

ENCLOSURE

SEQUOYAH NUCLEAR PLANT UNIT 1 CYCLE 7

CORE OPERATING LIMITS REPORT

REVISION 1

AUGUST 19, 1993

(L36 930812 800)

SEQUOYAH NUCLEAR PLANT UNIT 1, CYCLE 7

CORE OPERATING LIMITS REPORT

REVISION 1

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Revision 1

Pages affected 8-12

Reason for Revision Core was redesigned due to tilted  
fuel assembly H64 during core onload

## COLR FOR SEQUOYAH UNIT 1 CYCLE 7

### 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Sequoyah Unit 1 Cycle 7 has been prepared in accordance with the requirements of Technical Specification (TS) 6.9.1.14.

The TSSs affected by this report are listed below:

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

### 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  $\Delta k/k/^{\circ}F$  (BOL limit). With the measured BOL/ARO/HZP-MTC more positive than 0  $\Delta k/k/^{\circ}F$  (as-measured MTC limit), establish control rod withdrawal limits to ensure the MTC remains less positive than 0  $\Delta k/k/^{\circ}F$  for all times in core life.

The EOL/ARO/RTP-MTC shall be less negative than or equal to  $-4.0 \times 10^{-4}$   $\Delta k/k/^{\circ}F$ .

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2.1.2 The 300 ppm surveillance limit is:

The measured 300 ppm/ARO/RTP-MTC should be less negative than or equal to  $-3.1 \times 10^{-4} \Delta k/k/^{\circ}F$ .

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2.2.1 The shutdown rods shall be withdrawn to a position as defined below:

<u>Cycle Burnup (MWD/MFU)</u>	<u>Steps Withdrawn</u>
$\leq 2,000$	$\geq 226$ to $\leq 231$
$> 2,000$ to $< 14,000$	$\geq 222$ to $\leq 231$
$\geq 14,000$	$\geq 226$ 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 are provided in Figure 2.

2.5 Heat Flux Hot Channel Factor -  $F_0(Z)$  (Specification 3/4.2.2)

$$F_0(Z) \leq \frac{F_0^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_0(Z) \leq \frac{F_0^{RTP}}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

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

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2.5.1  $F_0^{RTP} = 2.40$

2.5.2  $K(Z)$  is provided in Figure 3.

2.5.3 Note that the  $W(Z)$  values required by TS SR 4.2.2.2 are provided in Figures 4 through 8. This information is sufficient to determine  $W(Z)$  versus core height for all cycle burnups through the use of three point interpolation.

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

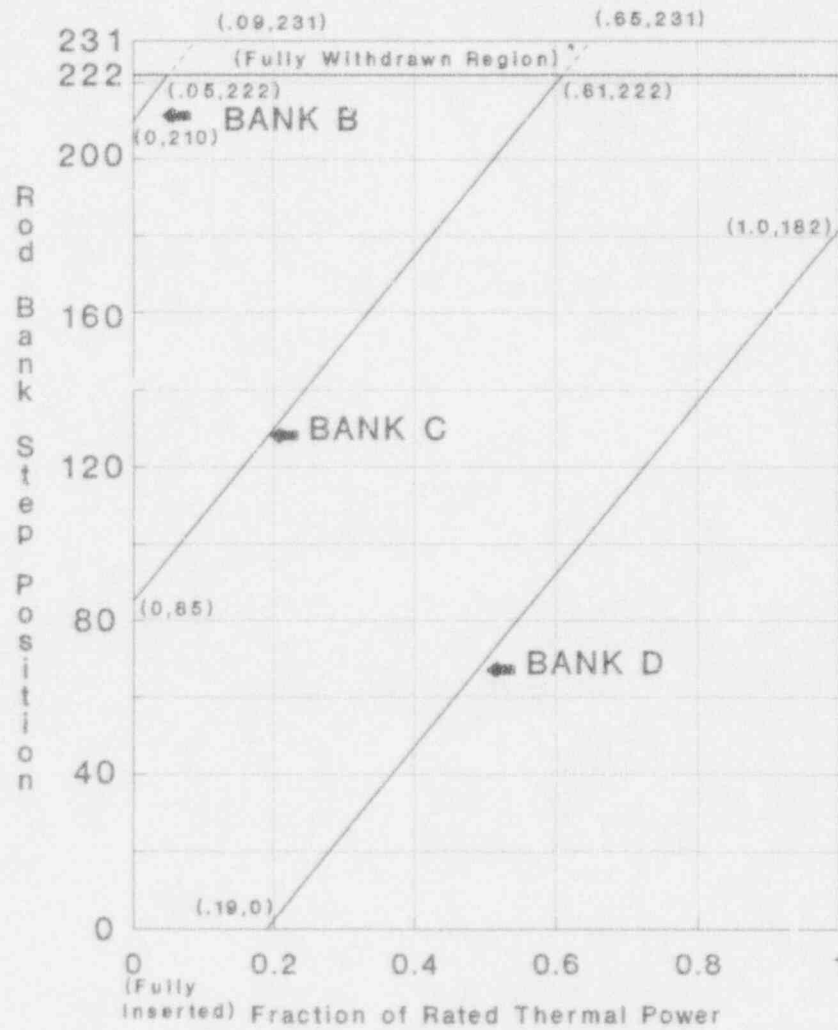
$$F_{\Delta H}^N \leq F_{\Delta H}^{RTP} * (1 + PF_{\Delta H} * [1 - P])$$

