June 03, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket No. 50-327
Tennessee Valley Authority	)	

SEQUOYAH NUCLEAR PLANT (SQN) - UNIT 1 CYCLE 13 CORE OPERATING LIMITS REPORT (COLR)

In accordance with Sequoyah Unit 1 Technical Specification 6.9.1.14.c, enclosed is the Unit 1 Cycle 13 COLR.

This letter is being sent in accordance with NRC RIS 2001-05. Please direct questions concerning this issue to me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Original signed by

Pedro Salas
Licensing and Industry Affairs Manager

Enclosure

ENCLOSURE

SEQUOYAH NUCLEAR PLANT UNIT 1 CYCLE 13
CORE OPERATING LIMITS REPORT
REVISION 0

COLR FOR SEQUOYAH UNIT 1 CYCLE 13

CORE OPERATING LIMITS REPORT

REVISION 0

May 2003

Prepared:

__Signed by Terry R. Moffett________________________________ / May 5, 2003
Nuclear Fuel   Date

Reviewed:

__Signed by Gary Bair______________________________________ / May 13, 2003
Reactor Engineering Supervisor   Date

__Signed by Ed E. Freeman__________________________________ / May 14, 2003__
Operations Manager   Date

__Signed by Ed E. Freeman, PORC Meeting 6119_______________ / May 15, 2003_
PORC Chairman   Date

Revision __0__

Pages affected _____

Reason for Revision ____

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1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Sequoyah Unit 1 Cycle 13 has been prepared in accordance with the requirements of Technical Specification (TS) 6.9.1.14.

The TSs affected by this report are listed below:

TABLE 2.2-1	f_1 (ΔI) trip reset function for OTΔT Trip (QTNL, QTPL) and rates of trip setpoint decrease per percent ΔI (QTNS, QTPS)
TABLE 2.2-1	f_2 (ΔI) trip reset function for OPΔT Trip (QPNL, QPPL) and rates of trip setpoint decrease per percent ΔI (QPNS, QPPS)
3/4.1.1.3	Moderator Temperature Coefficient (MTC)
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 (X,Y,Z))
3/4.2.3	Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$ (X,Y))

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 TS 6.9.1.14.

The following abbreviations are used in this section:

BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero THERMAL POWER
EOL stands for End of Cycle Life
RTP stands for RATED THERMAL POWER

2.1 Moderator Temperature Coefficient - MTC (Specification 3/4.1.1.3)

2.1.1 The MTC limits are:

The BOL/ARO/HZP MTC shall be less positive than 0 Δk/k/°F (BOL limit). With the measured BOL/ARO/HZP MTC more positive than -0.10×10^{-5} Δk/k/°F (as-measured MTC limit), establish control rod withdrawal limits to ensure the MTC remains less positive than 0 Δk/k/°F for all times in core life.

The EOL/ARO/RTP MTC shall be less negative than or equal to -4.5×10^{-4} Δk/k/°F.

2.1.2 The 300 ppm surveillance limit is:

The measured 300 ppm/ARO/RTP MTC should be less negative than or equal to -3.75×10^{-4} $\Delta k/k/°F$.

2.2 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.2.1 The shutdown rods shall be withdrawn to a position as defined below:

Cycle Burnup (MWD/MTU)	Steps Withdrawn
$\geq$ 0	$\geq$ 225 to $\leq$ 231

2.3 Control Rod Insertion Limits (Specification 3/4.1.3.6)

2.3.1 The control rod banks shall be limited in physical insertion as shown in Figure 1.

2.4 Axial Flux Difference - AFD (Specification 3/4.2.1)

2.4.1 The axial flux difference (AFD) limits (AFD^{Limit}) are provided in Figure 2.

2.5 Heat Flux Hot Channel Factor - F_Q (X,Y,Z) (Specification 3/4.2.2)

F_Q (X,Y,Z) shall be limited by the following relationships:

$$F_Q(X,Y,Z) \leq \frac{F_Q^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_Q(X,Y,Z) \leq \frac{F_Q^{RTP}}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

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

2.5.1 F_Q^{RTP} = 2.50

2.5.2 K(Z) is provided in Figure 3

The following parameters are required for core monitoring per the Surveillance Requirements of Specification 3/4.2.2:

2.5.3 $NSLOPE^{AFD}$ = 1.12

where $NSLOPE^{AFD}$ = Negative AFD limit adjustment required to compensate for each 1% that F_Q (X,Y,Z) exceeds BQDES.

