

**299-W19-15 (A4947)**  
**Log Data Report**

**Borehole Information:**

<b>Borehole:</b> 299-W19-15 (A4947)		<b>Site:</b> 216-U-1 & U-2 Cribs			
<b>Coordinates (WA St Plane)</b>		<b>GWL<sup>1</sup> (ft):</b> None		<b>GWL Date:</b> 05/13/04	
<b>North</b>	<b>East</b>	<b>Drill Date</b>	<b>TOC<sup>2</sup> Elevation (ft)</b>	<b>Total Depth (ft)</b>	<b>Type</b>
134975.778 m	567254.252 m	03/85	696.82	285	Cable

**Casing Information:**

<b>Casing Type</b>	<b>Stickup (ft)</b>	<b>Outer Diameter (in.)</b>	<b>Inside Diameter (in.)</b>	<b>Thickness (in.)</b>	<b>Top (ft)</b>	<b>Bottom (ft)</b>
Welded steel	1.4	6 5/8	6	5/16	+ 1.4	220
Welded Steel	0	Unk	8	0.322	0	200
Steel w/screen	0	Unk	5	0.258	215	285

**Borehole Notes:**

The logging engineer used a caliper to determine the thickness of the 6-in. casing. The caliper and casing stickup were both measured using a steel tape. All measurements were rounded to the nearest 1/16 in. The casing information is derived from Ledgerwood (1993). The 8-in. casing was perforated between 20 and 85 ft and between 170 and 197 ft. Grout was emplaced through the perforations to provide a seal. The depth to water was determined by Duratek personnel. Coordinates and top of casing (TOC) elevation are derived from HWIS<sup>3</sup>. Logging data acquisition is referenced to the TOC.

**Logging Equipment Information:**

<b>Logging System:</b> Gamma 2A	<b>Type:</b> SGLS (35%) SN: 34TP20893A
<b>Calibration Date:</b> 03/04	<b>Calibration Reference:</b> DOE-EM/GJ642-2004
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

**Spectral Gamma Logging System (SGLS) Log Run Information:**

<b>Log Run</b>	<b>1</b>	<b>2</b>	<b>3 Repeat</b>		
Date	05/17/04	05/18/04	05/18/04		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	2.0	251.0	45.0		
Finish Depth (ft)	140.0	139.0	35.0		
Count Time (sec)	200	200	400		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A <sup>4</sup>	N/A	N/A		

Log Run	1	2	3 Repeat		
Pre-Verification	BA336CAB	BA337CAB	BA337CAB		
Start File	BA336000	BA337000	BA337113		
Finish File	BA336138	BA337112	BA337123		
Post-Verification	BA336CAA	BA337CAA	BA337CAA		
Depth Return Error (in.)	-1/4	N/A	+ 1		
Comments	Gain adjustment after file BA336093.	No fine gain adjustment.	No fine gain adjustment.		

### **Logging Operation Notes:**

Logging was conducted with a centralizer on the sonde and measurements are referenced to TOC. A repeat section was collected in this borehole to evaluate system performance. The repeat data were acquired between 35 and 45 ft at 400 seconds rather than 200 seconds for the prior log runs. On the basis of a cursory view of the spectra during logging of this depth interval (log run 1), it was believed the longer counting time would enable quantification of some observed unusual energy peaks. Total logging depth was 251 ft. The groundwater pump retrieved from the borehole prior to logging was contaminated; therefore, logging was terminated just above the groundwater level.

### **Analysis Notes:**

<b>Analyst:</b>	Henwood	<b>Date:</b>	05/24/04	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging system were performed before and after each day's data acquisition. The acceptance criteria were met.

A combined casing correction for the 8- and 6-in. casings of 0.5625 in. (0.322 + 0.3125) was applied to a depth of 200 ft. A correction for 0.3125-in.-thick casing was applied from 200 to 215 ft. Between 215 and 220 ft a combined casing correction for 6-in. and 5-in. casings of 0.5705 in. (0.3125 + 0.258) was applied. Below 220 ft to total depth, a single 5-in. casing with a thickness of 0.258 in. was assumed. The 8-in. and 5-in. casing thicknesses were derived from published values for schedule-40 casing.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G2AMar04.xls using an efficiency function determined from annual calibrations. Dead time and water corrections were not necessary.

### **Log Plot Notes:**

Separate log plots are provided for the man-made radionuclides (<sup>137</sup>Cs and processed uranium [<sup>238</sup>U and <sup>235</sup>U]) detected in the borehole, naturally occurring radionuclides (<sup>40</sup>K, <sup>238</sup>U, <sup>232</sup>Th [KUT]), a combination of man-made, KUT, and dead time, and total gamma plotted with dead time. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. A repeat log section is also included.

## **Results and Interpretations:**

$^{137}\text{Cs}$  and processed uranium ( $^{238}\text{U}$  and  $^{235}\text{U}$ ) were the man-made radionuclides detected in this borehole.  $^{137}\text{Cs}$  was detected at a few sporadic locations in the borehole near its MDL of approximately 0.2 pCi/g.

Processed uranium is measured with the 1001-keV and 186-keV energy peaks associated with  $^{238}\text{U}$  and  $^{235}\text{U}$ , respectively.  $^{238}\text{U}$  was detected throughout the borehole at sporadic locations near its MDL of approximately 15 pCi/g. Below 200 ft,  $^{238}\text{U}$  is detected more consistently, and generally  $^{235}\text{U}$  (MDL approximately 1 pCi/g) is also detected at the same depth locations. The maximum concentrations of  $^{238}\text{U}$  and  $^{235}\text{U}$  below 200 ft are approximately 30 and 4 pCi/g, respectively at 244 ft. The maximum concentration measured in the borehole is 52 pCi/g at 122 ft.