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

2.6.1  $F_{\Delta H}^{RTP} = 1.62$

2.6.2  $PF_{\Delta H} = 0.3$

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**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  $\geq 222$  and  $\leq 231$  steps withdrawn, inclusive.

Fully withdrawn shall be the position as defined below.

Cycle Burnup (MWd/MTU)

$\leq 2000$   
 $> 2000$  to  $\leq 14,000$   
 $> 14,000$

Step Withdrawn

$\geq 226$  to  $\leq 231$   
 $\geq 222$  to  $\leq 231$   
 $\geq 226$  to  $\leq 231$

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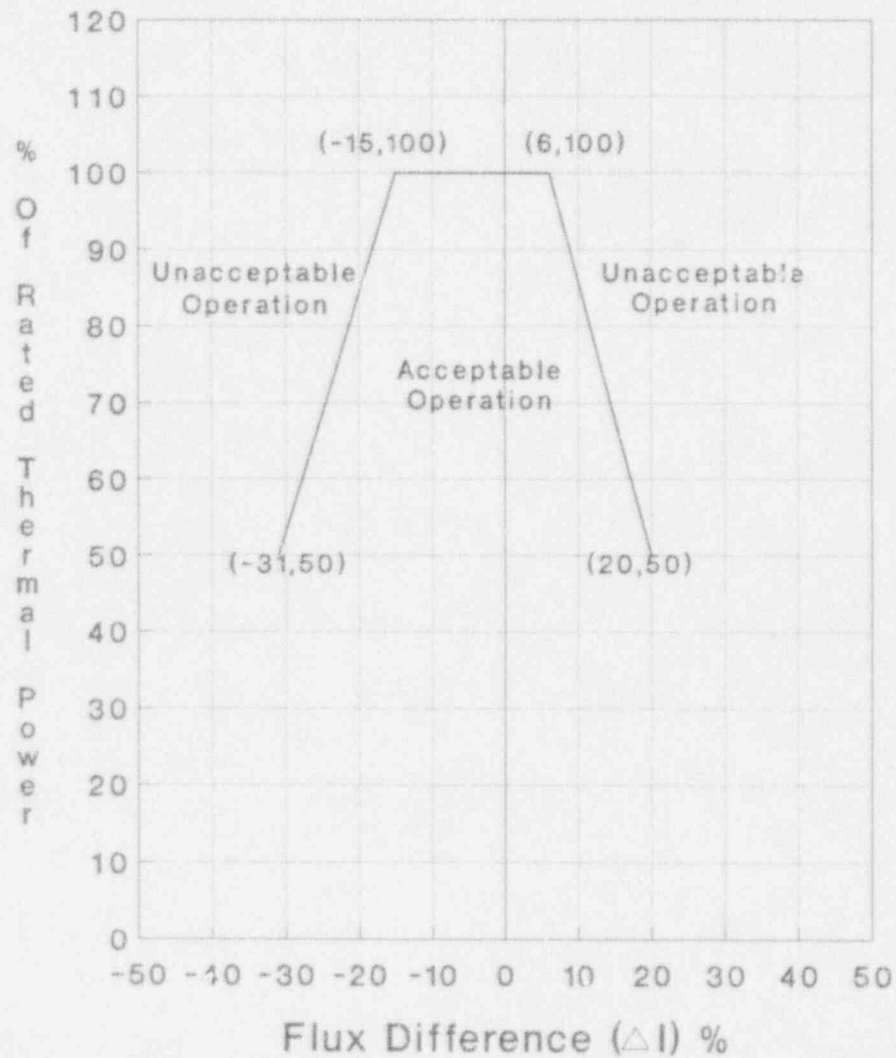