2.5.4 $PSLOPE^{AFD}$ = 0.94

where $PSLOPE^{AFD}$ = Positive AFD limit adjustment required to compensate for each 1% that F_Q (X,Y,Z) exceeds BQDES.

2.5.5 $NSLOPE^{f_2(\Delta I)}$ = 1.40

where $NSLOPE^{f_2(\Delta I)}$ = Adjustment to negative OPΔT $f_2(\Delta I)$ limit required to compensate for each 1% that F_Q (X,Y,Z) exceeds BCDES.

2.5.6 $PSLOPE^{f_2(\Delta I)}$ = 1.56

where $PSLOPE^{f_2(\Delta I)}$ = Adjustment to positive OPΔT $f_2(\Delta I)$ limit required to compensate for each 1% that F_Q (X,Y,Z) exceeds BCDES.

2.5.7 BQNOM(X,Y,Z) = Nominal design peaking factor, increased by an allowance for the expected deviation between the nominal design power distribution and the measurement.

2.5.8 BQDES(X,Y,Z) = Maximum allowable design peaking factor which ensures that the F_Q (X,Y,Z) limit will be preserved for operation within the LCO limits, including allowances for calculational and measurement uncertainties.

2.5.9 BCDES(X,Y,Z) = Maximum allowable design peaking factor which ensures that the centerline fuel melt limit will be preserved for operation within the LCO limits, including allowances for calculational and measurement uncertainties.

BQNOM(X,Y,Z), BQDES(X,Y,Z), and BCDES(X,Y,Z) data bases are provided for input to the plant power distribution analysis codes on a cycle specific basis and are determined using the methodology for core limit generation described in the references in Specification 6.9.1.14.

2.5.10 The increase in F_Q^M (X,Y,Z) for compliance with the 4.2.2.2.e Surveillance Requirements is defined as follows:

For cycle burnups $\leq$ 3668 MWd/MTU	2.0%
For cycle burnups > 3668 MWd/MTU to $\leq$ 4831 MWd/MTU	2.3%
For cycle burnups > 4831 MWd/MTU	2.0%

2.6 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}$ (X,Y) (Specification 3/4.2.3)

$F_{\Delta H}$ (X,Y) shall be limited by the following relationship:

$F_{\Delta H}$ (X,Y) $\leq$ MAP(X,Y,Z) / AXIAL(X,Y)

2.6.1 MAP(X,Y,Z) is provided in Table 1.

AXIAL(X,Y) is the axial peak from the normalized axial power shape.

The following parameters are required for core monitoring per the Surveillance Requirements of Specification 3/4.2.3:

$F\Delta HR^M$ (X,Y) $\leq$ BHNOM(X,Y)

where $F\Delta HR^M$ (X,Y) = $F_{\Delta H}$ (X,Y) / MAP^M / AXIAL(X,Y)

$F_{\Delta H}$ (X,Y) is the measured radial peak at location X,Y.

MAP^M is the value of MAP(X,Y,Z) obtained from Table 1 for the measured peak.

2.6.2 BHNOM(X,Y) = nominal design radial peaking factor, increased by an allowance for the expected deviation between the nominal design power distribution and the measurement.

2.6.3 BHDES(X,Y) = maximum allowable design radial peaking factor which ensures that the $F_{\Delta H}$ (X,Y) limit will be preserved for operation within the LCO limits, including allowances for calculational and measurement uncertainties.

2.6.4 BRDES(X,Y) = maximum allowable design radial peaking factor which ensures that the steady state DNBR limit will be preserved for operation within the LCO limits, including allowances for calculational and measurement uncertainties.

