

**299-W18-07 (A7524)**  
**Log Data Report**

**Borehole Information:**

<b>Borehole:</b> 299-W18-07 (A7524)		<b>Site:</b> 216-Z-1A Crib			
<b>Coordinates (WA St Plane)</b>		<b>GWL<sup>1</sup> (ft):</b> None		<b>GWL Date:</b> 01/19/06	
<b>North</b> 135409.803	<b>East</b> 566580.971	<b>Drill Date</b> 01/64	<b>Elevation (TOC)</b> 681.81	<b>Total Depth (ft)</b> 60	<b>Type</b> 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>
Carbon Steel	2.5	6	unknown	0.280	2.5	157
Carbon Steel	0.0	8	unknown	0.322	0.0	300

**Borehole Notes:**

Casing diameter measurements could not be acquired by the logging engineer because a flat 8-bolt flange is welded on the top of casing (TOC). Casing thickness is assumed to be consistent with published values for ASTM schedule-40 steel casing. Logging data acquisition is referenced to the TOC.

This borehole was originally drilled in 1964 with an 8-in. casing set to approximately 300 ft. The casing was perforated from 190 to 250 ft and from 270 to 298 ft. In 1972, the borehole was cleaned of 100 ft of fill material, and a groundwater monitoring screen set between 194 and 216 ft. In 1983, the 8-in. casing was perforated from 0 to 40 ft, from 55 to 85 ft, and from 100 to 150 ft. A packer was set at 157 ft and a 6-in. casing placed in the borehole. The annulus between the 6-in. and 8-in. casings was grouted.

**Spectral Gamma Logging System (SGLS) Equipment Information:**

<b>Logging System:</b> Gamma 1E	<b>Type:</b> SGLS (70%) SN: 34TP40587A	
<b>Effective Calibration Date:</b> 01/10/06	<b>Calibration Reference:</b> DOE/EM-GJ1106-2006	
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0		

**SGLS Log Run Information:**

<b>Log Run</b>	<b>1</b>	<b>2</b>	<b>3 Repeat</b>		
Date	01/19/06	01/20/06	01/20/06		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	3.0	191.0	115.0		
Finish Depth (ft)	1.5	116.0	96.0		
Count Time (sec)	115.0	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		

Log Run	1	2	3 Repeat		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A <sup>2</sup>	N/A	N/A		
Pre-Verification	AE149CAB	AE150CAB	AE150CAB		
Start File	AE149000	AE150000	AE150076		
Finish File	AE149112	AE150075	AE150095		
Post-Verification	AE149CAA	AE150CAA	AE150CAA		
Depth Return Error (in.)	- 1.5	N/A	+ 2.0		
Comments	Fine-gain adjustment after file -026	No fine-gain adjustment	No fine-gain adjustment		

### **Logging Operation Notes:**

Logging was conducted with a centralizer on the sonde. Measurements are referenced to the TOC. A repeat section was collected in this borehole to evaluate the logging system's performance.

### **Analysis Notes:**

<b>Analyst:</b>	Henwood	<b>Date:</b>	03/20/06	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. Acceptance criteria were met.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated using the EXCEL worksheet template identified as G1EJan06.xls. A combined casing correction for 0.602-in.-thick casing (0.280 + 0.322 for the 6-in. and 8-in. casings, respectively) was applied to the SGLS data. No corrections for dead time or water were required.

### **Results and Interpretations:**

An energy peak at approximately 662 keV was detected near the minimum detection level (MDL) at sporadic, but generally continuous, depth locations, between 140 and 160 ft. The error for these measurements is high (e.g., approximately 60 %) and the detections could be considered not valid. However, the more or less continuous detections over several depth intervals suggests validity. The 662 keV energy peak is generally considered to be either the result of <sup>137</sup>Cs (661.62 keV) or <sup>241</sup>Am (662.40 keV) gamma rays. Because the 216 Z-1A crib received waste from the Plutonium Finishing Plant, it is presumed <sup>241</sup>Am is more likely to exist than <sup>137</sup>Cs, especially at significant depths. A confirming peak for <sup>241</sup>Am at 722.01 keV was not detected. However, this peak has a lower gamma yield. Since the 662 keV peak is very near the MDL, the absence of the 722.01 keV peak is not conclusive.

Price et. al. (1979) acquired soil samples in numerous boreholes in this crib, but not this particular borehole. The maximum depth of the boreholes in this study was approximately 150 ft (46 m). The soil samples were analyzed for plutonium (<sup>239/240</sup>Pu) and <sup>241</sup>Am. <sup>241</sup>Am was detected at or near the bottom of many of the boreholes (i.e., between approximately 130 and 150 ft) at concentrations ranging from approximately 10<sup>-5</sup> to 10<sup>-3</sup> nCi/g (0.01 to 10 pCi/g).

