

## 299-E28-5 (A6787) Log Data Report

### Borehole Information:

<b>Borehole:</b> 299-E28-5 (A6787)		<b>Site:</b> 216-B-9 Crib			
<b>Coordinates</b> (WA State Plane)		<b>GWL (ft)<sup>1</sup>:</b> 275.05		<b>GWL Date:</b> 06/14/2002	
<b>North</b>	<b>East</b>	<b>Drill Date</b>	<b>TOC<sup>2</sup> Elevation</b>	<b>Total Depth (ft)</b>	<b>Type</b>
136,856.7 m	574,033.8 m	March 1948	206.2 m (676.5 ft)	327.6	Cable Tool

### Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.3	8.625	8	0.3125	0	218.5
Welded steel	1.45	6.5	6	0.25	0.85	305.3

### Borehole Notes:

The logging engineer measured the casing using a steel tape. A reference point survey "X" is not located on the casing. Zero reference is the top of 8-in. casing stickup. Top of casing stickup is cut squarely. HWIS<sup>3</sup> is the source of the TOC elevation and coordinates. Drill date, drill depth, total depth, and casing bottom are reported from information provided in Ledgerwood (1993). This borehole was not swabbed prior to logging. Stoller field personnel measured GWL (TOC reference).

### Logging Equipment Information:

<b>Logging System:</b> Gamma 2B	<b>Type:</b> SGLS (35%)
<b>Calibration Date:</b> 11/01/01	<b>Calibration Reference:</b> GJO-2002-287-TAR
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

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

Log Run	1	2	3	4	5
Date	06/14/02	06/17/02	06/18/02	06/18/02	06/19/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	2.5	183.0	310.0	220.0	216.5
Finish Depth (ft)	83.0	82.0	254.0	182.0	255.0
Count Time (sec)	100	200	100	200	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A <sup>4</sup>	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.5	1.0	0.5	1.0	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	BB118CAB	BB119CAB	BB120CAB	BB120CAB	BB122CAB
Start File	BB118000	BB119000	BB120000	BB121000	BB122000
Finish File	BB118161	BB119101	BB120112	BB121038	BB122077
Post-Verification	BB118CAA	BB119CAA	BB121CAA	BB121CAA	BB122CAA

Log Run	1	2	3	4	5
Depth Return Error (in.)	0	0	0	-2	N/A
Comments	Fine-gain adjustment listed below.	Fine-gain adjustment listed below.	No fine-gain adjustment.	Fine-gain adjustment before logging.	No fine-gain adjustment.

Log Run	6/Repeat	7/Repeat			
Date	06/19/02	06/19/02			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	255.5	295.0			
Finish Depth (ft)	270.0	310.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N/A	N/A			
MSA Interval (ft)	0.5	0.5			
ft/min	N/A	N/A			
Pre-Verification	BB122CAB	BB122CAB			
Start File	BB122078	BB122108			
Finish File	BB122107	BB122138			
Post-Verification	BB122CAA	BB122CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine-gain adjustment.	No fine-gain adjustment.			

### **Logging Operation Notes:**

Zero reference is the top of 8-in. casing for the SGLS logging. Above 216.5 ft, a centralizer was installed on the sonde during logging. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT verifier with serial number 082. Due to the potential for snagging in an uncased borehole, the borehole was not logged below 310 ft because this portion of the borehole was not cased.

During SGLS logging, fine-gain adjustments were made to maintain the 1460-keV (<sup>40</sup>K) photopeak at a pre-described channel. On 06/14/02, a fine-gain adjustment was made after file BB118086. On 06/17/02, fine-gain adjustments were made after files BB119028, BB119045, BB119072, and BB119089.

### **Analysis Notes:**

<b>Analyst:</b>	Sobczyk	<b>Date:</b>	06/24/02	<b>Reference:</b>	
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. All of the verification spectra were within the control limits except for spectra BB119CAB and BB120CAB. The peak counts per second (cps) at the 2615-keV photopeak on these pre-run verification spectra were below the control limits. Upon review of the log spectra, the electrical components of the logging system were tested and were found to be functioning normally. The counts per second at the 609-keV and 1461-keV photopeaks on the post-run verification spectrum as compared to the pre-run verification spectrum ranged from 4 to 9 percent lower at the end of each day.

Subsequent, more detailed evaluations of the verification spectra indicate that the ratio between net counts per second for the 583- and 2615-keV <sup>232</sup>Th peaks is greater than 2.5 on files BB119CAB and BB120CAB. For other verification spectra, this ratio is about 1.9. The higher ratio suggests a loss of sensitivity in the high-energy range, and <sup>232</sup>Th values for log runs 2, 3, and 4 may be too low.

Log spectra for the SGLS were processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. The post-verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC Supervisor. Concentrations were calculated in Excel (source file: G2BNov1.xls), using parameters determined from analysis of recent calibration data. Zero reference is the top of the 8-in. casing. The casing configuration (Ledgerwood 1993) was assumed to be a string of 8-in. casing with a thickness of 0.322 in. to 218.5 ft and a string of 6-in. casing with a thickness of 0.28 in. to a depth of 305.3 ft. These casing thicknesses are the published values for 8- and 6-in. ASTM schedule-40 steel pipe (commonly used casing materials at Hanford). These casing thicknesses are within the range of measurement error associated with the logging engineer's measurements. A water correction was applied to the SGLS data below 275.05 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

### **Log Plot Notes:**

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides ( $^{40}\text{K}$ ,  $^{238}\text{U}$ , and  $^{232}\text{Th}$ ), and man-made radionuclides. 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, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The  $^{214}\text{Bi}$  peak at 609 keV was used to determine the naturally occurring  $^{238}\text{U}$  concentrations on the combination plot rather than the  $^{214}\text{Bi}$  peak at 1764 keV because it generally exhibited slightly higher net counts.