BHNOM(X,Y), BHDES(X,Y) and BRDES(X,Y) data bases are provided for input to the plant power distribution analysis computer codes on a cycle specific basis and are determined using the methodology for core limit generation described in the references in Specification 6.9.1.14.

2.6.5 RRH = 3.34 when $0.8 < P \leq 1.0$

RRH = 1.67 when $P \leq 0.8$

where RRH = Thermal power reduction required to compensate for each 1% that $F_{\Delta H}(X,Y)$ exceeds its limit.

P = Thermal Power / Rated Thermal Power

2.6.6 TRH = 0.0334 when $0.8 < P \leq 1.0$

TRH = 0.0167 when $P \leq 0.8$

where TRH = Reduction in OTΔT K_1 setpoint required to compensate for each 1% $F_{\Delta H}(X,Y)$ exceeds its limit.

2.6.7 All cycle burnups shall use a 2% increase in $F_{\Delta H}^{M}$ (X,Y) margin for compliance with the 4.2.3.2.d.1 Surveillance Requirement.

3.0 REACTOR CORE PROTECTIVE LIMITS

3.1 Trip Reset Term [$f_1(\Delta I)$] for Overtemperature Delta T-Trip (Specification 2.2.1)

The following parameters are required to specify the power level-dependent $f_1(\Delta I)$ trip reset term limits for the Overtemperature Delta-T trip function:

3.1.1 QTNL = -20%

where QTNL = the maximum negative ΔI setpoint at rated thermal power at which the trip setpoint is not reduced by the axial power distribution.

3.1.2 QTPL = +5%

where QTPL = the maximum positive ΔI setpoint at rated thermal power at which the trip setpoint is not reduced by the axial power distribution.

3.1.3 QTNS = 2.50%

where QTNS = the percent reduction in Overtemperature Delta-T trip setpoint for each percent that the magnitude of ΔI exceeds its negative limit at rated thermal power (QTNL).

3.1.4 QTPS = 1.40%

where QTPS = the percent reduction in Overtemperature Delta-T trip setpoint for each percent that the magnitude of ΔI exceeds its positive limit at rated thermal power (QTPL).

3.2 Trip Reset Term [$f_2(\Delta I)$] for Overpower Delta-T Trip (Specification 2.2.1)

The following parameters are required to specify the power level-dependent $f_2(\Delta I)$ trip reset term limits for the Overpower Delta-T trip function:

3.2.1 QPNL = -25%

where QPNL = the maximum negative ΔI setpoint at rated thermal power at which the trip setpoint is not reduced by the axial power distribution.

3.2.2 QPPL = +25%

where QPPL = the maximum positive ΔI setpoint at rated thermal power at which the trip setpoint is not reduced by the axial power distribution.

3.2.3 QPNS = 1.70%

where QPNS = the percent reduction in Overpower Delta-T trip setpoint for each percent that the magnitude of ΔI exceeds its negative limit at rated thermal power (QPNL).

3.2.4 QPPS = 1.70%

where QPPS = the percent reduction in Overpower Delta T trip setpoint for each percent that the magnitude of ΔI exceeds its positive limit at rated thermal power (QPPL).

Table 1

Maximum Allowable Peaking Limits MAP(X,Y,Z)

AXIAL(X,Y)	ELEVATION (ft)	MAP(X,Y,Z)
1.1	2	1.9540
	4	1.9494
	6	1.9431
	8	1.9337
	10	1.9147
1.2	2	2.1780
	4	2.1682
	6	2.1543
	8	2.1317
	10	2.0855
1.3	2	2.4025
	4	2.3875
	6	2.3672
	8	2.3029
	10	2.1902
1.4	2	2.6264
	4	2.6047
	6	2.5629
	8	2.4204
	10	2.2893
1.5	2	2.8525
	4	2.8119
	6	2.6771
	8	2.5251
	10	2.3839
1.7	2	2.7765
	4	3.0191
	6	2.8610
	8	2.7036
	10	2.5528

