Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

March 3, 2000

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 CORE OPERATING LIMITS REPORT (COLR)

In accordance with SQN Unit 1 Technical Specification 6.9.1.14.c, enclosed is the Unit 1 Cycle 11 COLR.

Please direct questions concerning this issue to me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Pedro Salas
Licensing and Industry Affairs Manager

Enclosure
cc: See page 2

A001

cc (Enclosure):

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ENCLOSURE

SEQUOYAH NUCLEAR PLANT UNIT 1 CYCLE 11
CORE OPERATING LIMITS REPORT
REVISION 0

LICENSING TRANSMITTAL TO NRC
SUMMARY AND CONCURRENCE SHEET

THE PURPOSE OF THIS CONCURRENCE SHEET IS TO ASSURE THE ACCURACY AND COMPLETENESS OF TVA SUBMITTALS TO THE NRC.

DATE ______________ DATE DUE NRC 04/15/2000 - C

SUBMITTAL PREPARED BY J. W. Proffitt

SUBJECT: Sequoyah Nuclear Plant (SQN) - Unit 1 Core OperatingLimits Report (COLR)

PURPOSE/SUMMARY Transmit to NRC the latest COLR revision.

RESPONDS TO ______________________ (RIMS NO.) ______________

NEW COMMITMENTS ____ YES X NO

INDEPENDENT REVIEW ________________ DATE: ________________

LICENSING BASIS CHANGE - If this submittal requires a change to the licensing basis, a change has been initiated in accordance with NADP-7. ______________ DATE __________

A concurrence signature reflects that the signatory has assured that the submittal is appropriate and consistent with TVA Policy, applicable commitments are approved for implementation and supporting documentation for submittal completeness and accuracy has been prepared.

CONCURRENCE (3)

NAME	ORGANIZATION	SIGNATURE	DATE
D. L Koehl	SQN Plant Manager		

10CFR 50.54(f) oath or affirmation required [ ] Yes [ ] No [X] N/A

NAME	ORGANIZATION	SIGNATURE	DATE
J. D. Smith	SQN Licensing Supv.		
J. W. Proffitt	SQN Lic & IA		

I: license / worddoc / Unit 1 Cycle 11 COLR
JWP:PMB

L36 000217 800

QA RECORD

COLR FOR SEQUOYAH UNIT 1 CYCLE 11

SEQUOYAH NUCLEAR PLANT UNIT 1, CYCLE 11

REVISION 0

February 2000

Prepared:

[signature] / 2-22-2000

Nuclear Fuel — Date

Reviewed:

[signature] / 2-22-2000

Reactor Engineering Supervisor — Date

[signature] / 2-22-2000

Operations Manager — Date

[signature] / 2-24-2000

PORC Chairman — Date

Revision 0

Pages affected ____

Reason for Revision ____

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Sequoyah Unit 1 Cycle 11 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 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} Δk/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
≤ 4,000	≥ 225 to ≤ 231
> 4,000 to < 14,000	≥ 222 to ≤ 231
≥ 14,000	≥ 225 to ≤ 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:

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

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

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

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 $NSLOPE^{AFD}$ = 1.15

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

2.5.4 $PSLOPE^{AFD}$ = 1.08

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 $PSLOPE^{f_2(\Delta I)}$ = 1.63

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 $\leq$ 7128 MWd/MTU	2.0%
For cycle burnups > 7128 MWd/MTU to $\leq$ 7774 MWd/MTU	3.0%
For cycle burnups > 7774 MWd/MTU to $\leq$ 9171 MWd/MTU	4.0%
For cycle burnups > 9171 MWd/MTU to $\leq$ 9494 MWd/MTU	3.0%
For cycle burnups > 9494 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)

Elevation (ft)	AXIAL (X,Y)	MAP (X,Y,Z)
2	1.1	1.970
4		1.966
6		1.958
8		1.945
10		1.917
2	1.2	2.208
4		2.197
6		2.180
8		2.150
10		2.072
2	1.3	2.453
4		2.434
6		2.406
8		2.315
10		2.185
2	1.4	2.702
4		2.672
6		2.572
8		2.429
10		2.288
2	1.5	2.956
4		2.826
6		2.683
8		2.529
10		2.381
2	1.7	3.162
4		3.007
6		2.850
8		2.690
10		2.542
2	1.9	3.283
4		3.133
6		2.982
8		2.821
10		2.685