### **Results and Interpretations:**

$^{137}\text{Cs}$  and  $^{60}\text{Co}$  were the man-made radionuclides detected in this borehole.  $^{137}\text{Cs}$  was detected near the ground surface (2.5-ft log depth) with an activity of 0.6 pCi/g. At 261.5 and 263.0 ft,  $^{137}\text{Cs}$  was detected with an activity near its MDL of about 0.2 pCi/g.  $^{60}\text{Co}$  was detected in the interval from 301 to 306.5 ft with activities ranging from the MDL (0.1 pCi/g) to 0.2 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. A gradual increase of about 5 pCi/g in apparent  $^{40}\text{K}$  activity occurs at approximately 17 ft while there is an apparent decrease of about 5 pCi/g in apparent  $^{40}\text{K}$  activity at approximately 305 ft. In the interval from 242 through 249 ft, apparent  $^{40}\text{K}$  and  $^{238}\text{U}$  activities are elevated with a corresponding 75-cps increase in total gamma. The apparent  $^{232}\text{Th}$  activities below 82 ft are anomalously low and should be considered suspect. The apparent  $^{232}\text{Th}$  activities are about 0.3 pCi/g lower than expected and may be due to the nature of the completion of the borehole or an electrical malfunction in the logging system.

The behavior of the  $^{238}\text{U}$  log suggests that radon may be present inside the borehole casing. This effect is observed in log run 1 (35 to 82 ft). The effects of radon appear to be minimal in the other log runs. Radon and its daughters such as  $^{214}\text{Bi}$  may appear to build-up in the borehole. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with  $^{214}\text{Bi}$  and  $^{214}\text{Pb}$ . This phenomenon appears to best explain the observed  $^{238}\text{U}$  values in log runs 3, 4 and the repeat log run. The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The gross gamma profile from Additon et al. (1978) (attached) indicates gamma-emitting contamination in the sediments surrounding this borehole may have been present at the time of the log below about 82 m (269 ft). The profile from 5/17/63 appears to detect gamma activity above background in the borehole in the interval from 82 m (269 ft) to 97 m (318 ft). The SGLS detected  $^{137}\text{Cs}$  at 261.5 and 263.0 ft with an activity near its MDL (0.2 pCi/g). The SGLS detected  $^{60}\text{Co}$  in the interval from 301 to 306.5 ft with activities ranging from 0.1 pCi/g to 0.2 pCi/g.

**References:**

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200 East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

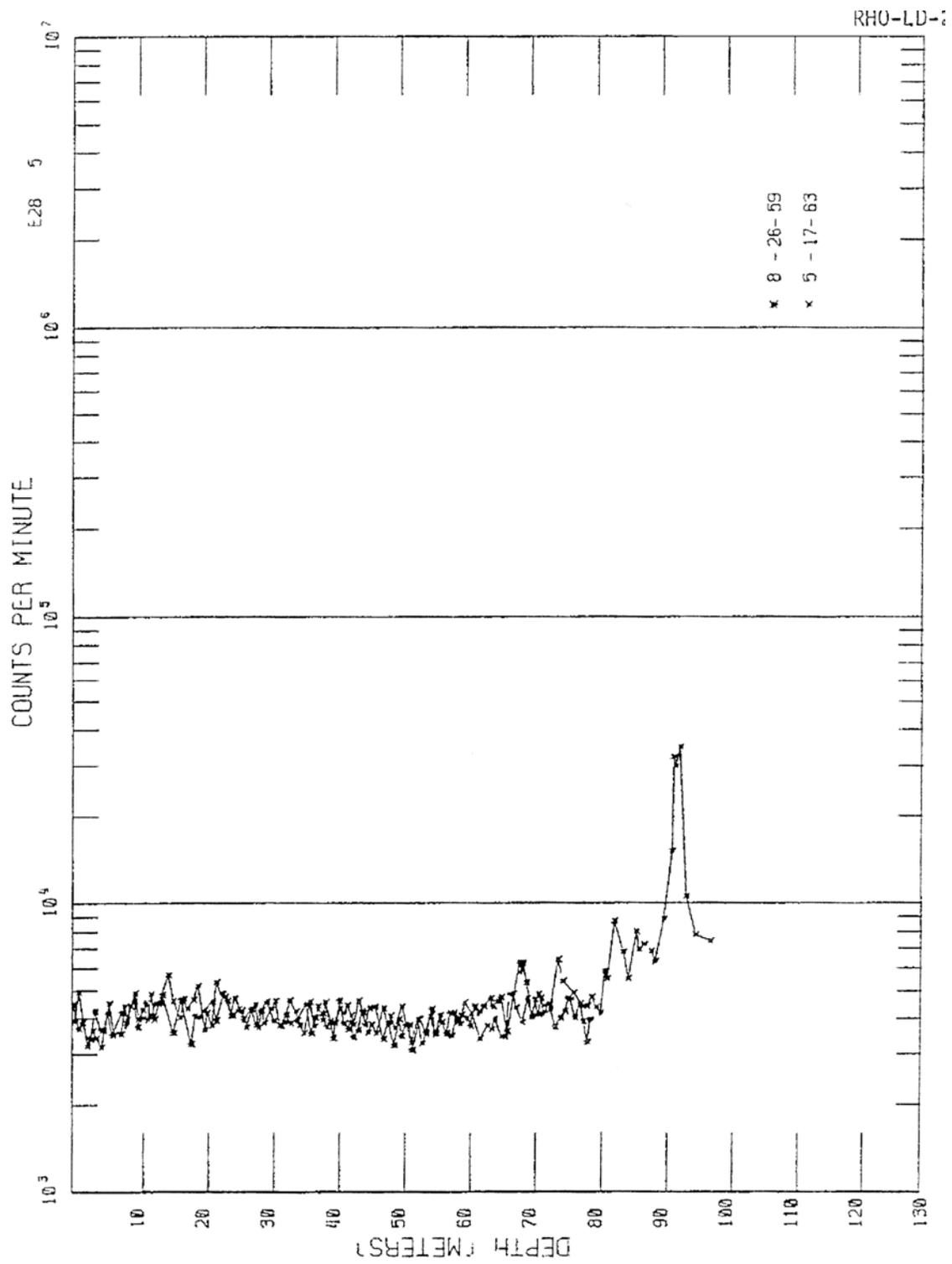
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<sup>1</sup> GWL – groundwater level