Recognizable changes in the KUT logs occurred in this borehole. The KUT response of the sediments surrounding the borehole above 197 ft is masked by grout. For example, the relatively low  $^{40}\text{K}$  and  $^{232}\text{Th}$  concentrations in the interval between 170 and 197 ft correspond with perforations in the 8-in. casing as described in Ledgerwood (1993). Between 150 and 166 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is shown by an increase in total gamma (30 cps),  $^{40}\text{K}$  (2 pCi/g), and  $^{232}\text{Th}$  (0.4 pCi/g). There is about an 8-pCi/g decrease in  $^{40}\text{K}$  concentrations in the interval between 166 and 170 ft. Based on low  $^{40}\text{K}$  concentrations, the carbonate-rich paleosols of the Cold Creek Unit are interpreted as being between 166 ft and 170 ft. Ledgerwood (1993) reported caliche in the interval from 164 to 167 ft.

Elevated radon existed in the borehole during log runs 2 and 3. The comparison of the natural  $^{238}\text{U}$  concentrations determined from log runs 1 and 3 shows the slightly elevated  $^{238}\text{U}$  acquired during the repeat logging (log run 3). The repeat log data were acquired at 400 seconds versus 200 seconds for the other log runs. The repeat section indicated good agreement of the naturally occurring KUT except for the  $^{238}\text{U}$ , which was influenced by the radon. This agreement suggests the 200-second counting time is adequate to quantify the naturally occurring radionuclides.

The longer counting time did not identify any man-made radionuclides, which is consistent with the data acquired during log run 1. The MDLs for  $^{238}\text{U}$  and  $^{235}\text{U}$  (processed uranium) in the repeat section (400 second counting time), which was in a double-cased interval, were approximately 15 and 1.6 pCi/g, respectively. The MDLs in the same interval using a 200 second counting time (log run 1) were approximately 21 and 2.1 for  $^{238}\text{U}$  and  $^{235}\text{U}$ , respectively. MDLs for the two radionuclides are approximately 16 and 1 pCi/g in the single-cased intervals. The MDLs stated above were calculated from depth intervals where no man-made radionuclides were detected. If a man-made radionuclide is detected, the MDL will vary from these values.

It is recommended additional boreholes in the area of the 216-U-1 and U-2 Cribs be logged. These boreholes are designated as 299-W19-16, -17, -18, -3, -11, and -9.

## **References:**

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-West Resource Protection Wells*, WHC-SD-ER-TI-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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<sup>1</sup> GWL – groundwater level