The existence of <sup>241</sup>Am, as measured from soil samples to 150 ft in depth, is consistent with the 662 energy peak detected at approximately the same depths with the SGLS. This consistency would appear to corroborate the interpretation that the 662 keV energy peak is the result of <sup>241</sup>Am. Furthermore, the 662 peak is measured to 160 ft in depth, approximately 10 ft deeper than the maximum depth of the 1977 study boreholes.

The SGLS data suggest concentrations up to 90,000 pCi/g, several orders of magnitude greater than the soil samples. The cause of this discrepancy is unknown, primarily because a direct borehole comparison cannot be made. Significant uncertainty in the SGLS measurements is created by double casing with grout in the borehole and the fact that the detections are near the MDL. The calculated uncertainty (counting error only) is approximately 40,000 pCi/g. Also, the volumes of interrogation of the soil samples and the SGLS in-situ measurements are different.

For the purposes of this log data report, concentrations are reported as calculated using standard analysis procedures and assumptions. It is interpreted that  $^{241}\text{Am}$  exists in the specified depth intervals at levels less than 100 nCi/g. As additional borehole data are acquired in the 216-Z-1A crib, further comparisons with soil sample data will be made. The 662 keV detections at 3, 27, 58, and 106 ft are interpreted to be the result of statistical fluctuations and not an indication of  $^{241}\text{Am}$ .

The KUT logs may be influenced by the grout in the borehole above 157 ft in depth. However it appears the top of the Cold Creek Unit exists at 140 ft. A low concentration of  $^{40}\text{K}$  and elevated  $^{238}\text{U}$  exhibited at this depth is characteristic of this unit, suggesting "caliche." It appears contamination is associated with this unit. Elevated radon was observed in log runs 2 and 3, conducted January 20, between 96 and 191 ft. The cause of the elevated  $^{238}\text{U}$  at 175 ft is unknown but is believed to be naturally occurring and likely indicative of a thin silty zone.

The repeat sections for the SGLS indicate good agreement for the naturally occurring radionuclides.

### **List of Plots:**

Man-Made Radionuclides  
Natural Gamma Logs  
Combination Plot  
Total Gamma and Dead Time  
Repeat Section of Natural Gamma Logs

### **References:**

S.M. Price, R.B. Kasper, M.K. Additon, R.M. Smith, and G.V. Last, 1979. *Distribution of Plutonium and Americium beneath the 216-Z-1A Crib: A Status Report*, RHO-ST-17, Rockwell Hanford Operations, Richland, Washington.

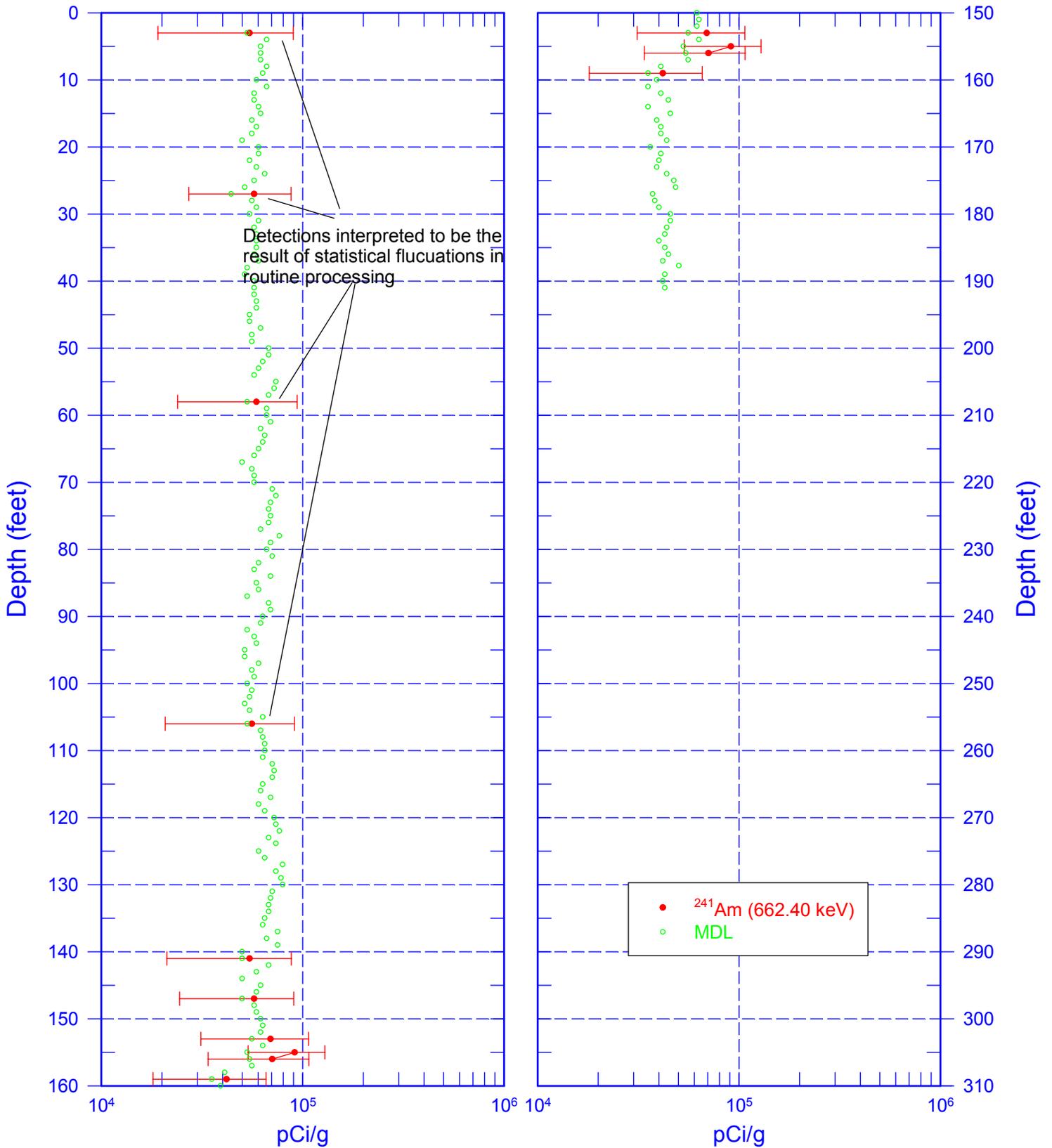
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<sup>1</sup> GWL – groundwater level