<sup>2</sup> TOC – top of casing

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

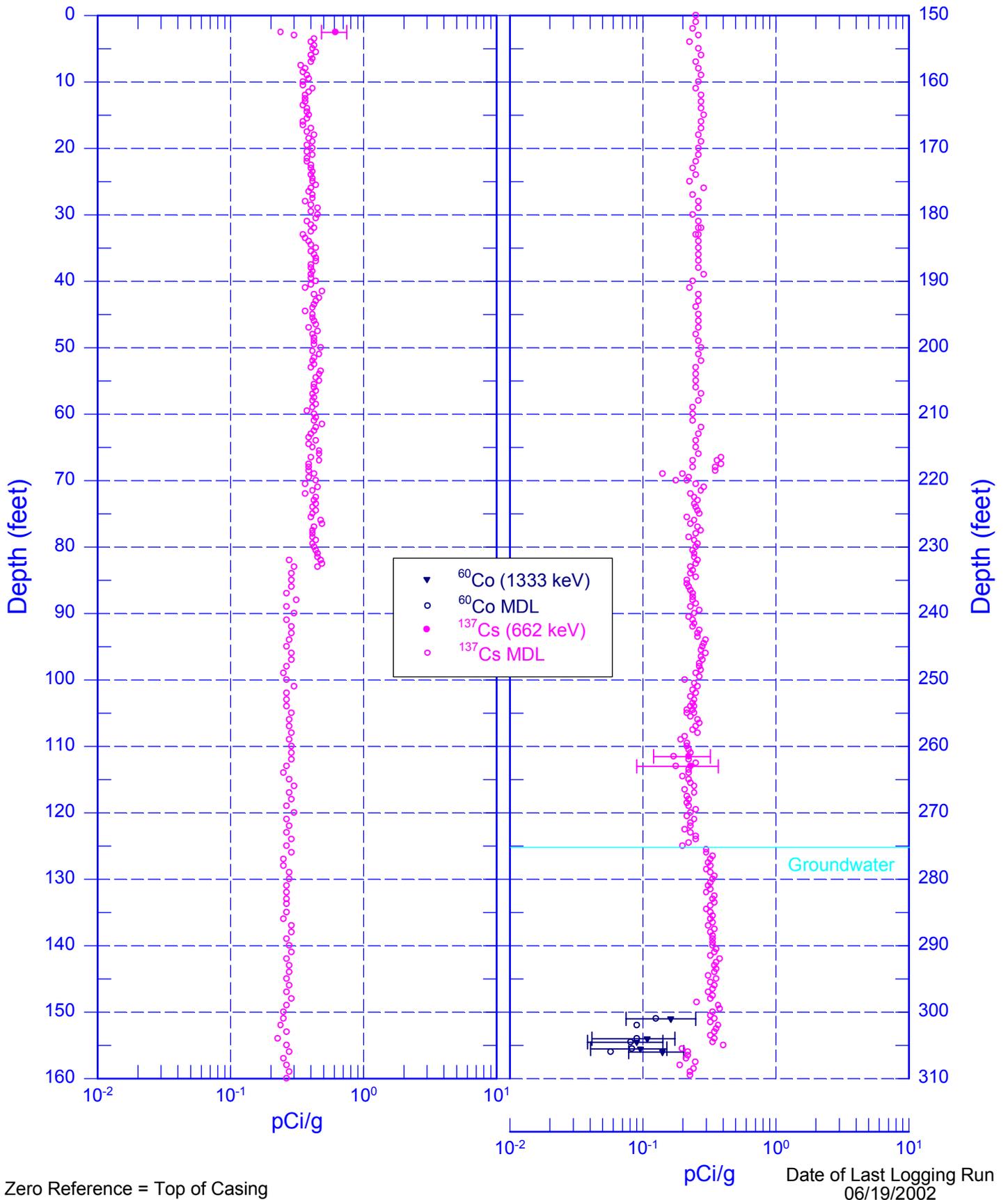
<sup>4</sup> N/A – not applicable



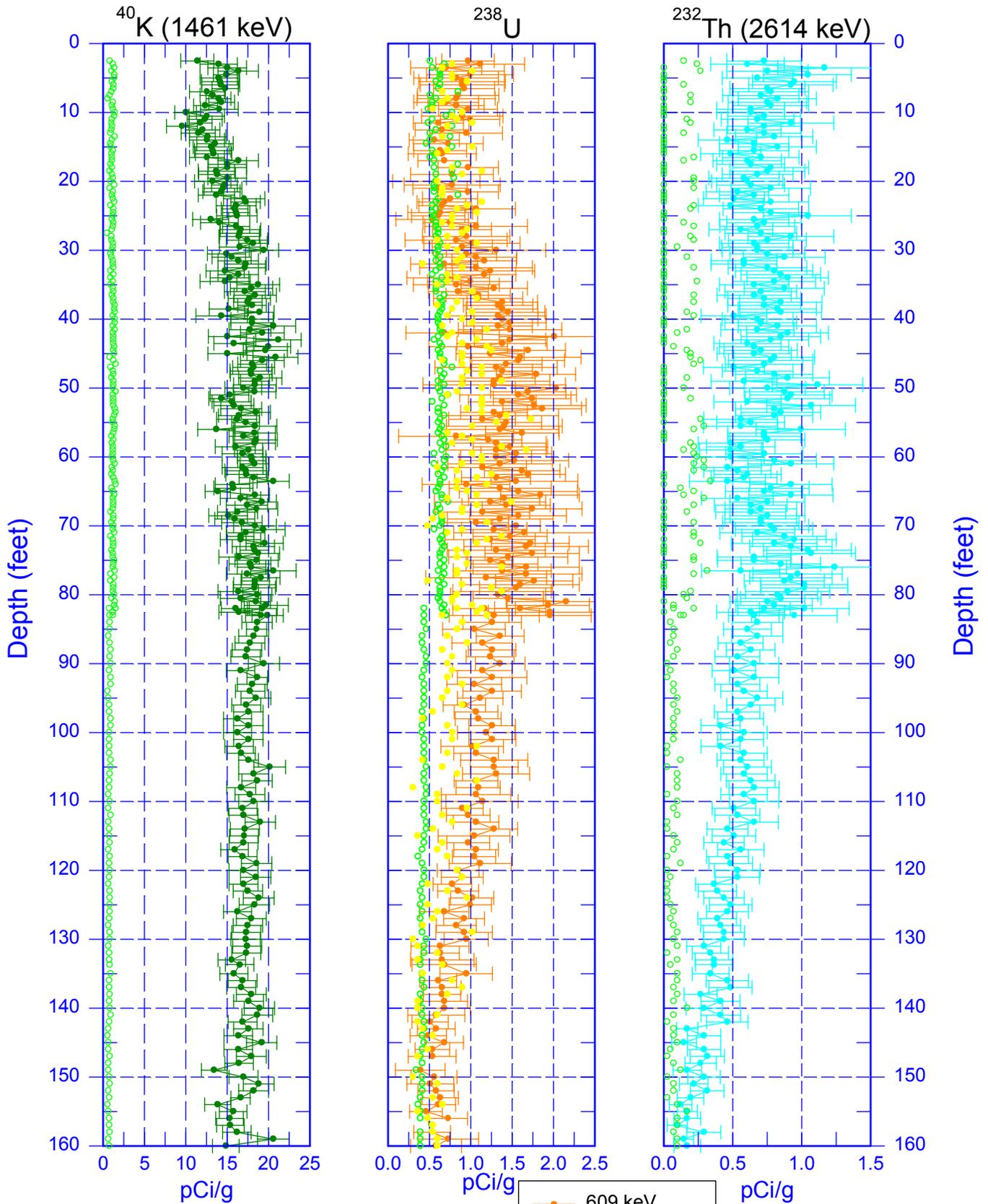
from Additon et al. (1978)