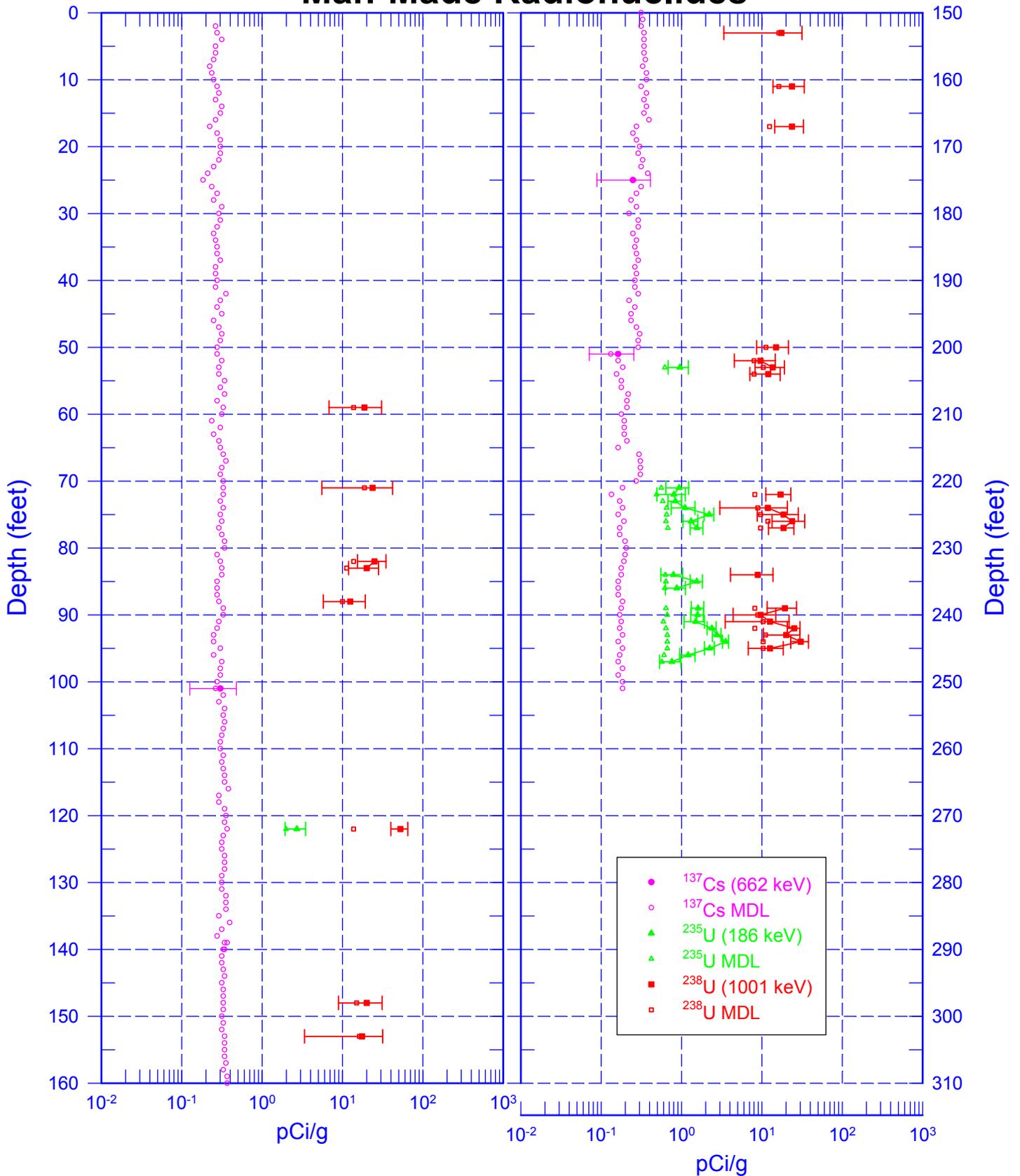
<sup>2</sup> TOC – top of casing

<sup>3</sup> HWIS – Hanford Well Information System

<sup>4</sup> N/A – not applicable

# 299-W19-15 (A4947)

## Man-Made Radionuclides

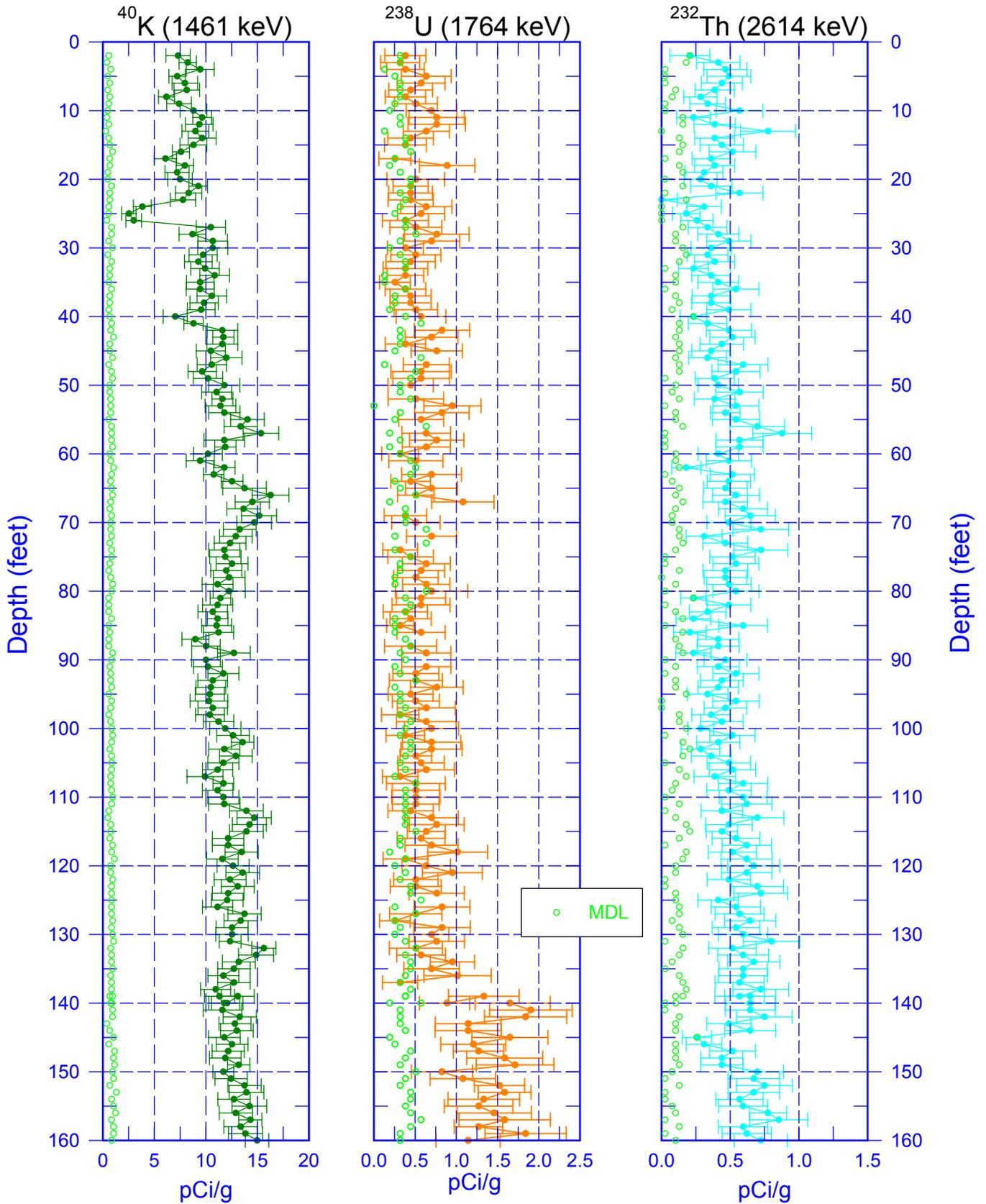