<sup>2</sup> N/A – not applicable

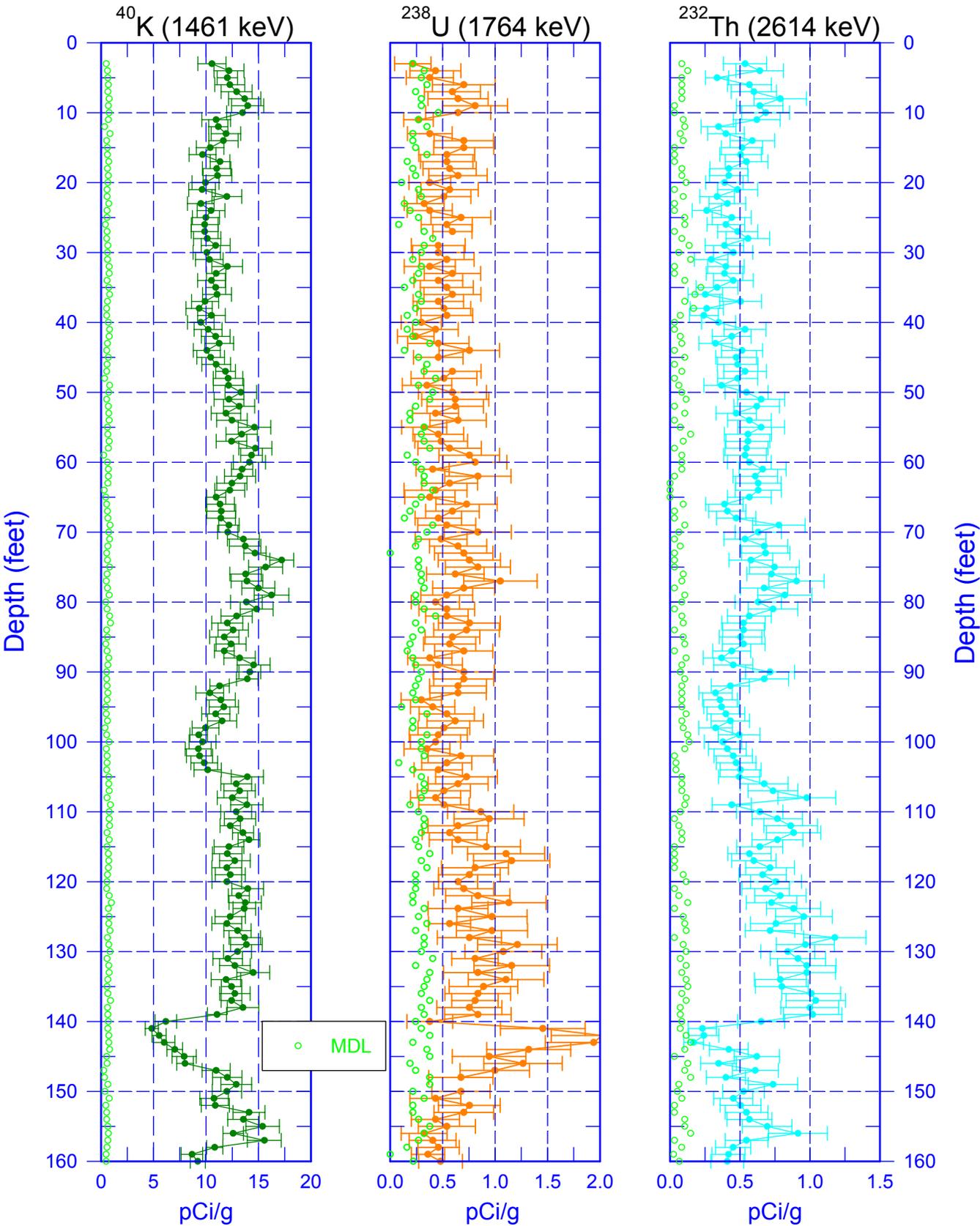
# 299-W18-07 (A7524)

