	1.2482	1.2431	1.2464	1.2280
9.80	1.2823	1.2758	1.2738	1.2746	1.2497
10.00	1.3021	1.3106	1.3129	1.3024	1.2710
10.20	1.3170	1.3407	1.3487	1.3284	1.2908
≥10.40	1.0000	1.0000	1.0000	1.0000	1.0000