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 05/18/04

# 299-W19-15 (A4947) Natural Gamma Logs

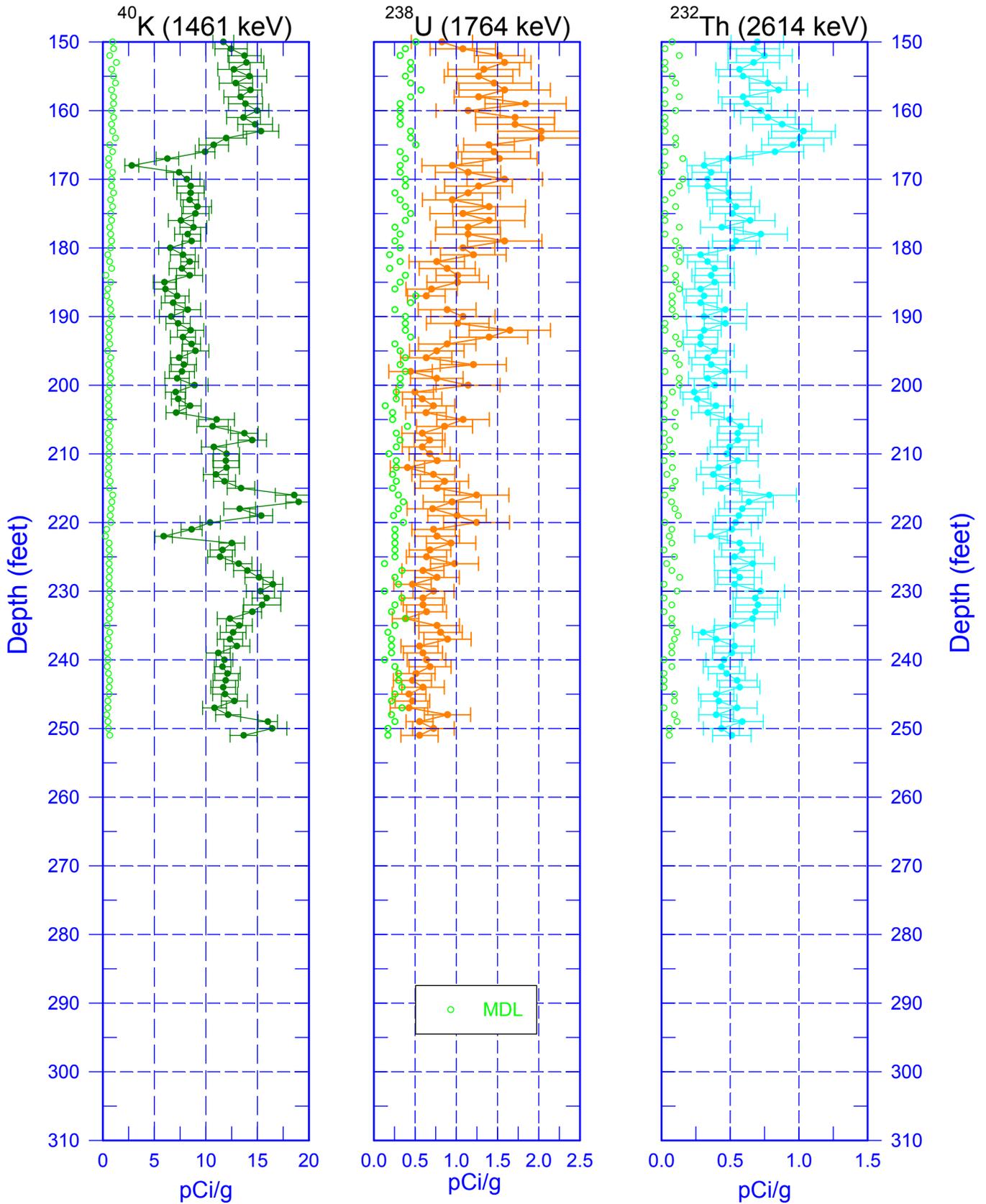


Zero Reference = Top of Casing