## Man-Made Radionuclides



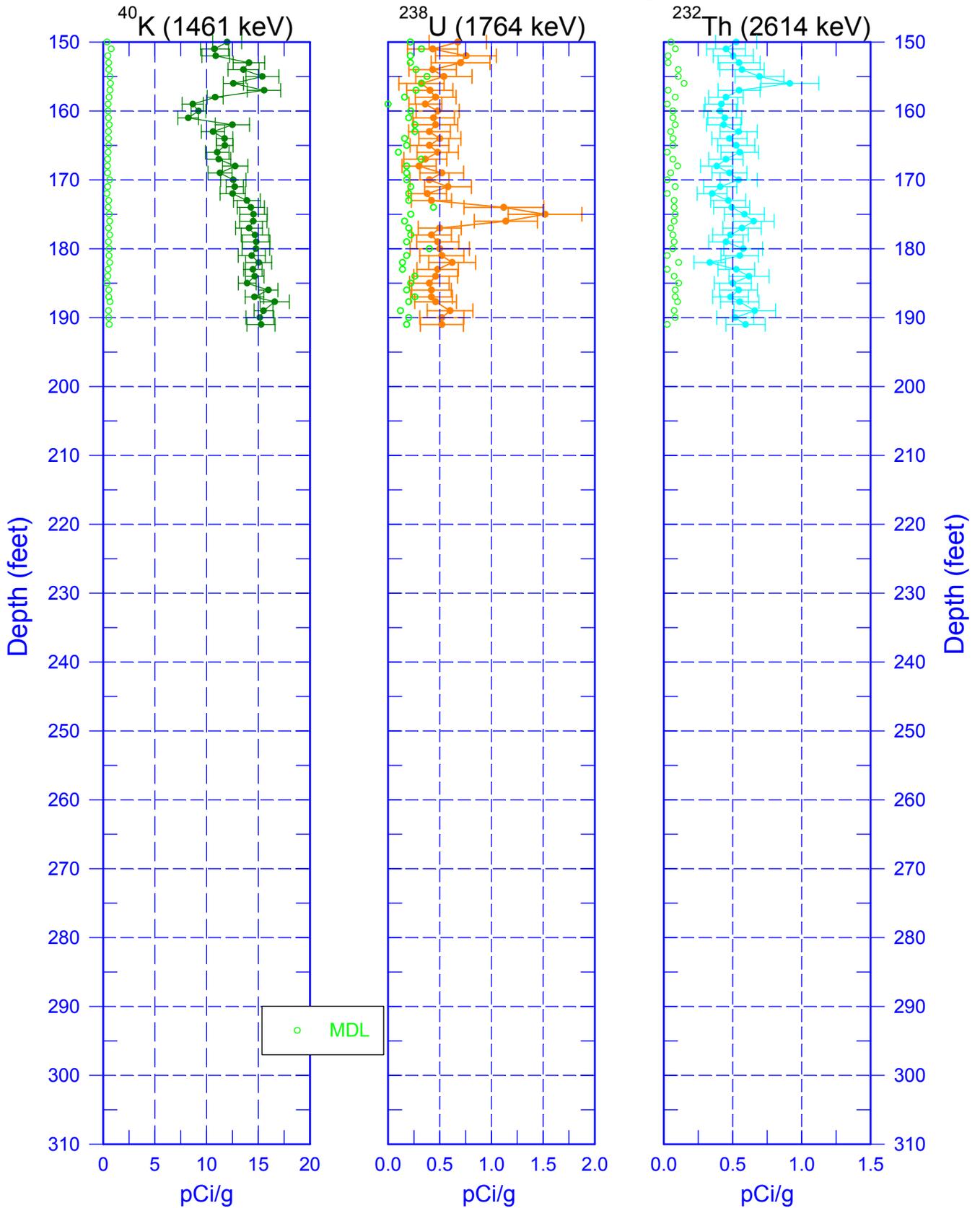
Zero Reference = Top of Casing

# 299-W18-07 (A7524) Natural Gamma Logs



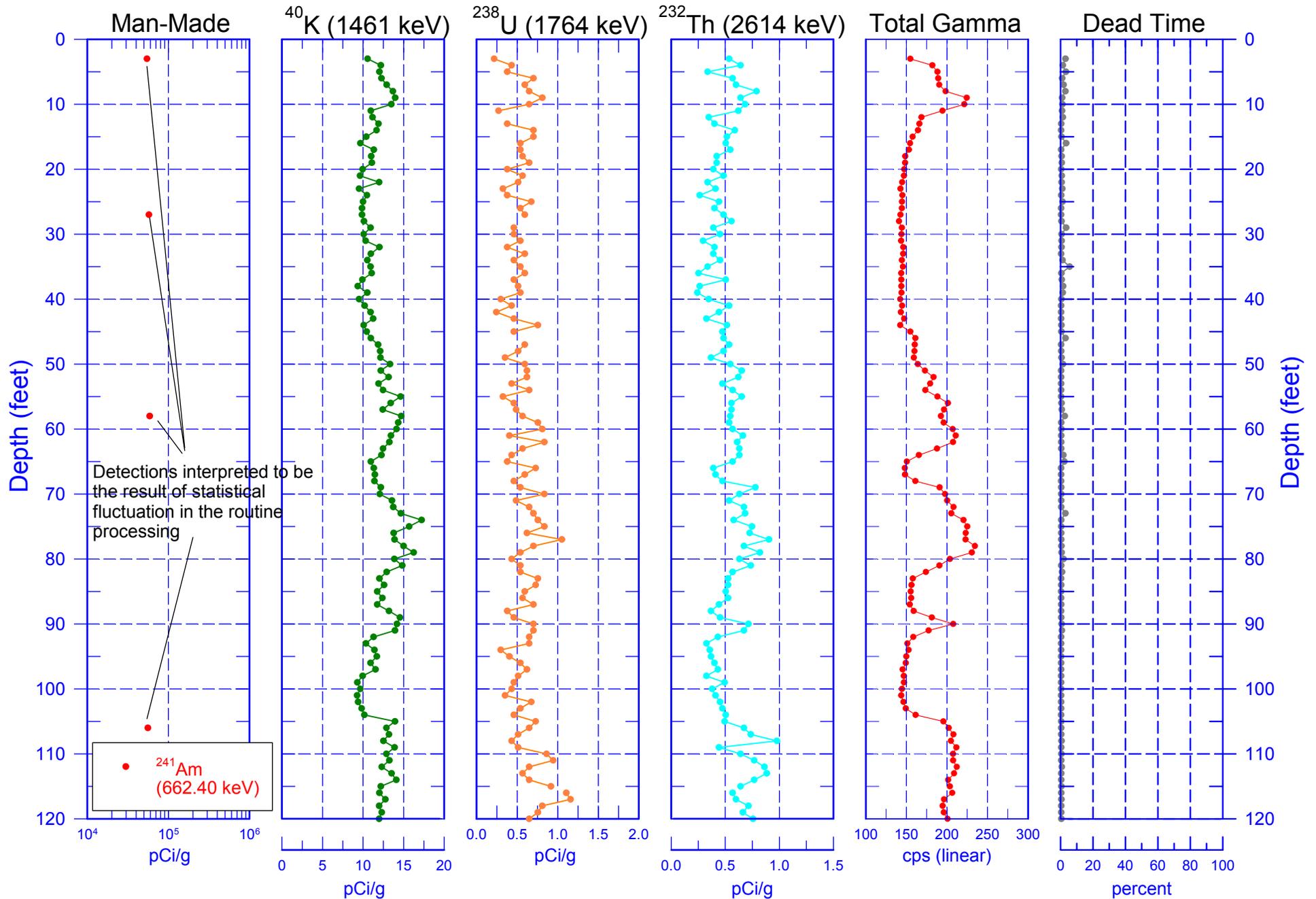