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## Man-Made Radionuclides



# 299-E28-5 (A6787) Natural Gamma Logs



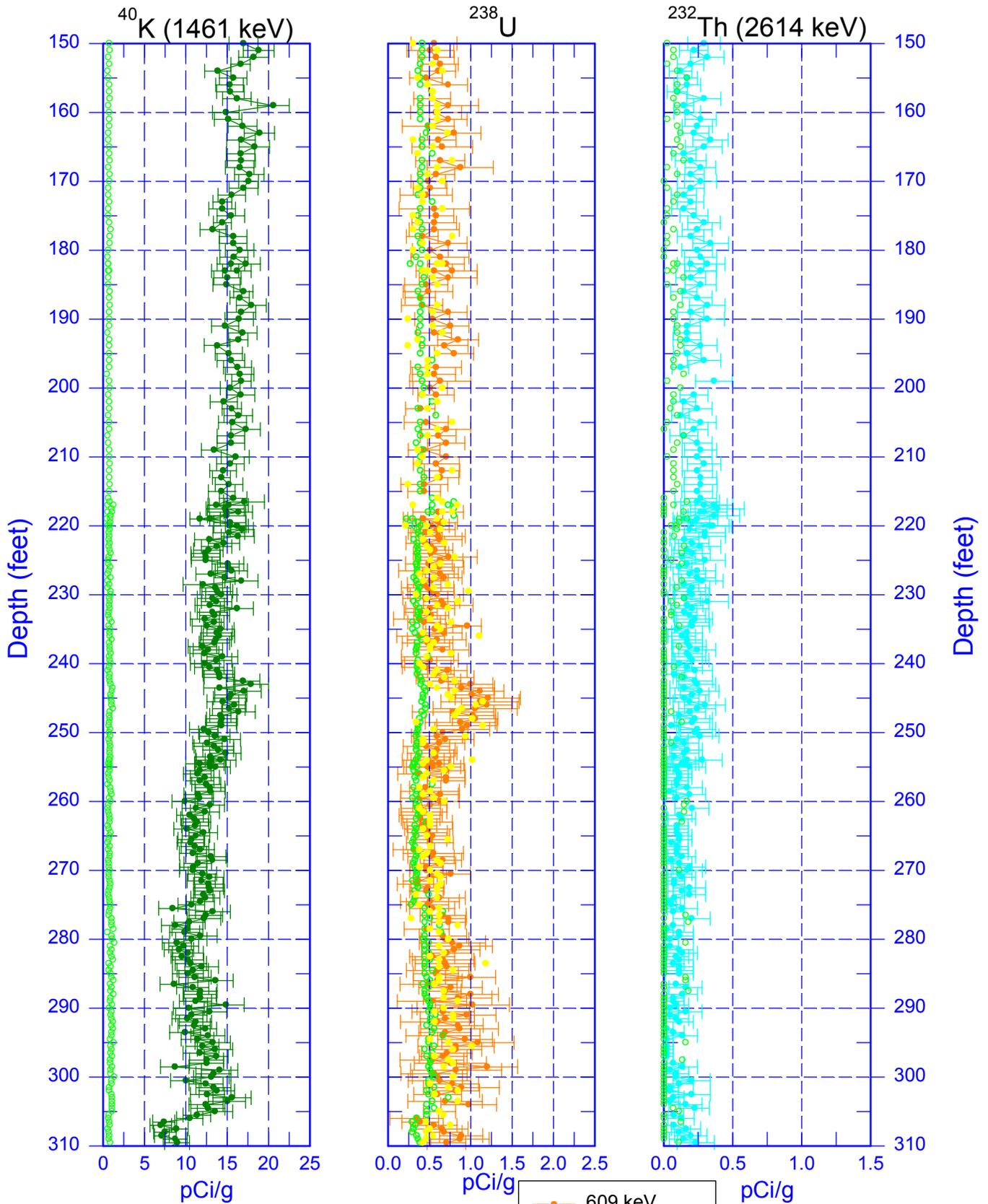
○ MDL

Zero Reference = Top of Casing

- 609 keV
- MDL 609 keV
- 1764 keV