FIGURE 2

Axial Flux Difference Limits As  
A Function Of Rated Thermal Power

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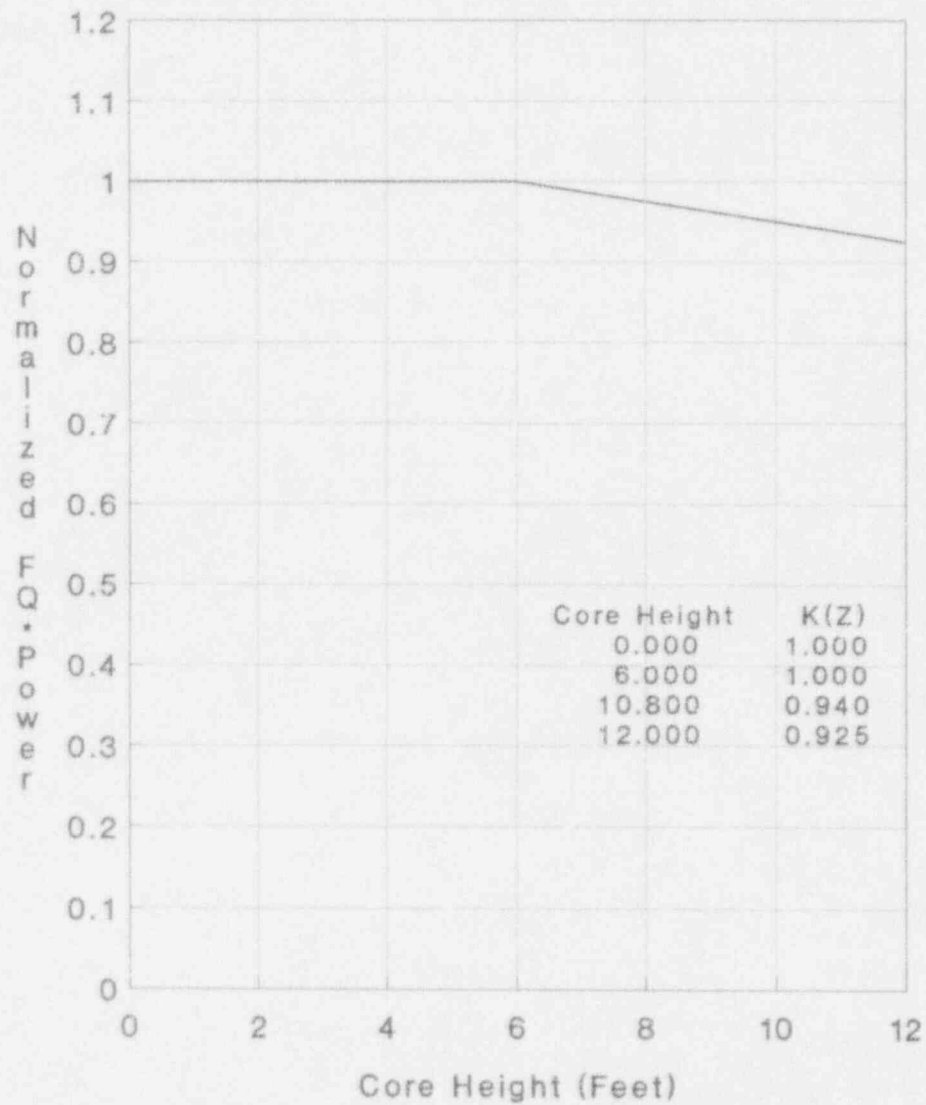