AXIAL(X,Y)	ELEVATION (ft)	MAP(X,Y,Z)
1.9	2	2.8169
	4	3.1537
	6	3.0026
	8	2.8465
	10	2.6987
>1.9	2	2.5377
	4	2.8412
	6	2.7051
	8	2.5644
	10	2.4313
2.2	2	2.6873
	4	3.3150
	6	3.1660
	8	3.0227
	10	2.7136
2.6	2	2.6965
	4	3.5807
	6	3.5514
	8	3.3102
	10	2.9726
3.0	2	2.9517
	4	3.8016
	6	4.1225
	8	3.6877
	10	3.3466
3.5	2	3.1500
	4	4.1097
	6	4.1197
	8	3.7296
	10	3.4811

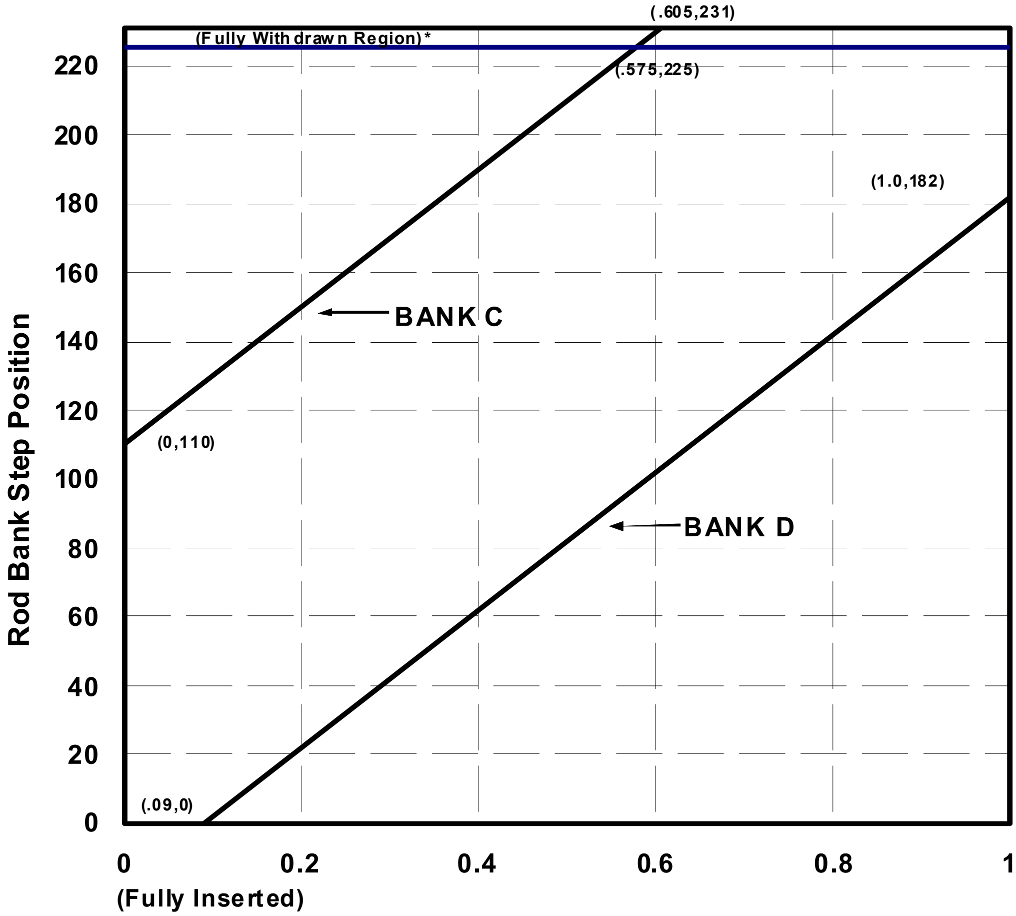

FIGURE 1
Rod Bank Insertion Limits Versus Thermal Power, Four Loop Operation

*Fully withdrawn region shall be the condition where shutdown and control banks are at a position within the interval of ≥225 and ≤231 steps withdrawn, inclusive.

Fully withdrawn shall be the position as defined below,

Cycle Burnup (MWd/mtU)	Steps Withdrawn
≥ 0	≥225 to ≤231

This figure is valid for operation at a rated thermal power of 3455 MWt when the LEFM is in operation.