Zero Reference = Top of Casing

# 299-W18-07 (A7524) Natural Gamma Logs



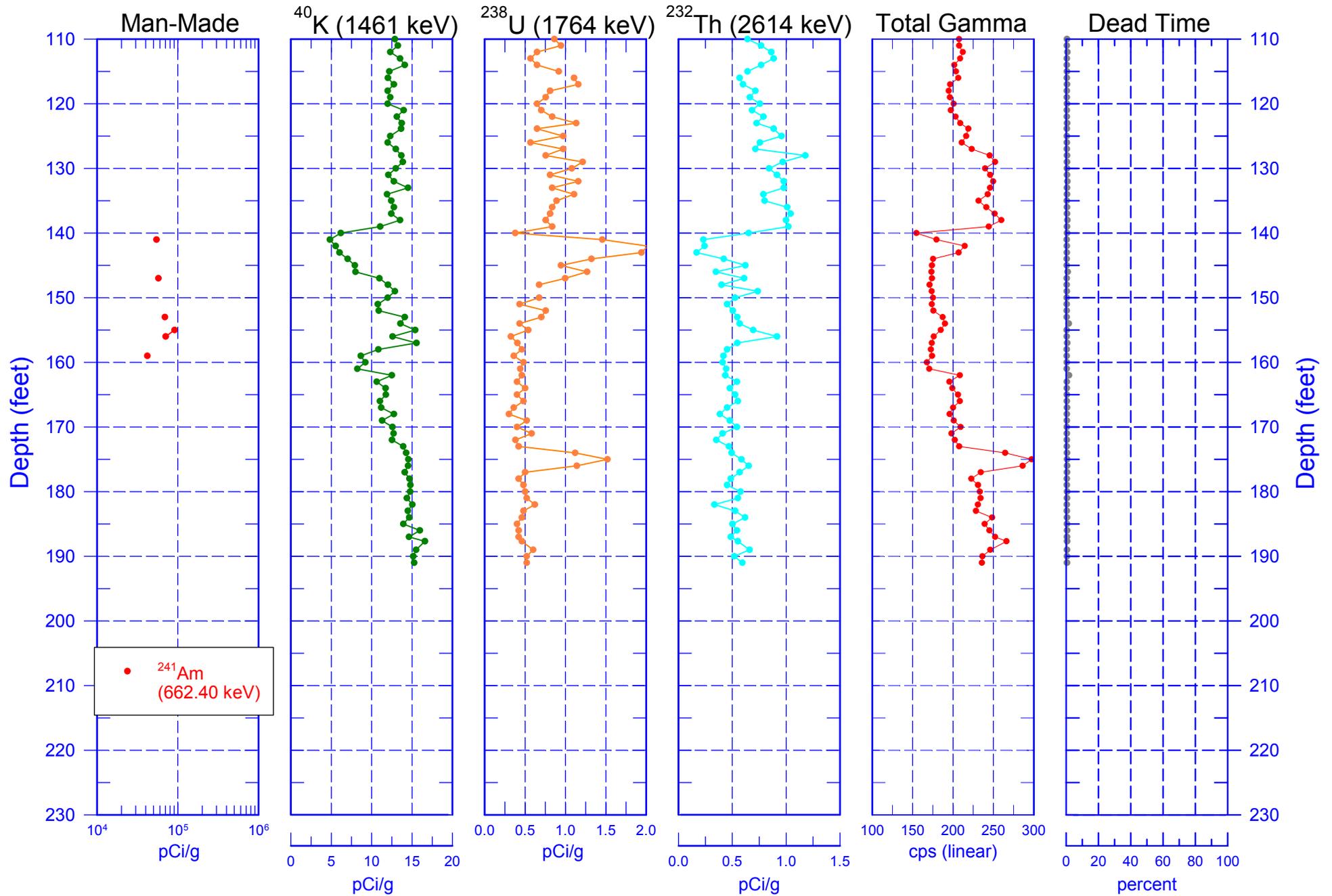
Zero Reference = Top of Casing