Date of Last Logging Run  
06/19/2002

# 299-E28-5 (A6787) Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run  
06/19/2002

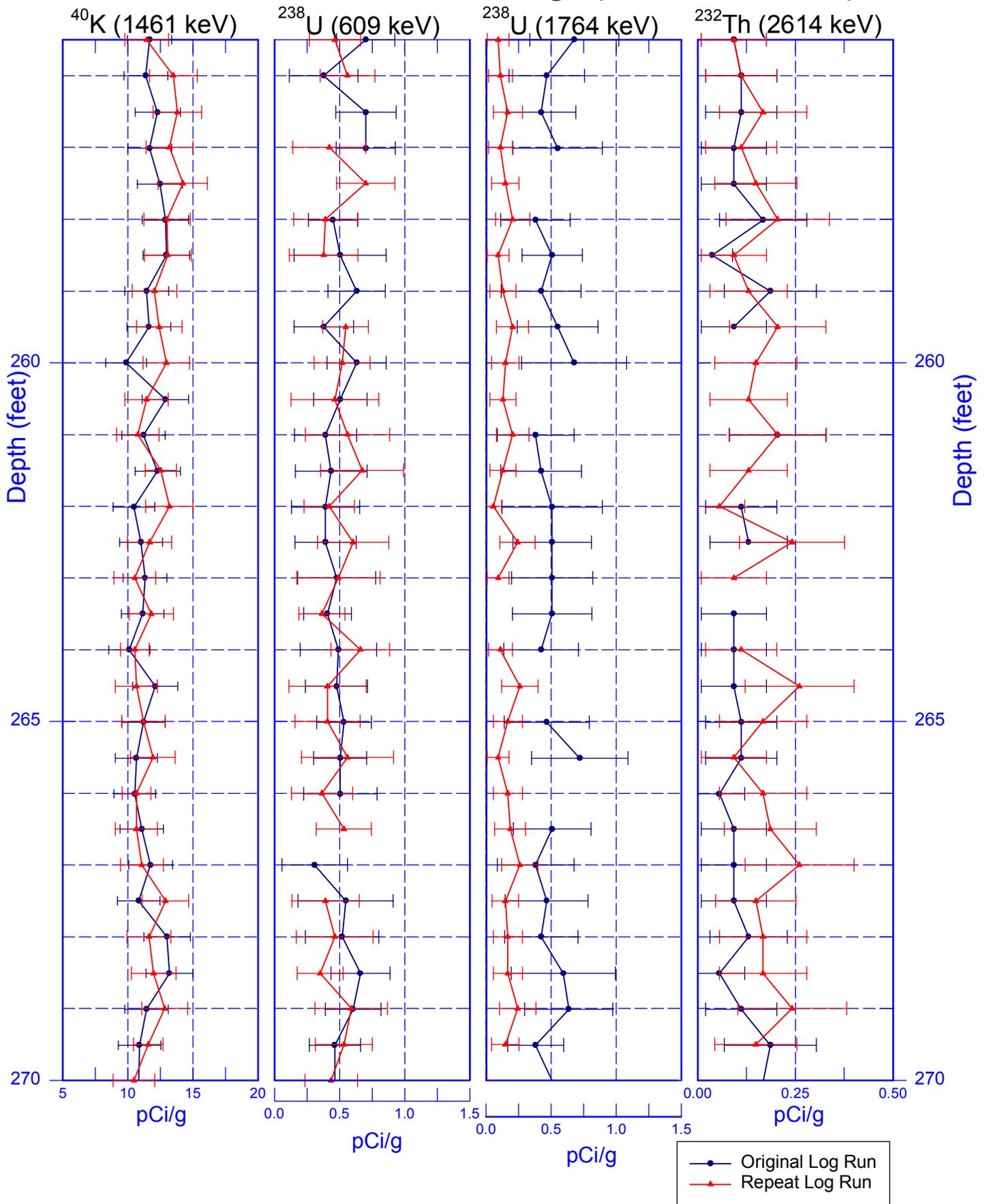






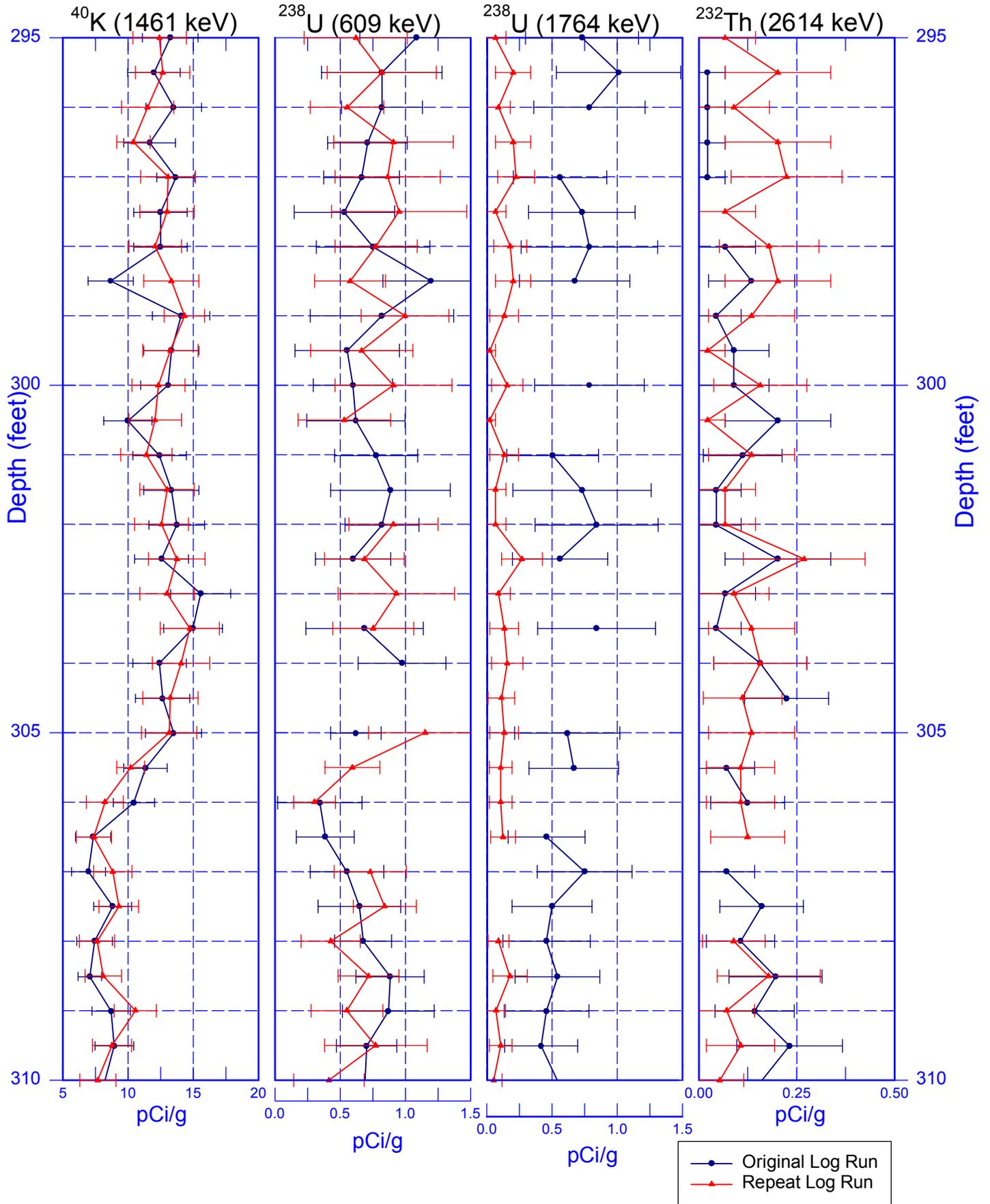
# 299-E28-5 (A6787)

## Rerun of Natural Gamma Logs (255.5 to 270.0 ft)



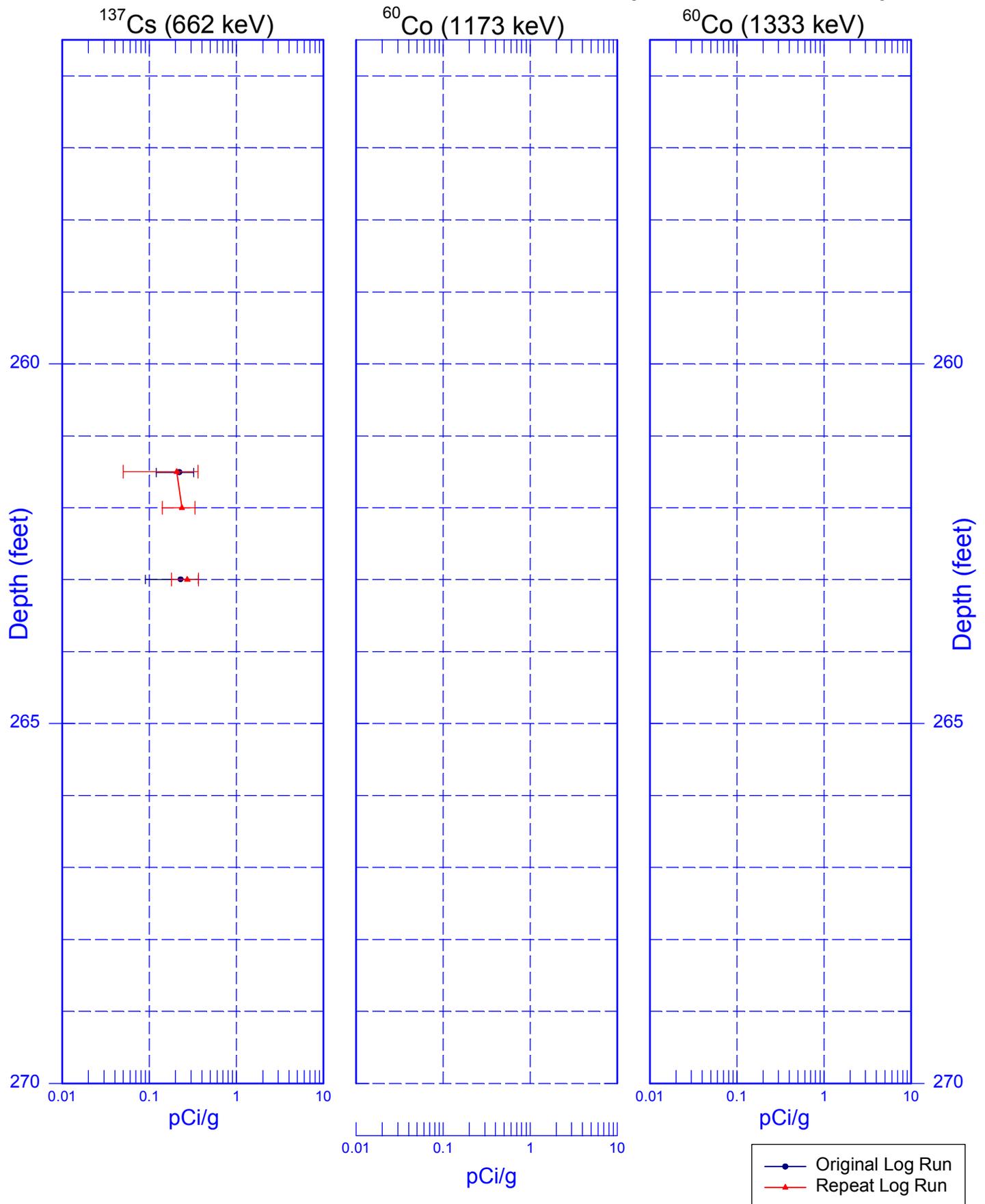
# 299-E28-5 (A6787)