If the LEFM becomes inoperable, then prior to the next NIS calibration, the maximum allowable power level must be reduced by 1.3% in power, and the rod insertion limit lines must be increased by 3 steps withdrawn until the LEFM is returned to operation.

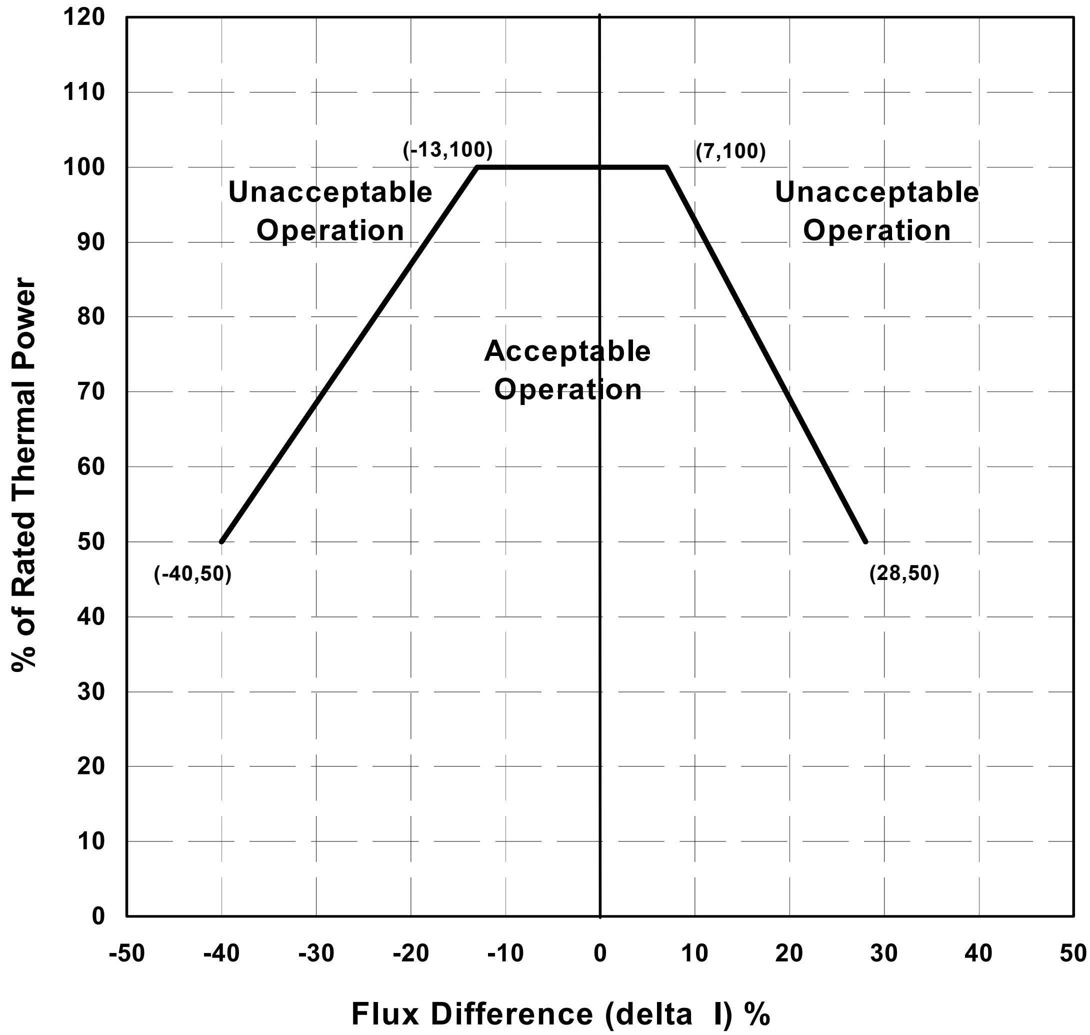

FIGURE 2

Axial Flux Difference Limits As A Function of Rated Thermal Power

This figure is valid for operation at a rated thermal power of 3455 MWt when the LEFM is in operation. If the LEFM becomes inoperable, then prior to the next NIS calibration, the maximum allowable power level must be reduced by 1.3% in power, and the AFD limit lines must be made more restrictive by 1% in AFD until the LEFM is returned to operation.