# 299-W18-07 (A7524) Combination Plot



Zero Reference = Top of Casing

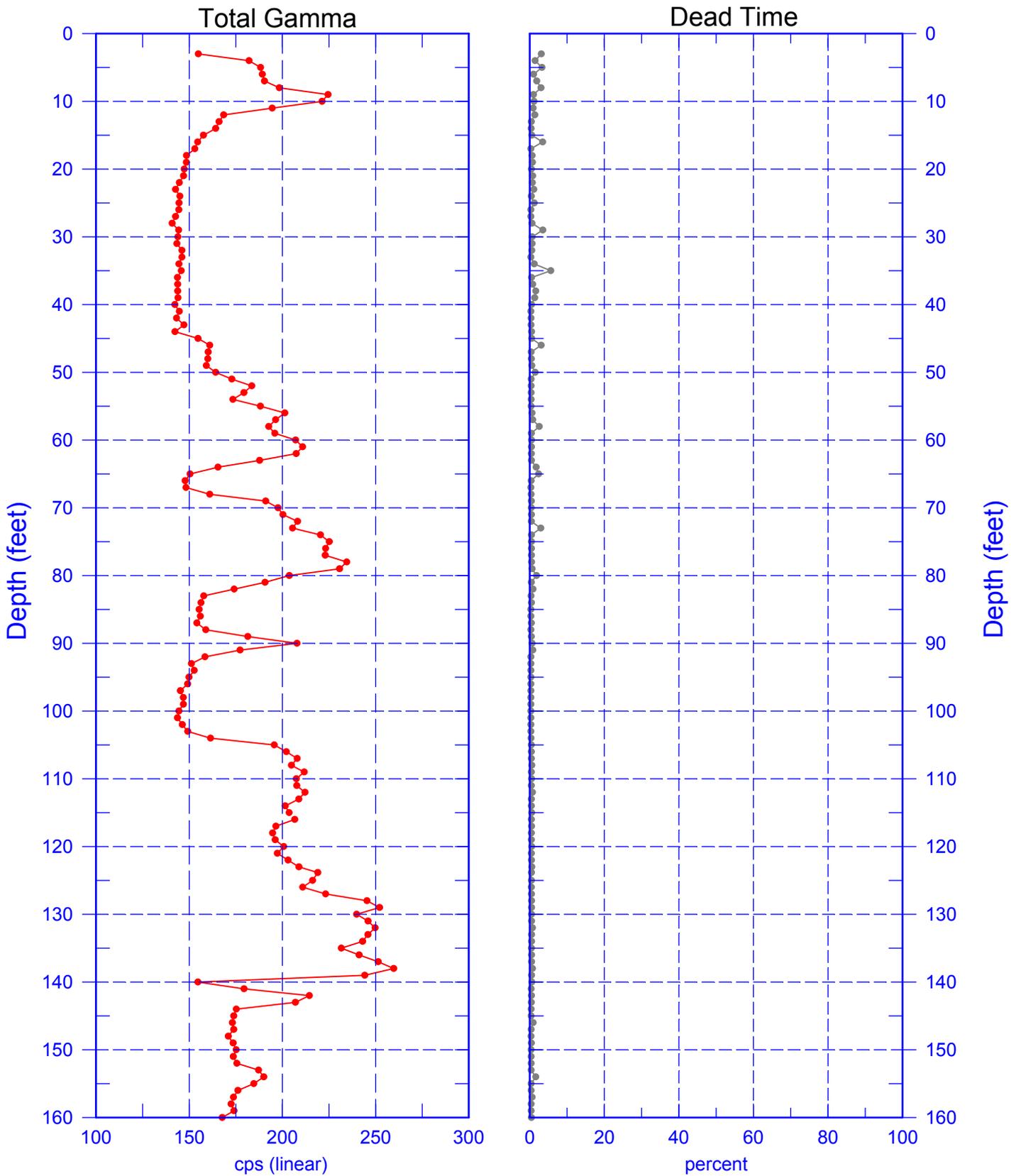
# 299-W18-07 (A7524) Combination Plot



Zero Reference = Top of Casing