FIGURE 3

K(Z) - Normalized Fq(Z) as a Function of Core Height



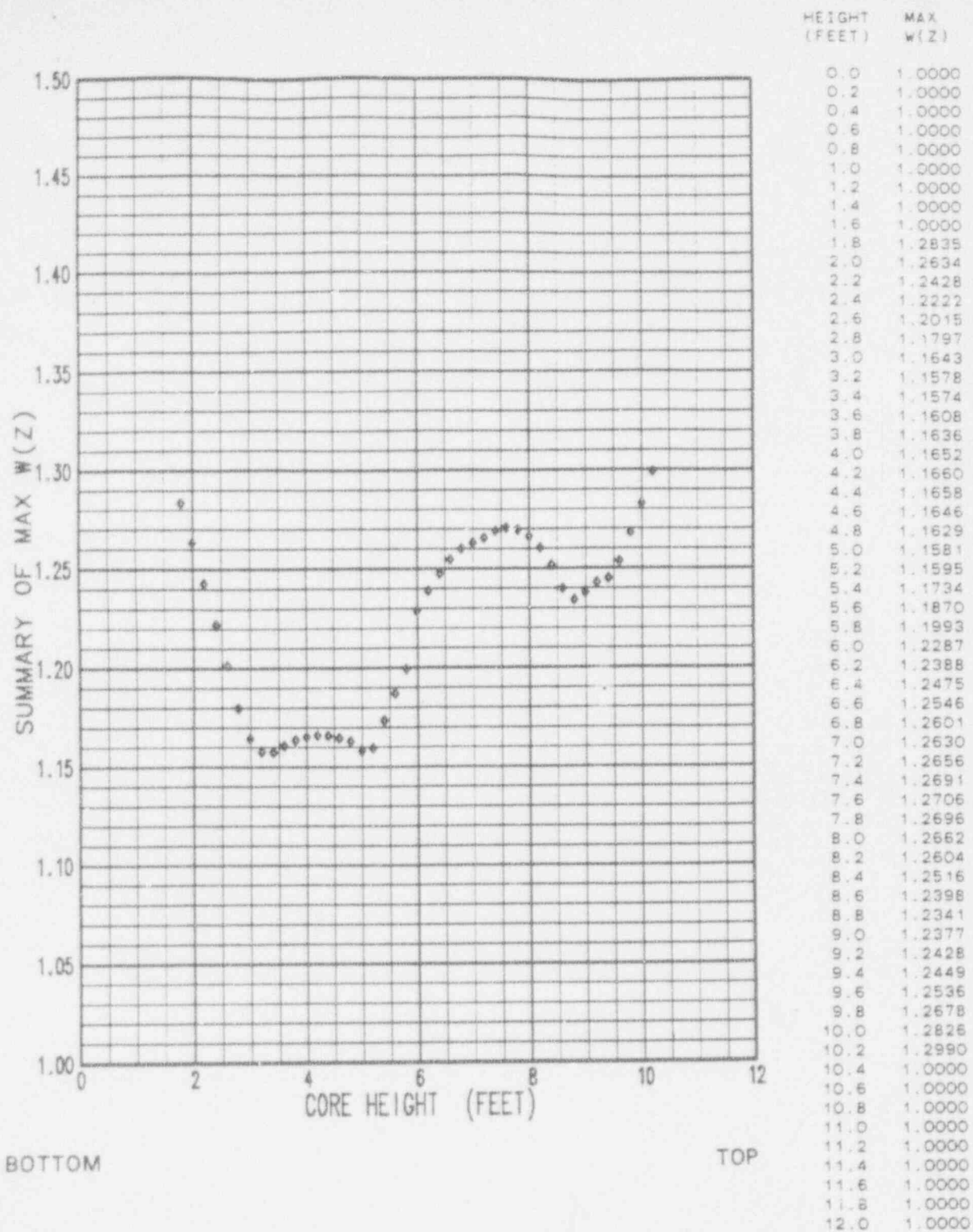


FIGURE 4  
 SEQUOYAH UNIT 1 CYCLE 7  
 RAOC SUMMARY OF MAX W(Z) AT 150 MWD/MTU  
 (TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.2.G)

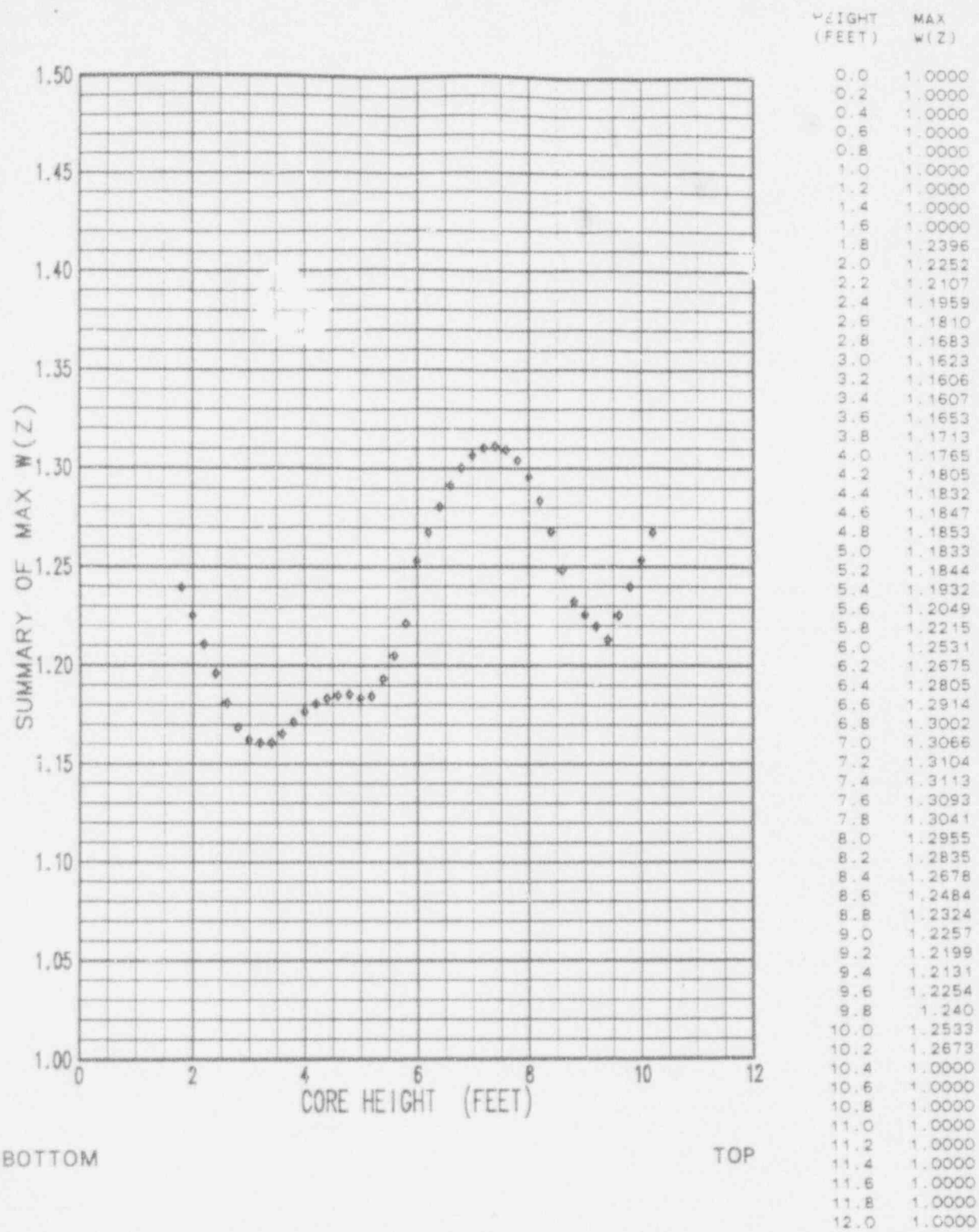


FIGURE 5  
 SEQUOYAH UNIT 1 CYCLE 7  
 RAOC SUMMARY OF MAX W(Z) AT 4000 MWD/MTU  
 (TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.2.G)

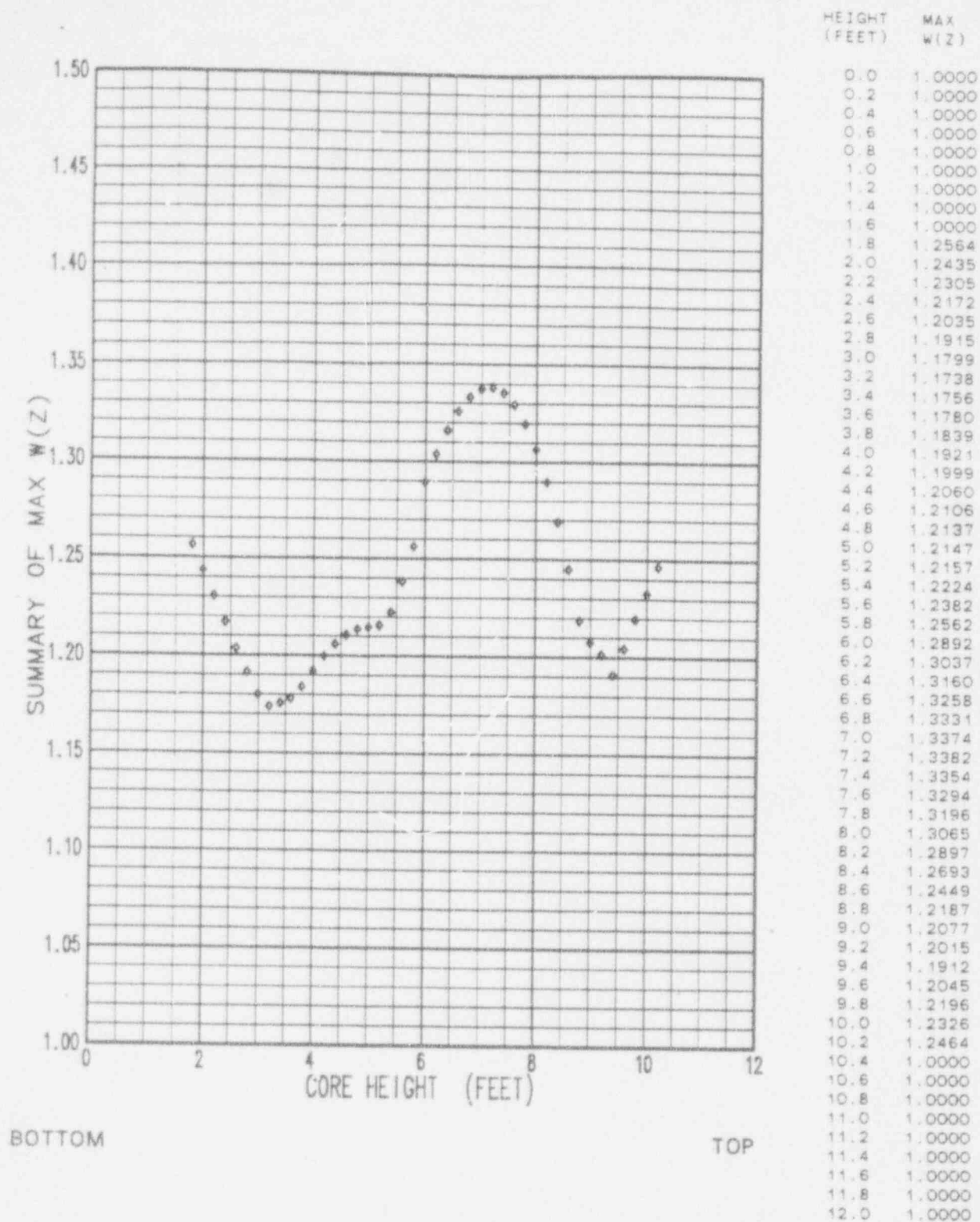


FIGURE 6  
 SEQUOYAH UNIT 1 CYCLE 7  
 RAOC SUMMARY OF MAX W(Z) AT 7000 MWD/MTU  
 (TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.2.G)