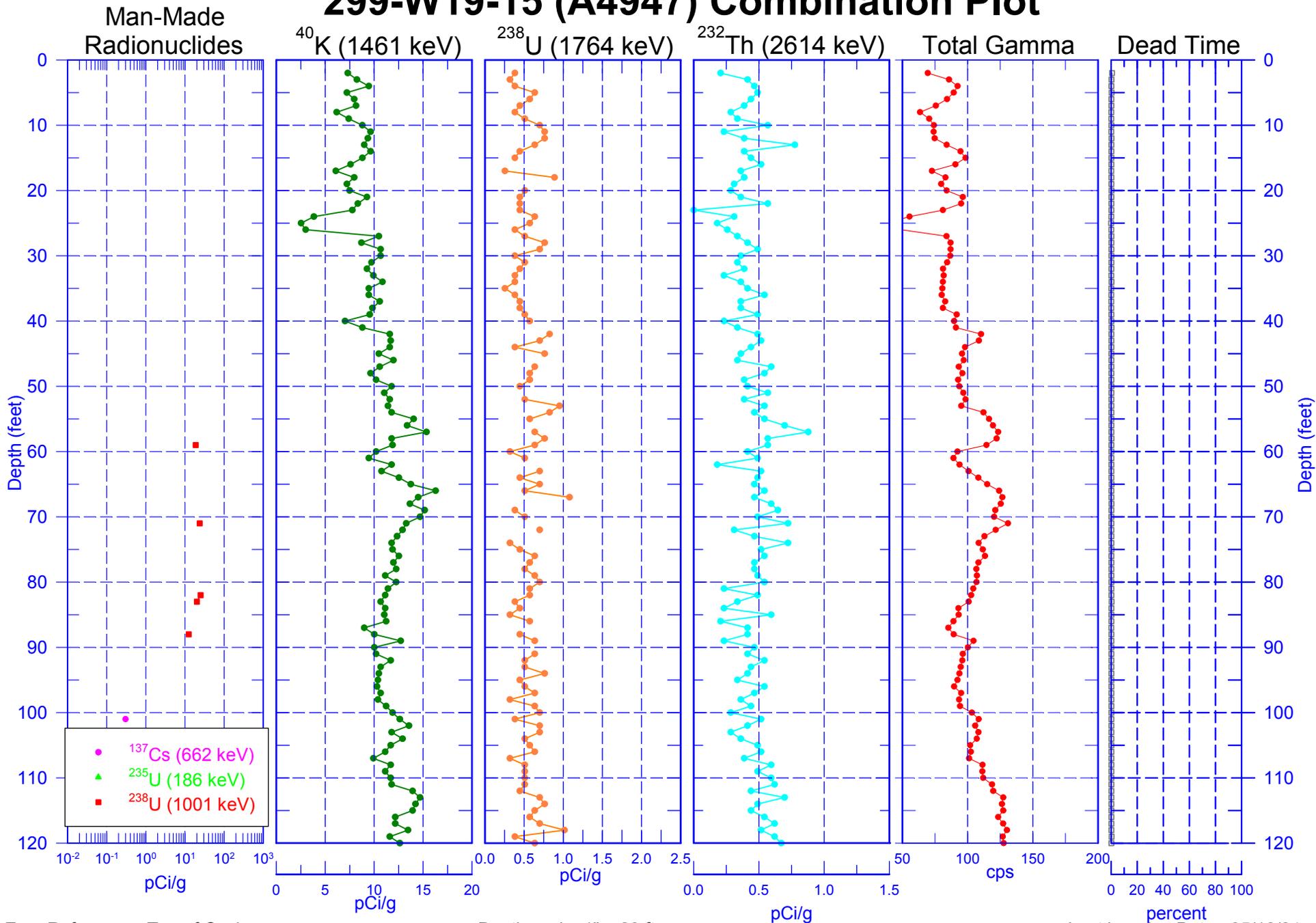
Depth scale: 1" = 20 ft

Last Log Date - 05/18/04

# 299-W19-15 (A4947) Natural Gamma Logs



# 299-W19-15 (A4947) Combination Plot

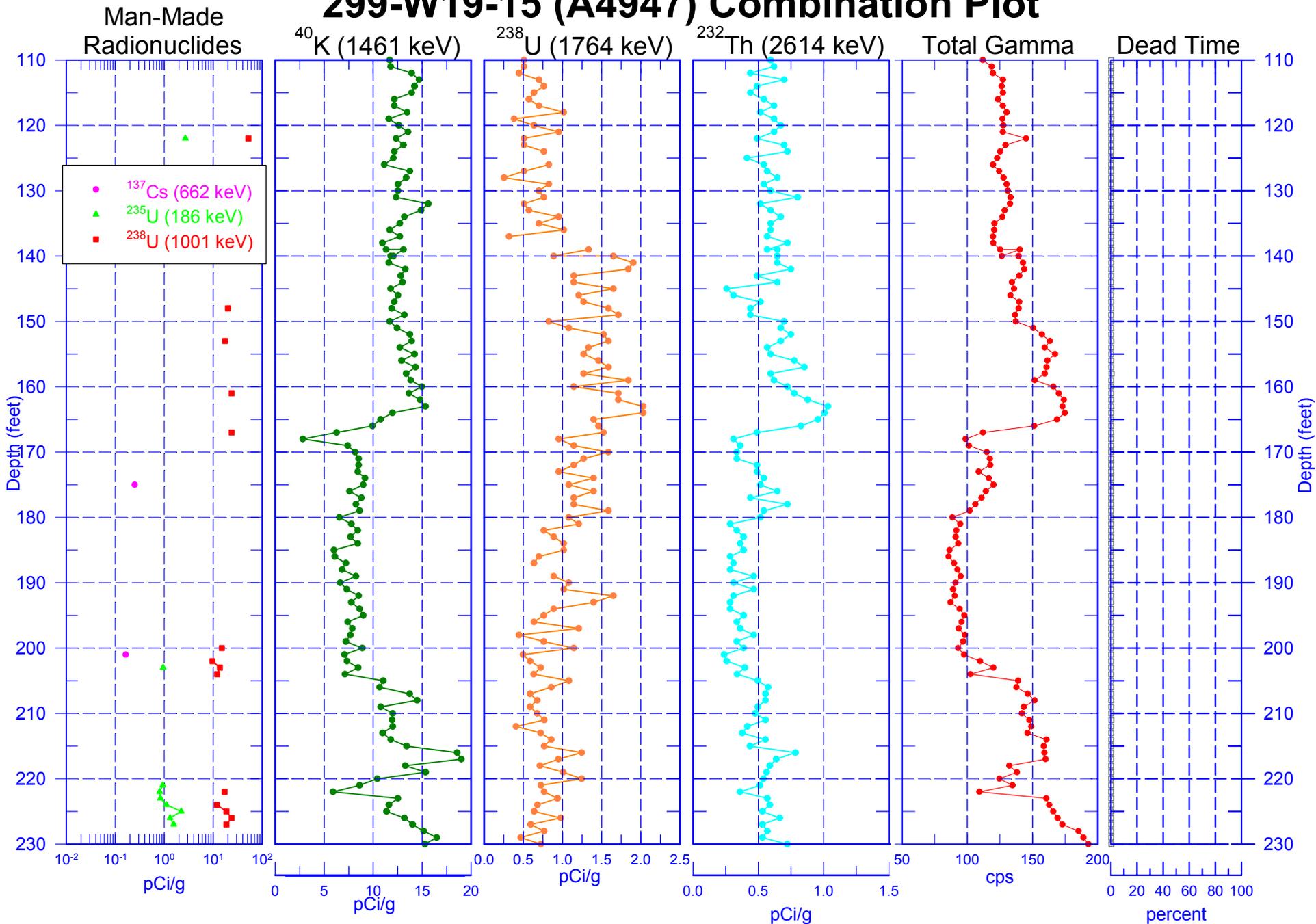