# 299-W18-07 (A7524)

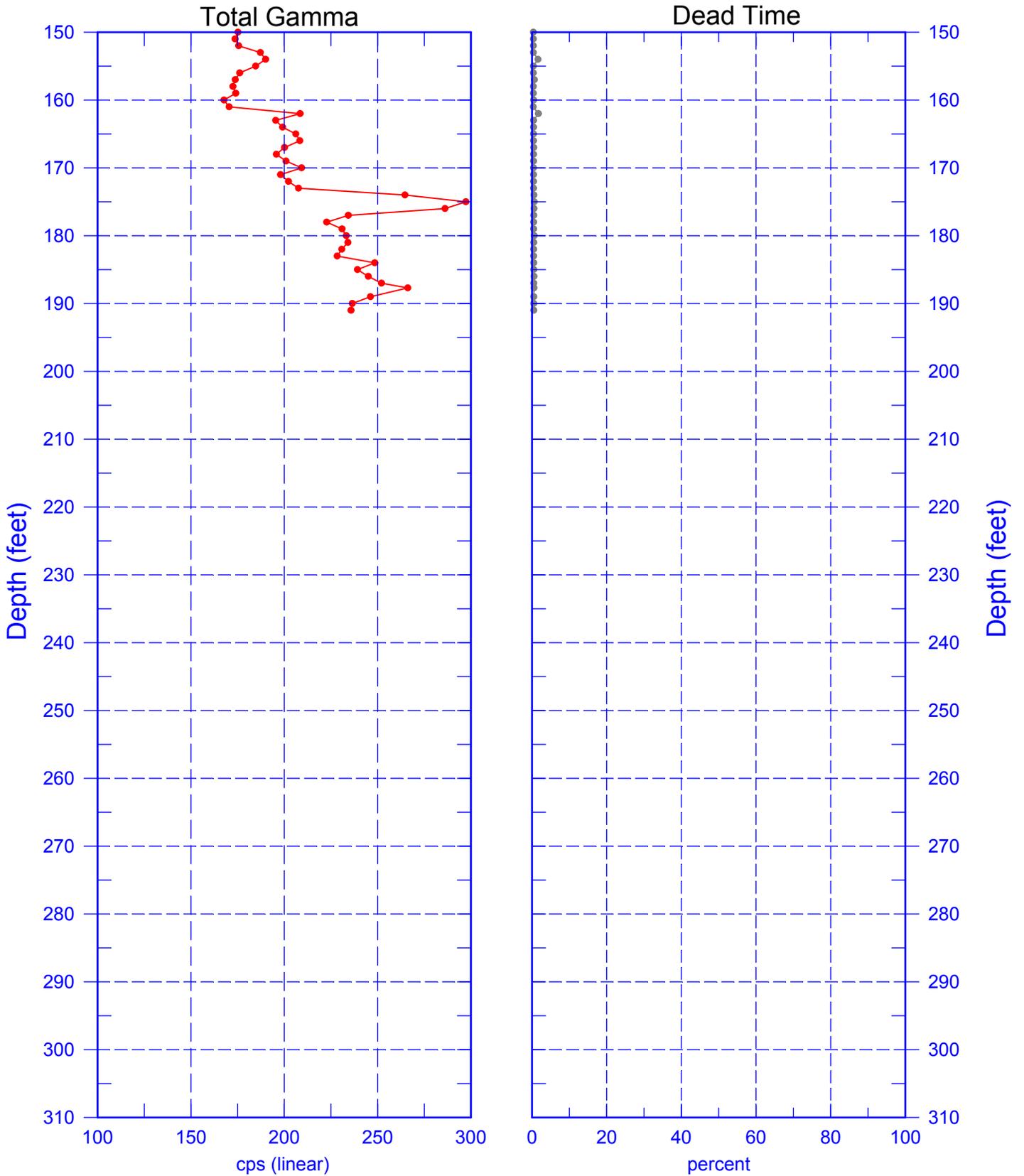
## Total Gamma & Dead Time



Reference - Top of Casing

# 299-W18-07 (A7524)