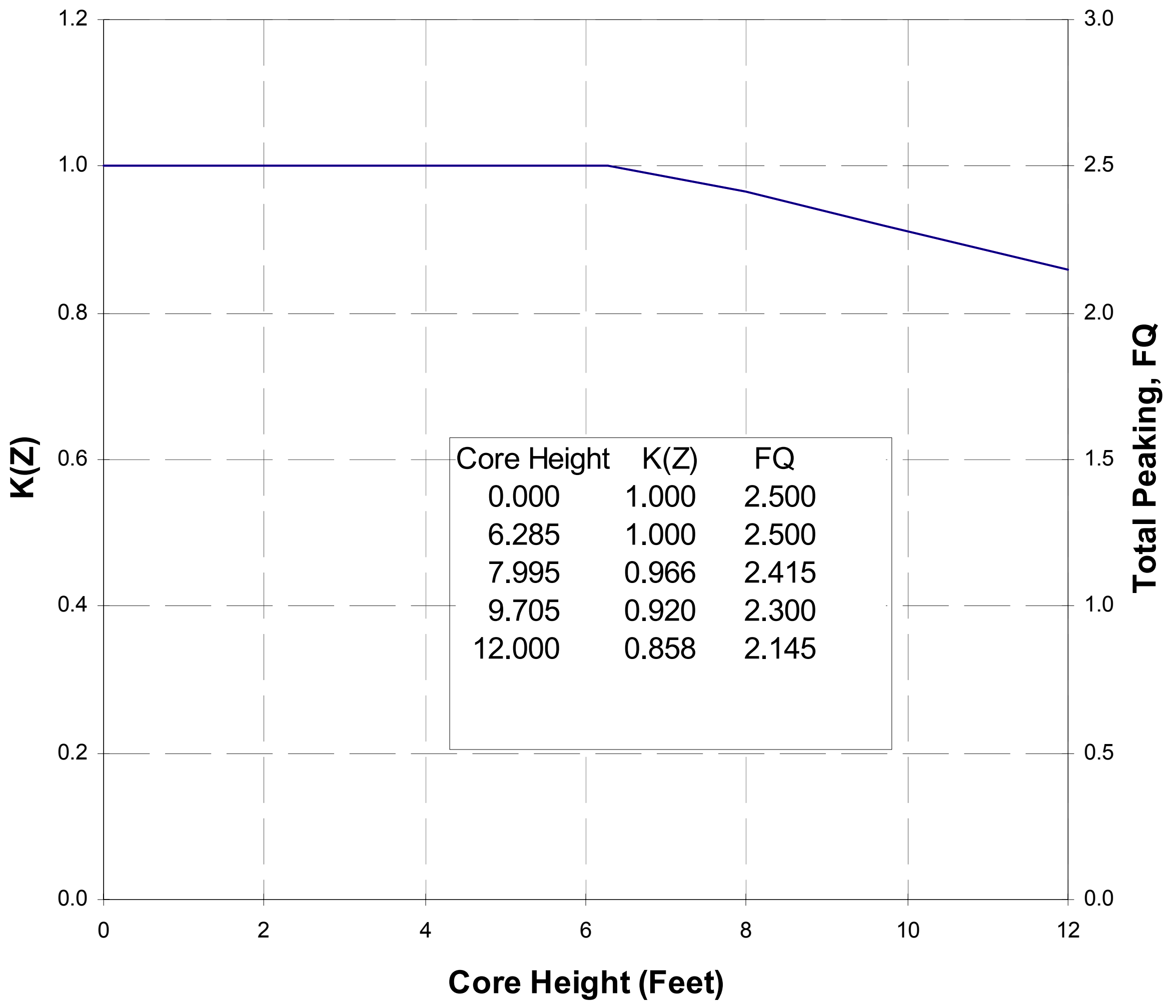

FIGURE 3

K(Z) - Normalized FQ(X, Y, Z) as a Function of Core Height