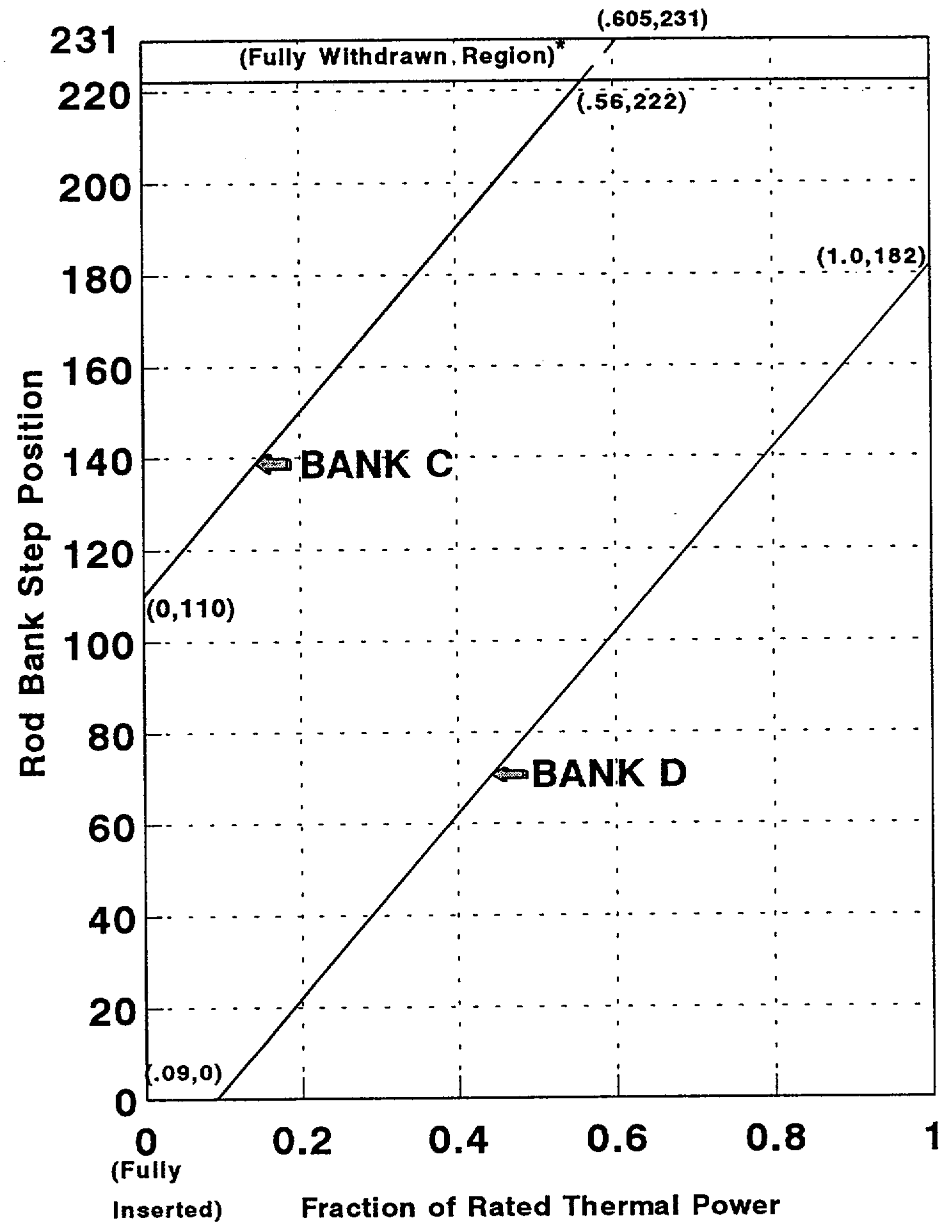

FIGURE 1

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 ≥ 222 and ≤ 231 steps withdrawn, inclusive.

Fully withdrawn shall be the position as defined below,

Cycle Burnup (MWd/MTU)	Step Withdrawn
≤ 4000	≥ 225 to ≤ 231
> 4000 to < 14,000	≥ 222 to ≤ 231
≥ 14,000	≥ 225 to ≤ 231

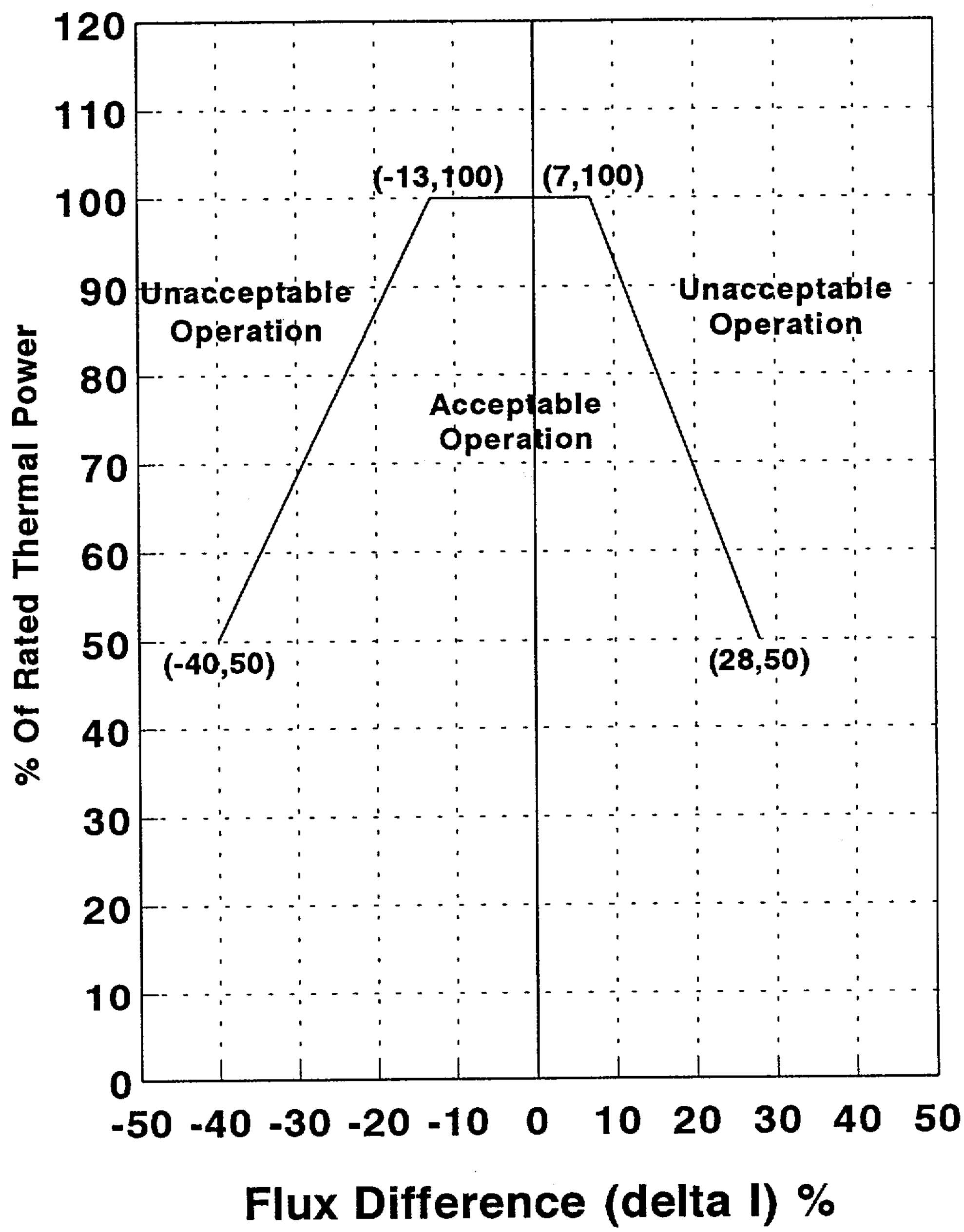

FIGURE 2

Axial Flux Difference Limits As A Function Of Rated Thermal Power

COLR For Sequoyah Unit 1 Cycle 11

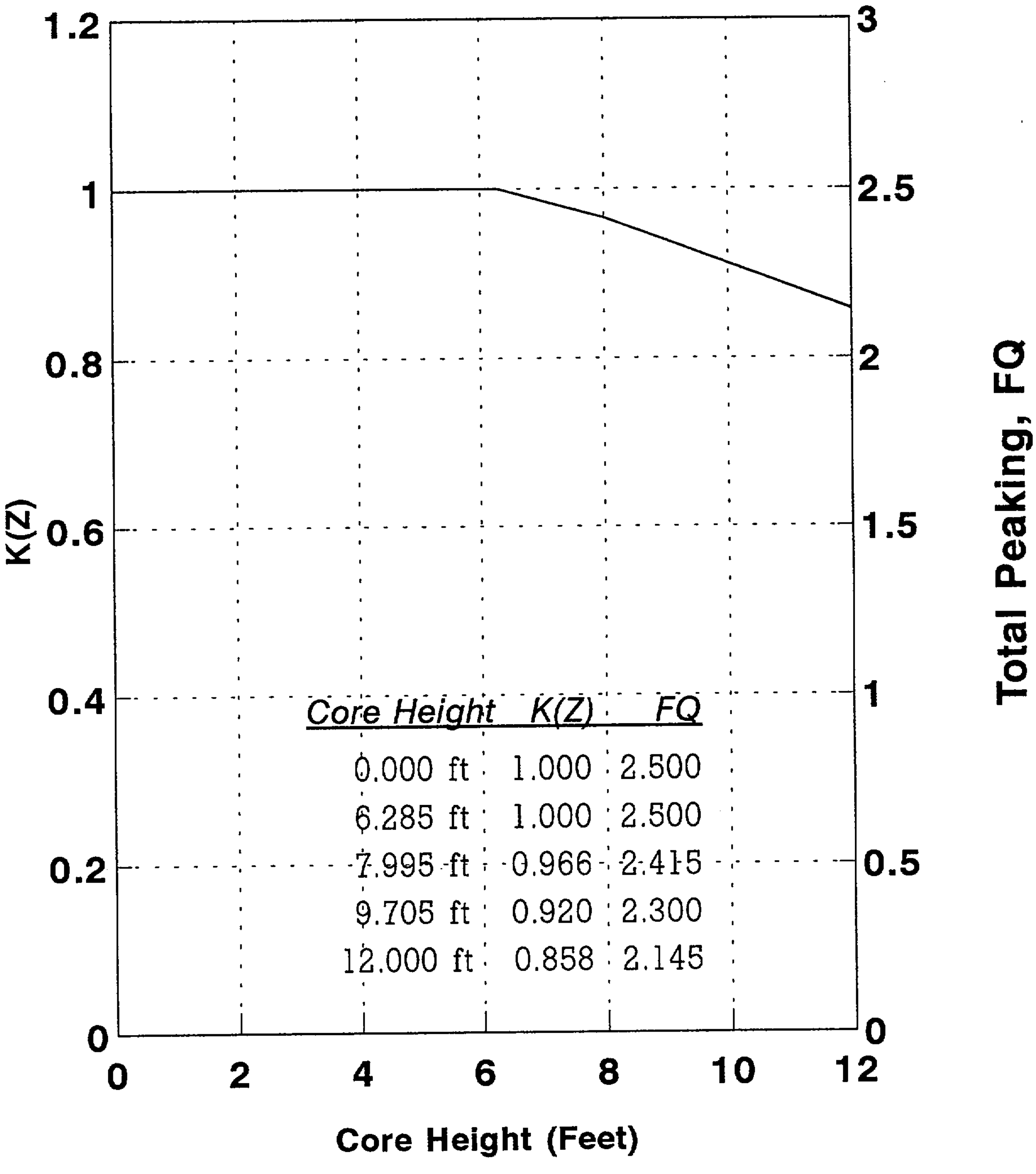

FIGURE 3

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