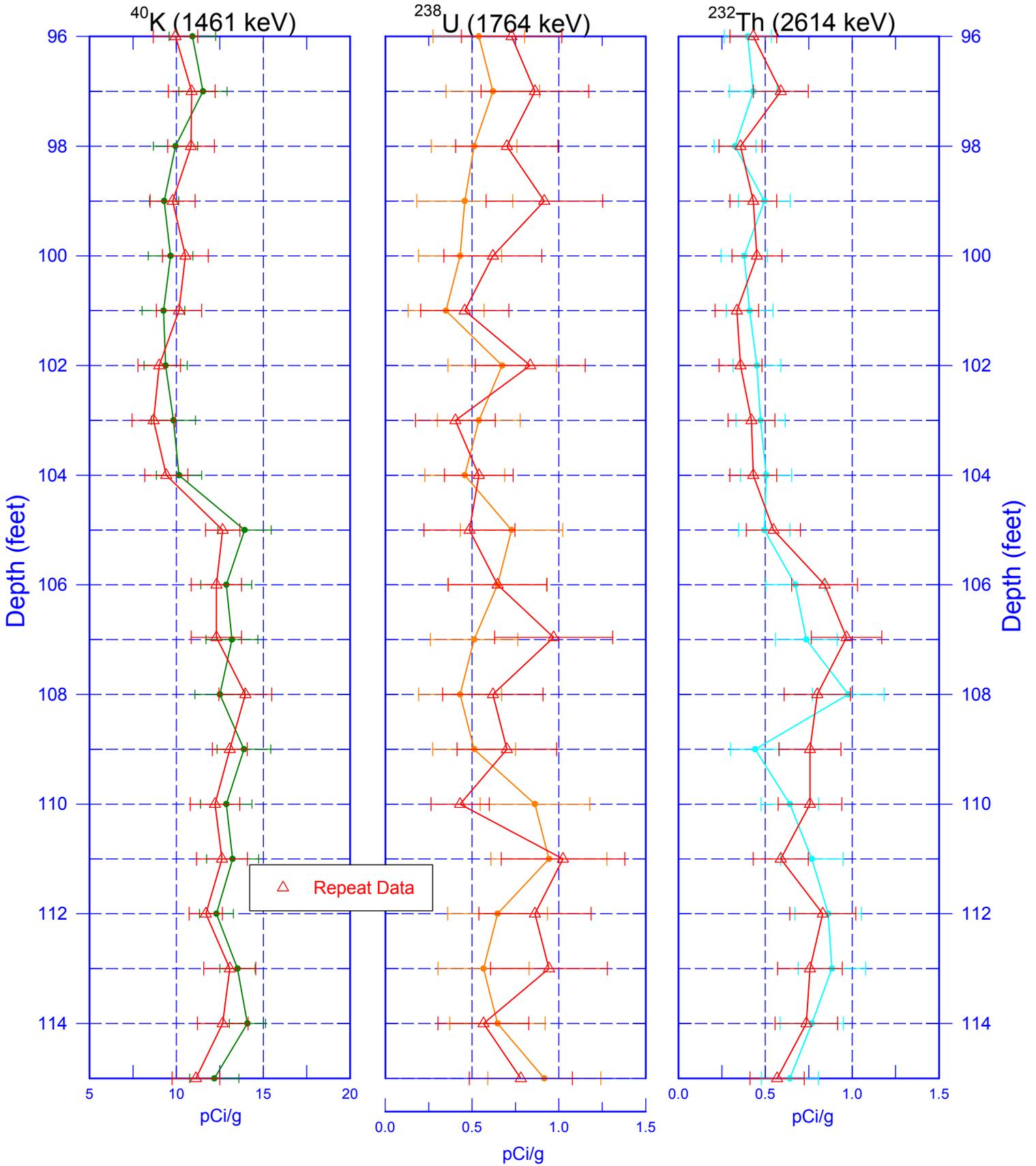
## Total Gamma & Dead Time



Reference - Top of Casing

# 299-W18-07 (A7524)

## Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing