

299-E33-22 (A6856) Log Data Report

Borehole Information:

Borehole: 299-E33-22 (A6856)		Site: 216-B-45 Crib			
Coordinates (WA State Plane)		GWL¹ (ft): 234.0	GWL Date: 09/02		
North 137661	East 573625	Drill Date 08/65	TOC² Elevation 634.49	Total Depth (ft) 234.95	Type cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel (welded)	3.25	6.625	6.125	0.3125	0	235
Steel (welded)	3.2	4.50	4.026	0.250	0	217

Borehole Notes:

The casing depth information provided above is derived from a well construction and completion summary obtained from Ledgerwood (1993). The casing size information for the 4-in. and 6-in. steel casings is determined from tape and caliper measurements collected in the field by Stoller personnel. The groundwater level, measured at 234.0 ft from the TOC by Stoller personnel, is reported to have been at 224 ft from ground surface in 1965 (Ledgerwood 1993). The coordinates and TOC elevation are derived from HWIS³.

This borehole was originally drilled to a depth of 232 ft in 1965. A 6-in. casing was reported as placed to the bottom of the borehole (232 ft). In 1979, a cement plug was placed in the bottom of the borehole and the 6-in. casing was perforated at two cuts per foot from 0 to 207 ft and at one cut per foot from 217 to 231 ft. A 4-in. casing was introduced inside the 6-in. casing to a depth of 217 ft. A packer was set at a depth of 217 ft and grout was placed between the 4-in. and 6-in. casings from the ground surface to the depth of the packer.

Logging Equipment Information:

Logging System: Gamma 1D	Type: SGLS (35%)
Calibration Date: 07/01	Calibration Reference: GJO-2001-243-TAR
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Logging System: Gamma 1C	Type: HRLS
Calibration Date: 02/02	Calibration Reference: GJO-2002-309-TAR
	Logging Procedure: MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5 Repeat
Date	09/04/02	09/05/02	09/05/02	09/06/02	09/09/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	235.0	208.0	101.0	235.0
Finish Depth (ft)	48.0	208.5	161.0	48.0	211.0
Count Time (sec)	200	100	200	200	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	0.5	1.0	1.0	0.5
ft/min	n/a ⁴	n/a	n/a	n/a	n/a
Pre-Verification	AD029CAB	AD031CAB	AD031CAB	AD032CAB	AD033CAB
Start File	A0030000	A0031000	A0031054	A0032000	A0033000
Finish File	A0030048	A0031053	A0031101	A0032053	A0033048
Post-Verification	AD030CAA	AD031CAA	AD031CAA	AD032CAA	AD033CAA

Log Run	6	2	3	4	5
Date	09/09/02				
Logging Engineer	Spatz				
Start Depth (ft)	162.0				
Finish Depth (ft)	100.0				
Count Time (sec)	200				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	n/a				
Pre-Verification	AD033CAB				
Start File	AD033049				
Finish File	AD033111				
Post-Verification	AD033CAA				

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2	3	4	5
Date	10/10/02	11/07/02	11/07/02	11/18/02	11/19/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	7.0	99.0	160.0	166.0	21.0
Finish Depth (ft)	100.0	160.0	167.0	205.0	42.0
Count Time (sec)	100	100	300	300	100
Live/Real	R	L	L	L	R
Shield (Y/N)	N	N	N	N	Y (internal)
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	n/a	n/a	n/a	n/a	n/a
Pre-Verification	AC043CAB	AC044CAB	AC044CAB	AC045CAB	AC046CAB
Start File	AC043000	AC044000	AC044062	AC045000	AC046000
Finish File	AC043095	AC044061	AC044069	AC045039	AC046022
Post-Verification	AC043CAA	AC044CAA	AC044CAA	AC045CAA	AC046CAA

Logging Operation Notes:

Spectral gamma logging was performed in this borehole during September 2002 (SGLS) and October and November 2002 (HRLS). Logging was conducted without a centralizer on the sonde because the borehole diameter was too small. Logging measurements are referenced to the top of the 6-in. casing. A repeat section was collected in this borehole with the SGLS (log run 5).

Analysis Notes:

Analyst:	Henwood	Date:	12/18/02	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications of the SGLS were performed for each day's log event. The efficiency (peak counts per second) of the logging system was consistently lower each day in the post-run verification as compared to the pre-run verification. This change generally was in the range of 6 to 10 percent. The acceptance criteria were passed except for the post-run verification for log run 1 acquired September 4 that failed the acceptance criteria control limits for the peak counts per second at the 1461-, 609-, and 2615-keV energy levels. Verification measurements for the HRLS passed acceptance criteria. The post-run verification files were used for the energy and resolution calibration necessary to process the data except for the log run 1 post-verification (noted above) where the pre-run verification data were used.

Casing corrections for 0.3125-in. and 0.25-in.-thick casings were applied for the 6-in. and 4-in. steel casings, respectively. These values are within the error of the field measurements collected to estimate casing size. Where more than one casing exists at a depth the casing correction is additive (e.g., a 6-in. and 4-in. casing would be the correction for $0.3125 + 0.25 = 0.5625$).

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1dcalc4.xls and G1cFeb02.xls for the SGLS and HRLS, respectively, using an efficiency function and corrections for casing and dead time as appropriate. Where SGLS dead time is greater than about 40 percent, pulse pileup and peak spreading effects tend to result in underestimation of peak count rates. HRLS data are substituted in these situations. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations rather than the ^{214}Bi peak at 609 keV. The higher energy 1764-keV energy peak exhibits slightly better count rates than the 609-keV peak because of less gamma attenuation caused by the dual casings in this borehole.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs , ^{154}Eu , and ^{60}Co) detected in the borehole, naturally occurring radionuclides (^{40}K , ^{238}U , ^{232}Th [KUT]), a combination of man-made, KUT, and dead time, total gamma plotted with dead time, and an SGLS repeat section. In addition, a comparison log plot of man-made radionuclides is provided that compares data collected with the Westinghouse Hanford Company Radionuclide Logging System (RLS) with SGLS and HRLS data. This plot is included to assess the possibility of contaminant movement in the vadose zone. 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. The SGLS total gamma plots are not reliable over much of this borehole because of high dead time and detector saturation. The HRLS has a much lower detection efficiency, and total gamma values from the HRLS cannot be directly compared to the SGLS.

Results and Interpretations:

^{137}Cs , ^{154}Eu , and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected continuously throughout the borehole at levels that range from about 1 pCi/g to 7,000,000 pCi/g. Concentrations exceeded 1,000 pCi/g between 7 and 205 ft. The highest concentrations (exceeding 1,000,000 pCi/g) occurred between 21 and 42 ft. ^{154}Eu was detected between 49 and 60 ft in depth at a concentration of about 10 pCi/g. ^{60}Co was detected between 169 and 174 ft and between 203 ft and the total depth of the borehole at 235 ft. The maximum ^{60}Co concentration is 10 pCi/g at 230 ft.

The engineer's log included in Ledgerwood (1993) contains readings collected on sediment samples that show the sediments between 14.5 and 62 ft were contaminated at the time of drilling. Below these depths, no contaminated sediments were reported except between 115 and 125 ft. The validity of the engineer's log may be questionable, such that, low-level contamination may not have been observed with the instruments and methods used at the time.

The KUT concentrations could not be measured in most of the borehole because of the high gamma flux. Where the concentrations could be measured below 205 ft in a relatively lower zone of gamma flux, no lithologic features could be discerned.

A comparison log plot of data collected in 1991 by the RLS and in 2002 with the SGLS and the HRLS is included. The RLS concentration data (¹³⁷Cs and ⁶⁰Co) were decayed to September 2002, the date of the SGLS logging event; HRLS data were collected 2 months later in November 2002. The comparison between the logging systems suggests no changes in the contaminant profile that would indicate possible contaminant movement. However, there are no RLS data available below 188 ft that can be used for comparison.

A repeat section of SGLS data shows good repeatability for depth and radionuclide concentrations.