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Logging Date - 05/18/04

# 299-W19-15 (A4947) Combination Plot

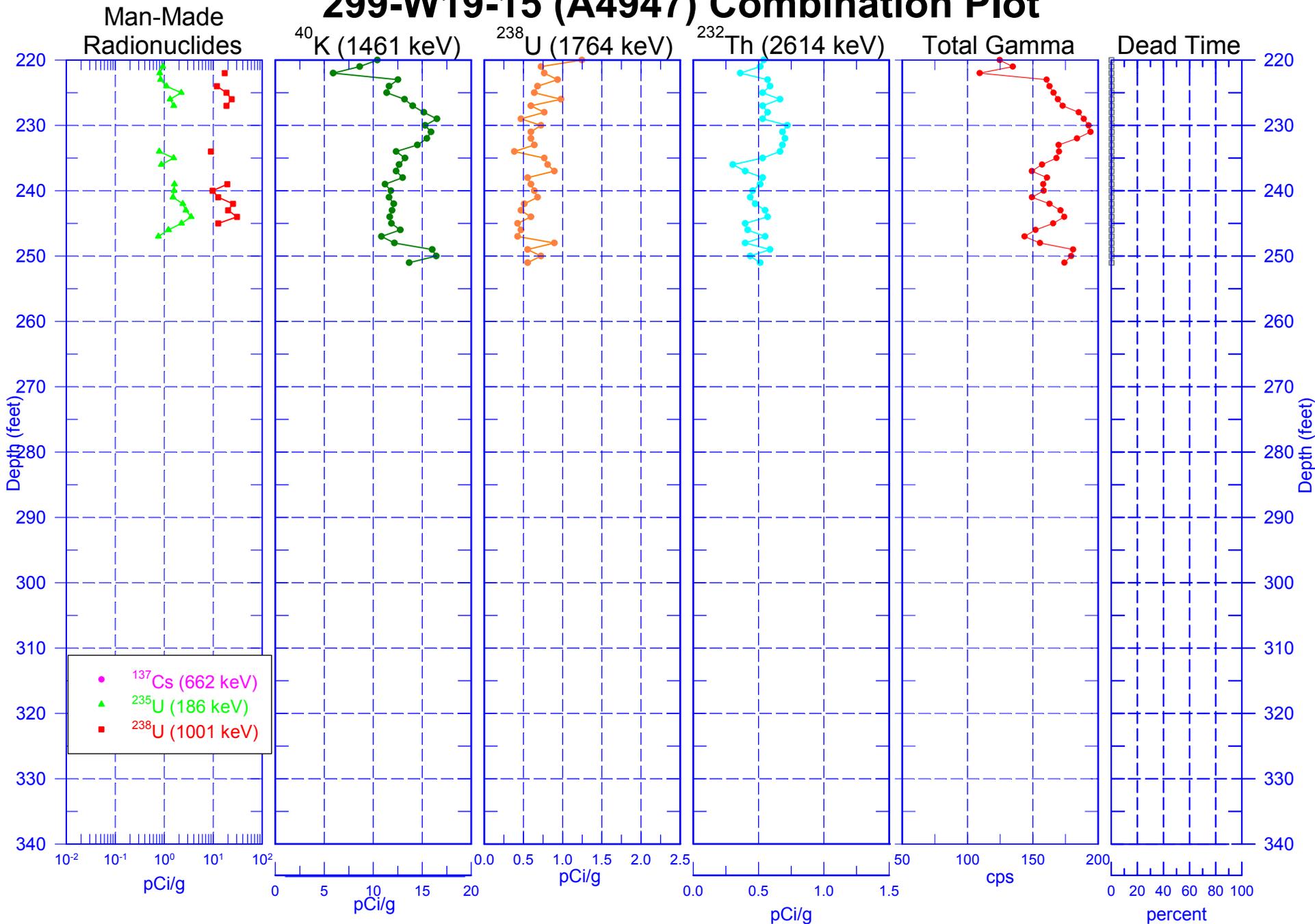


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Logging Date - 05/18/04

# 299-W19-15 (A4947) Combination Plot

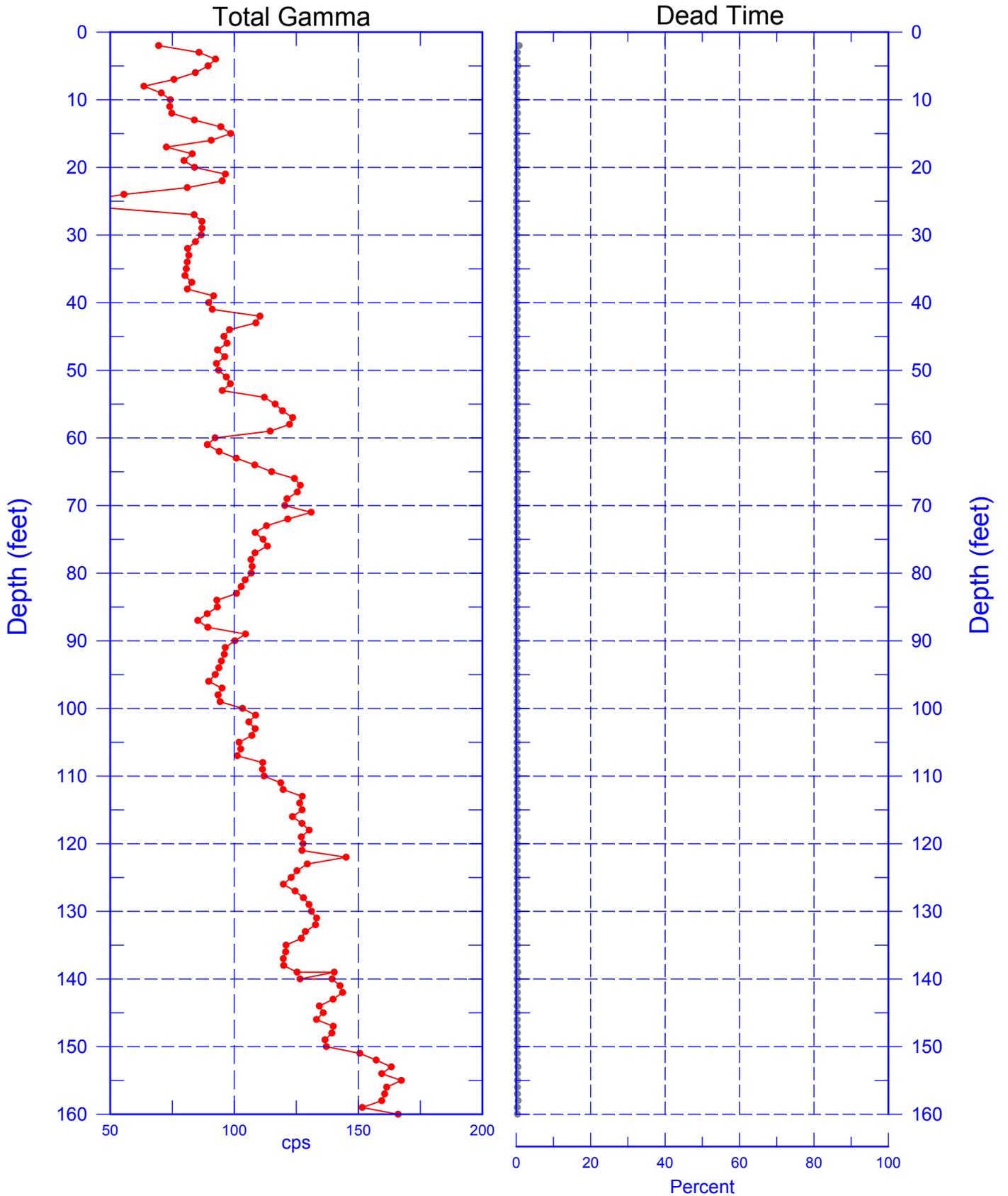


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

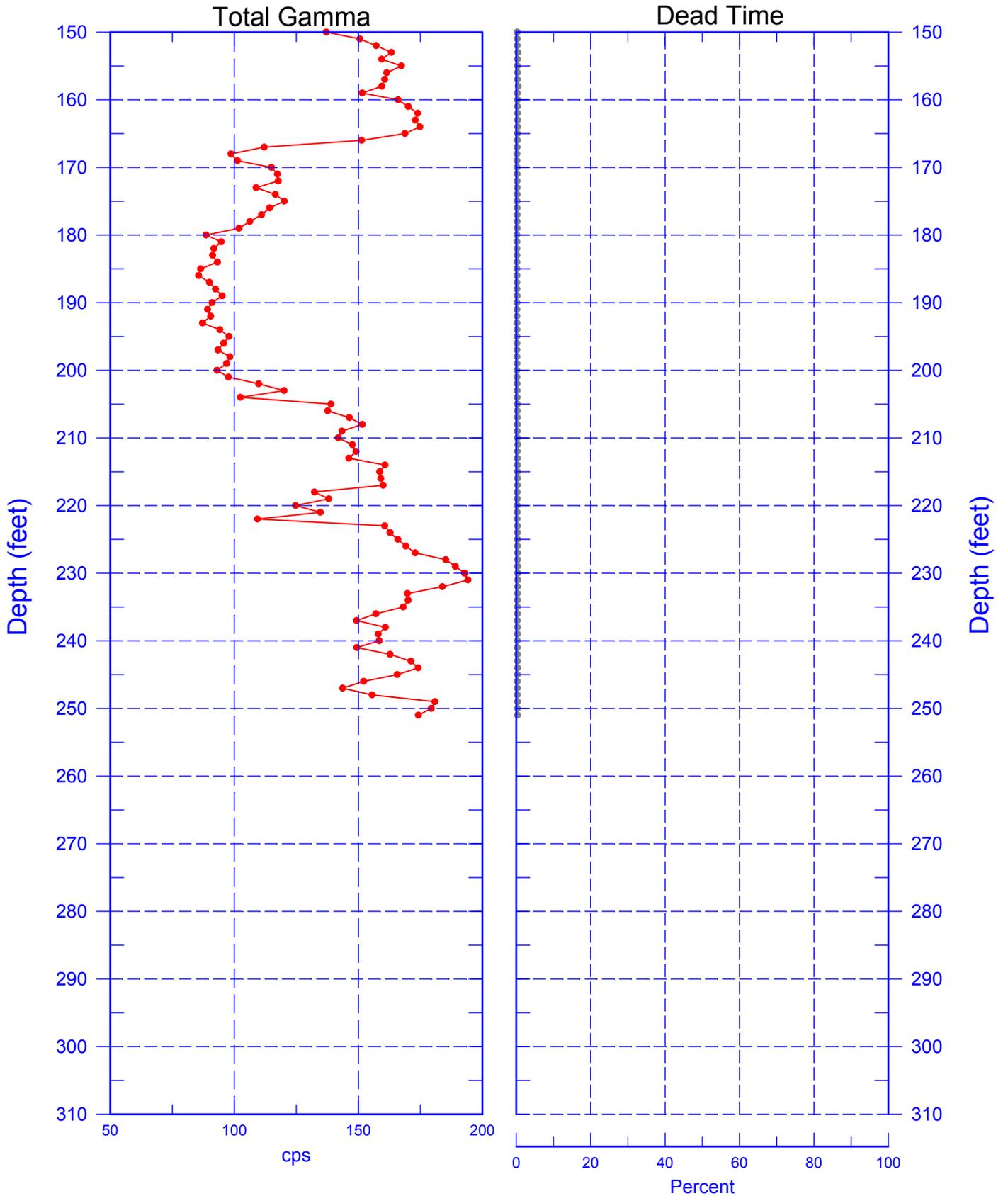
Last Logging Date - 05/18/04

# 299-W19-15 (A4947) Total Gamma & Dead Time



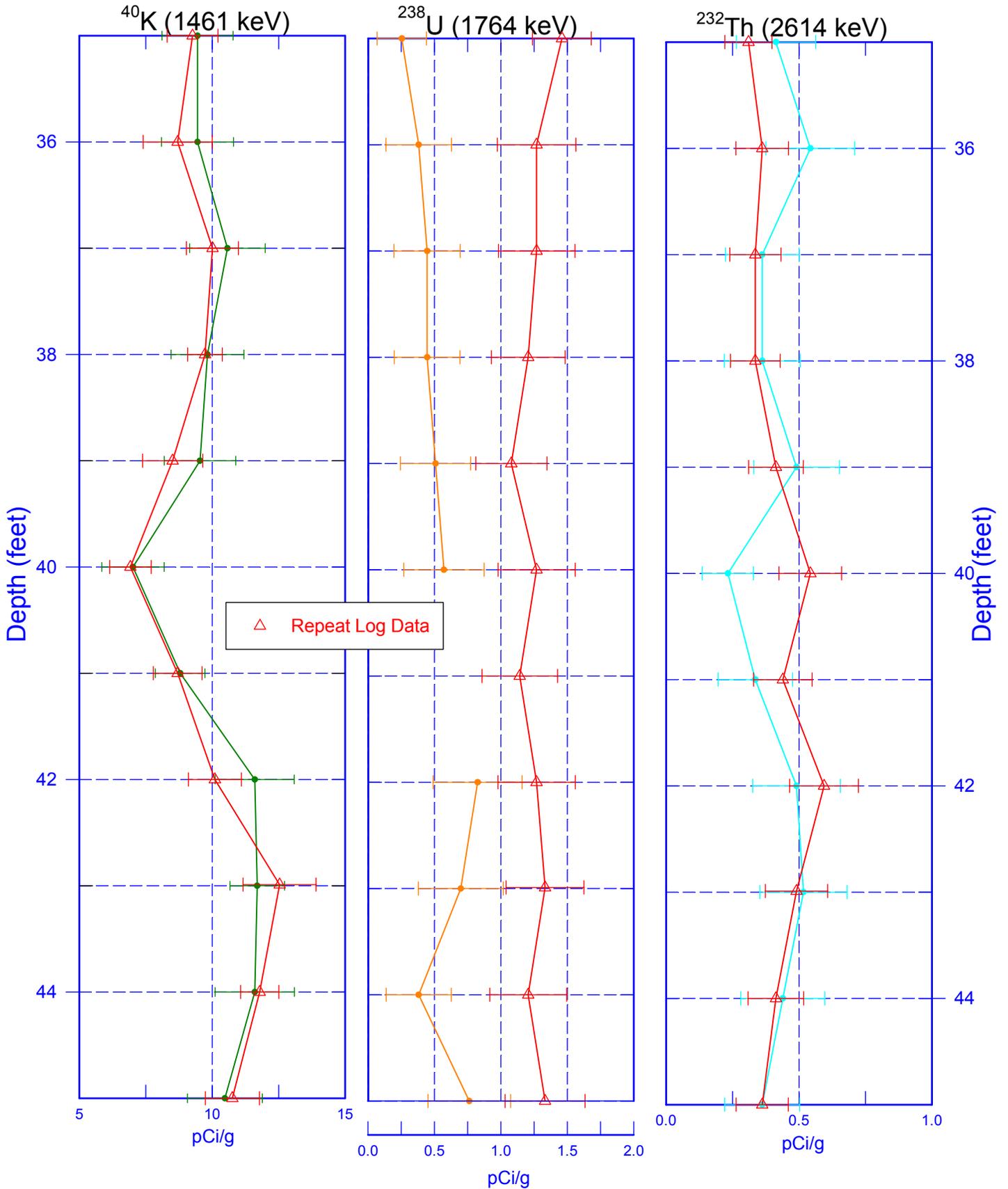
# 299-W19-15 (A4947)

## Total Gamma & Dead Time



# 299-W19-15 (A4947)

## Repeat Section of Natural Gamma Logs



Zero Reference - Top of Casing

Last Log Date - 05/18/04