## Rerun of Natural Gamma Logs (295.0 to 310.0 ft)



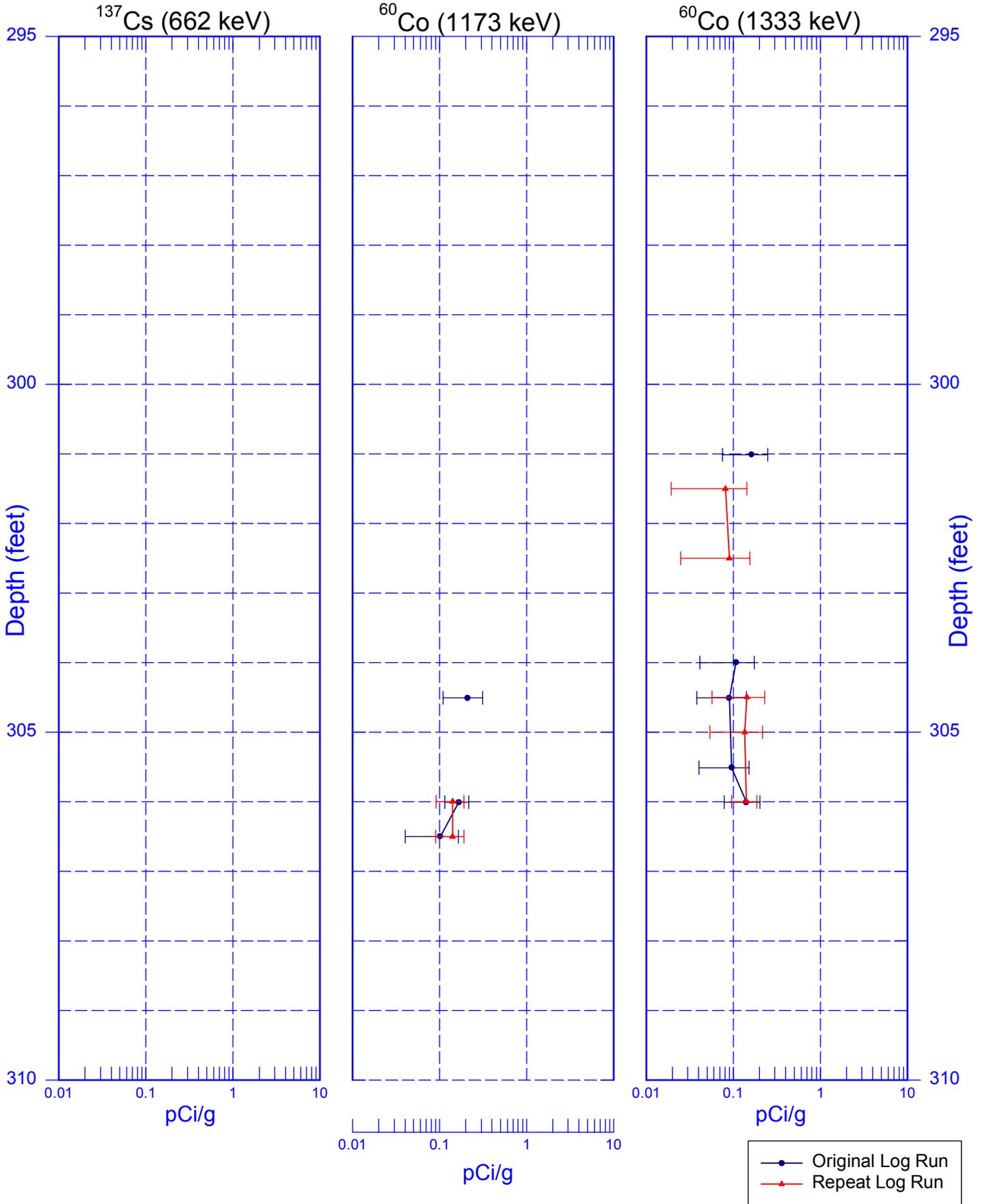
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## Rerun of Man-Made Radionuclides (255.5 to 270.0 ft)



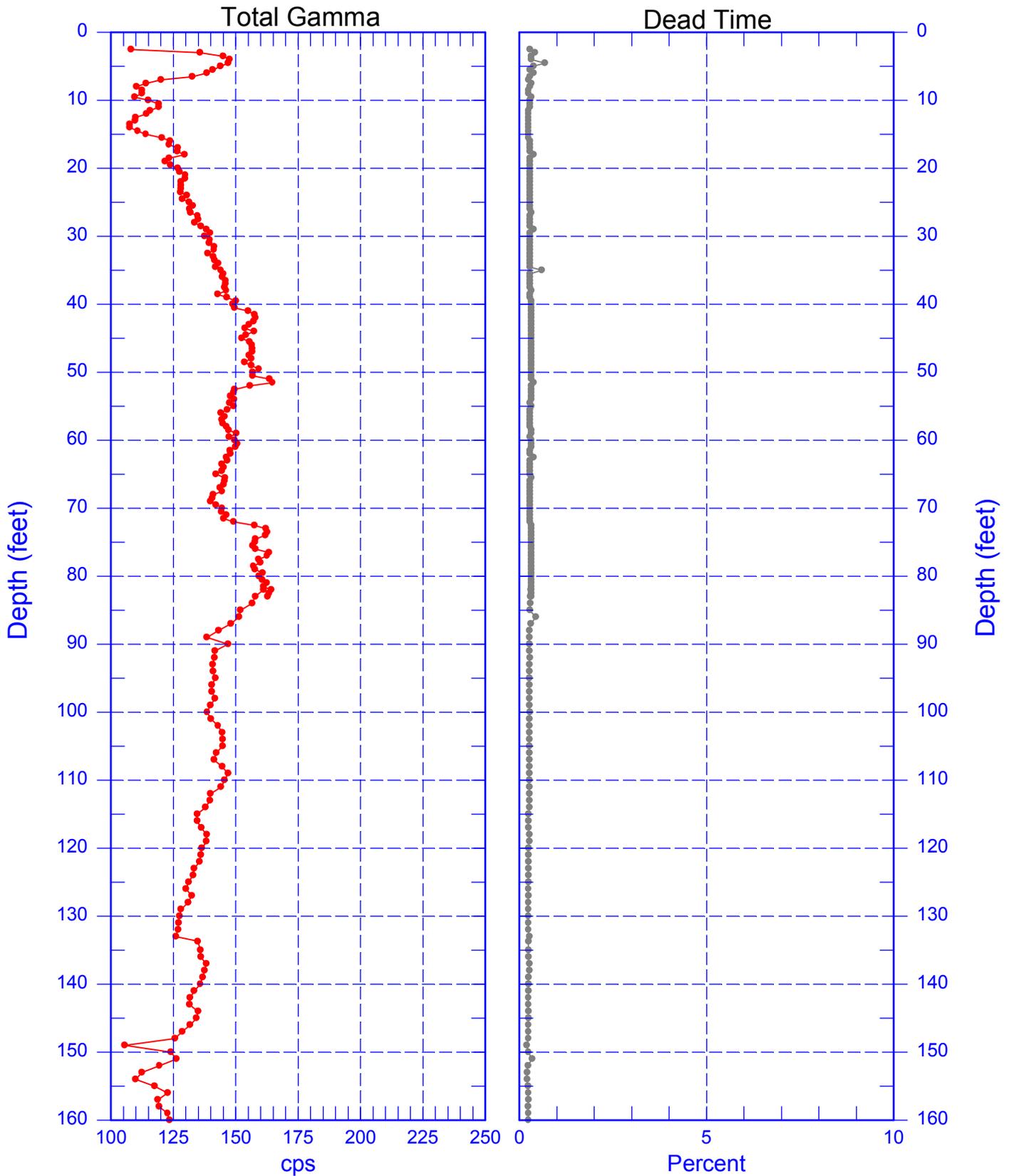
# 299-E28-5 (A6787)