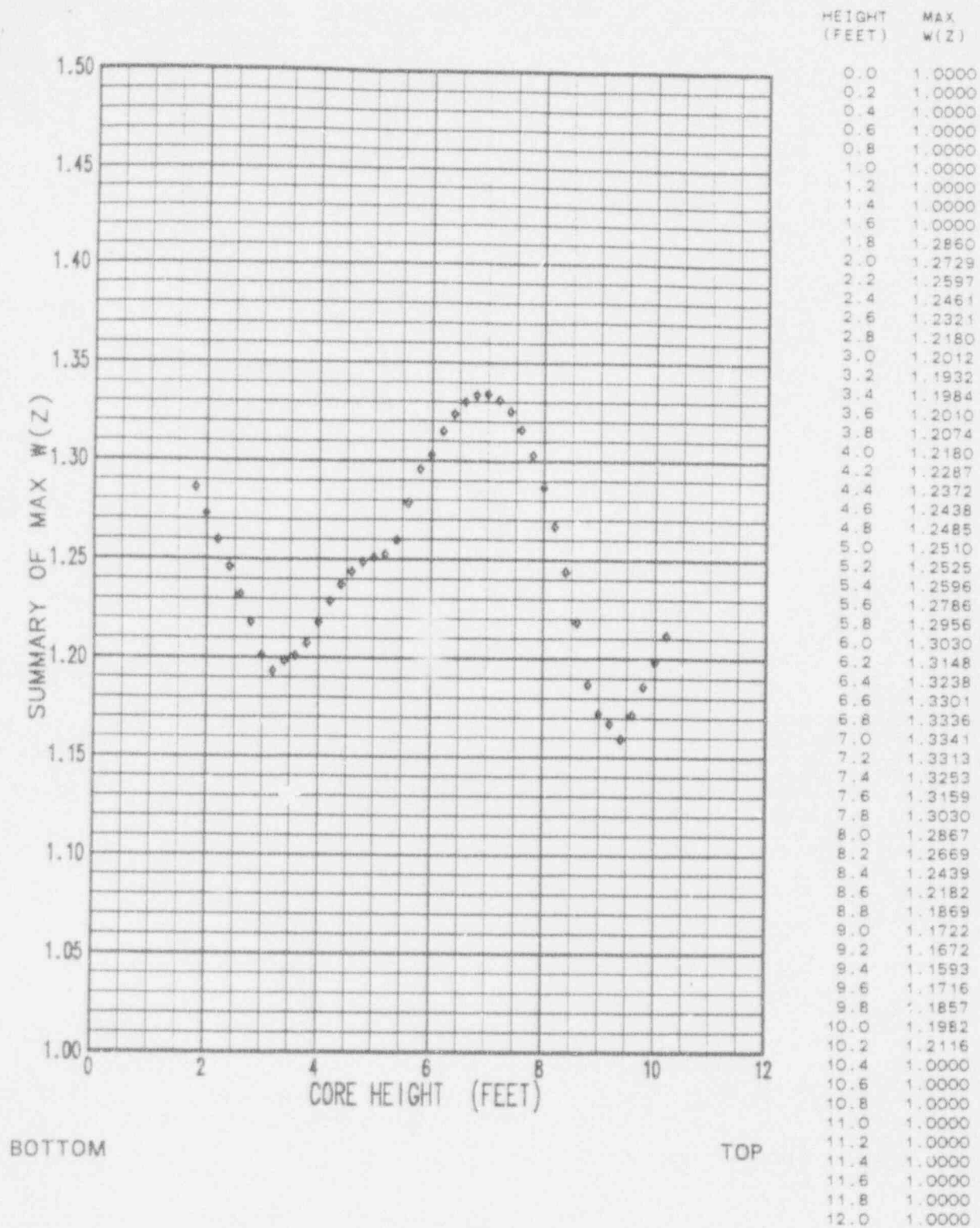


FIGURE 7  
 SEQUOYAH UNIT 1 CYCLE 7  
 RAOC SUMMARY OF MAX W(Z) AT 10000 MWD/MTU  
 (TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.2.G)

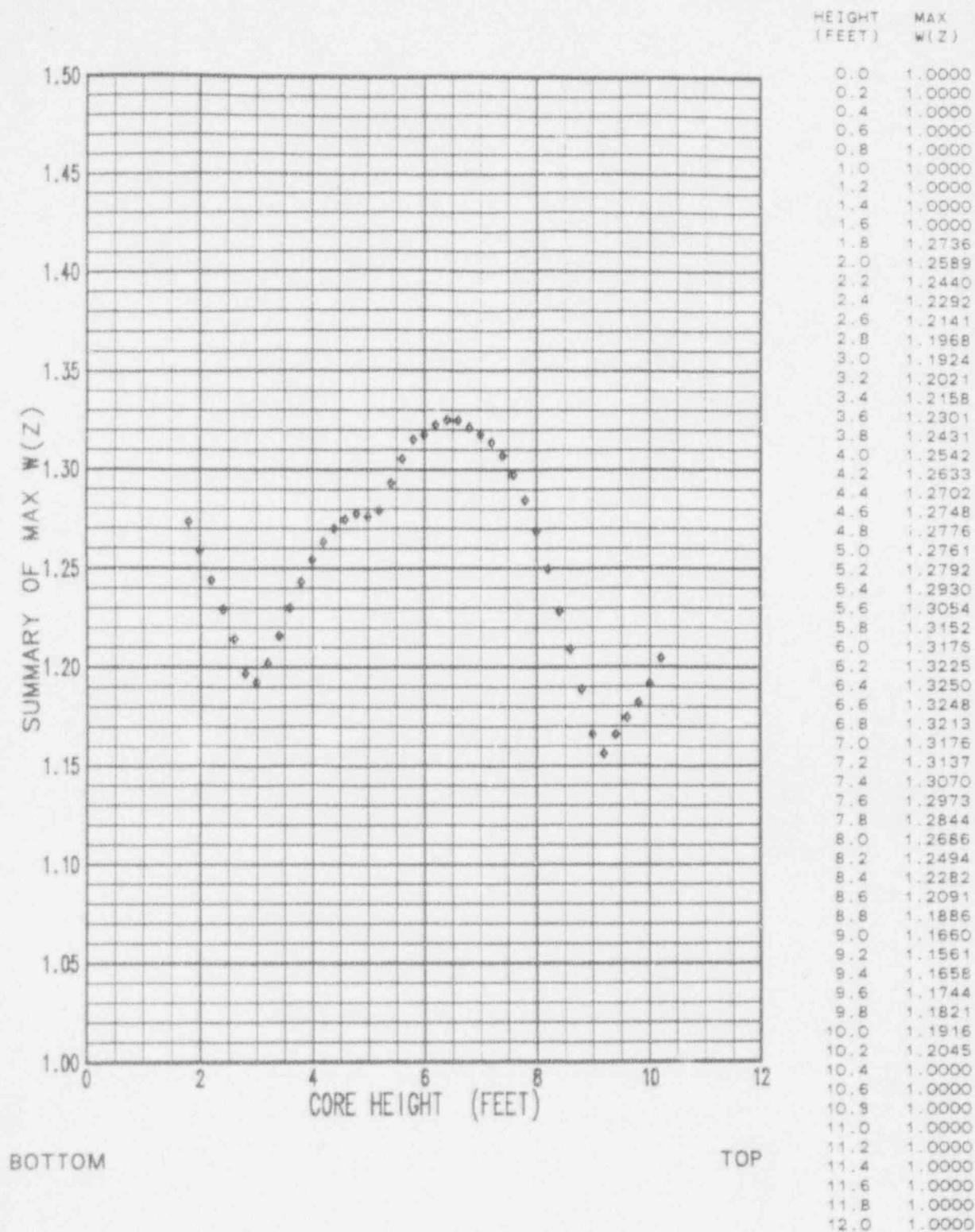


FIGURE 8  
 SEQUOYAH UNIT 1 CYCLE 7  
 RAOC SUMMARY OF MAX W(Z) AT 14000 MWD/MTU  
 (TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.2.G)