## Rerun of Man-Made Radionuclides (295.0 to 310.0 ft)



# 299-E28-5 (A6787)

## Total Gamma & Dead Time

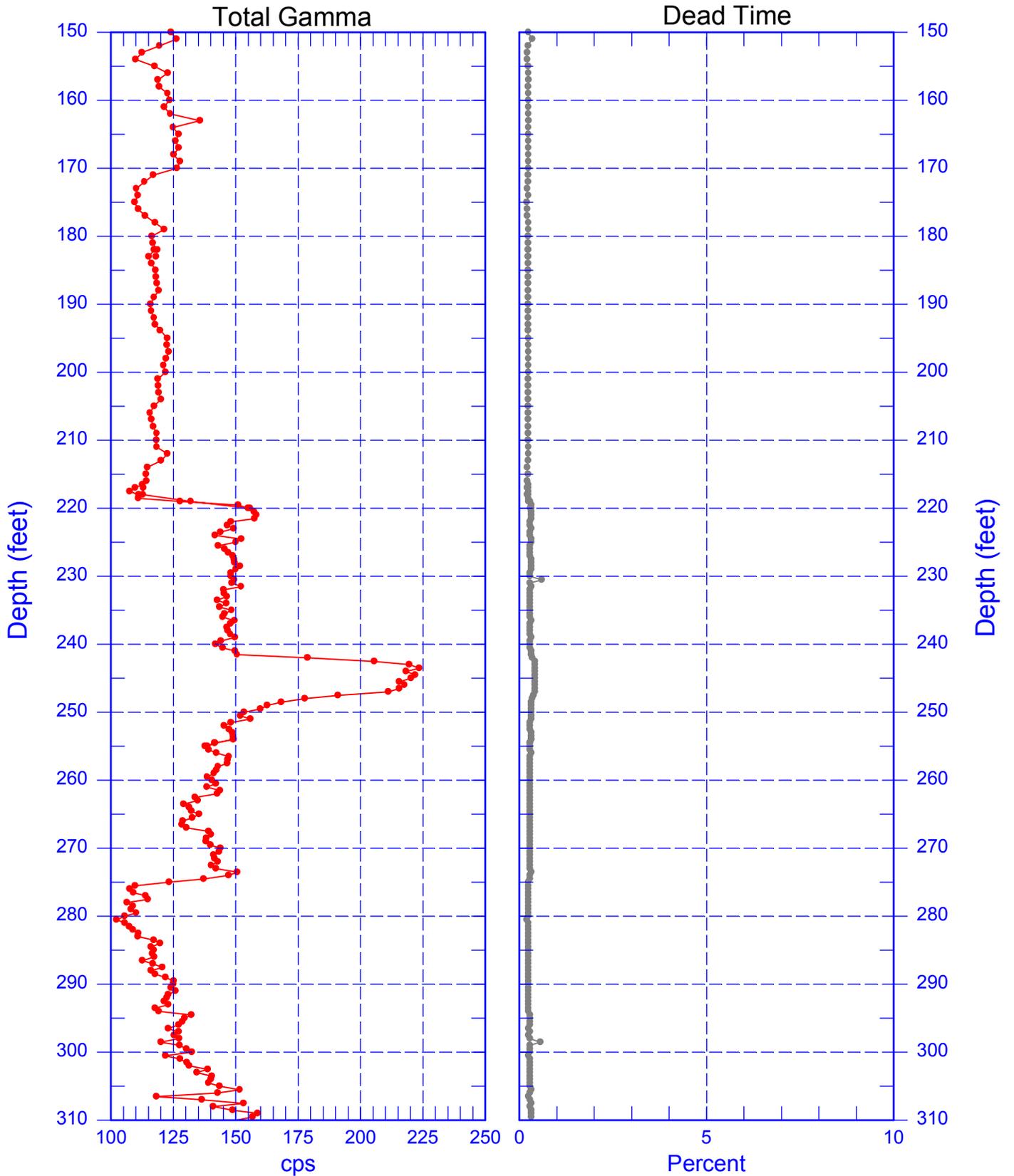


Zero Reference = Top of Casing

Date of Last Logging Run  
06/19/2002

# 299-E28-5 (A6787)

## Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run  
06/19/2002