References:

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

¹ GWL – groundwater level

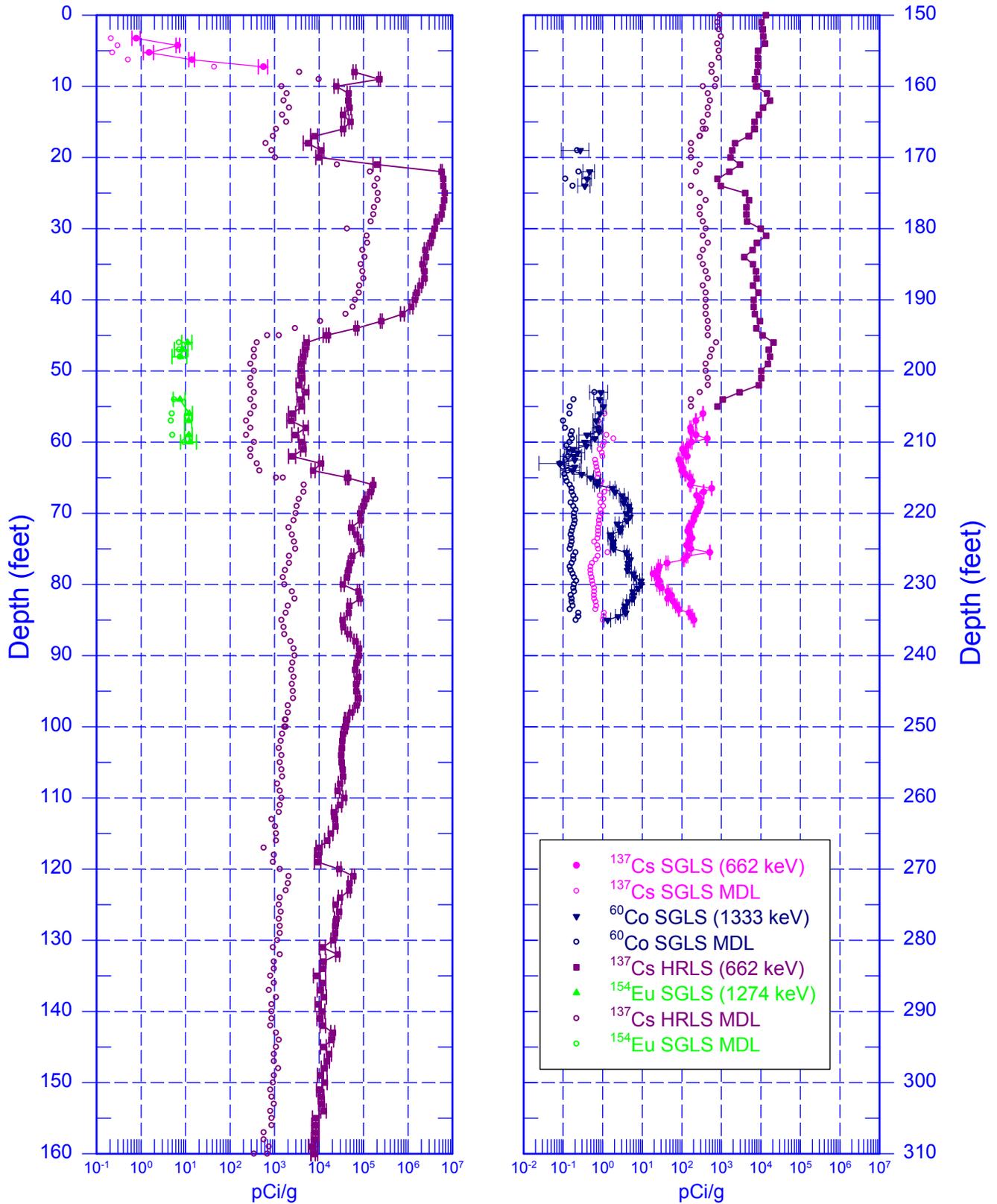
² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ n/a – not applicable

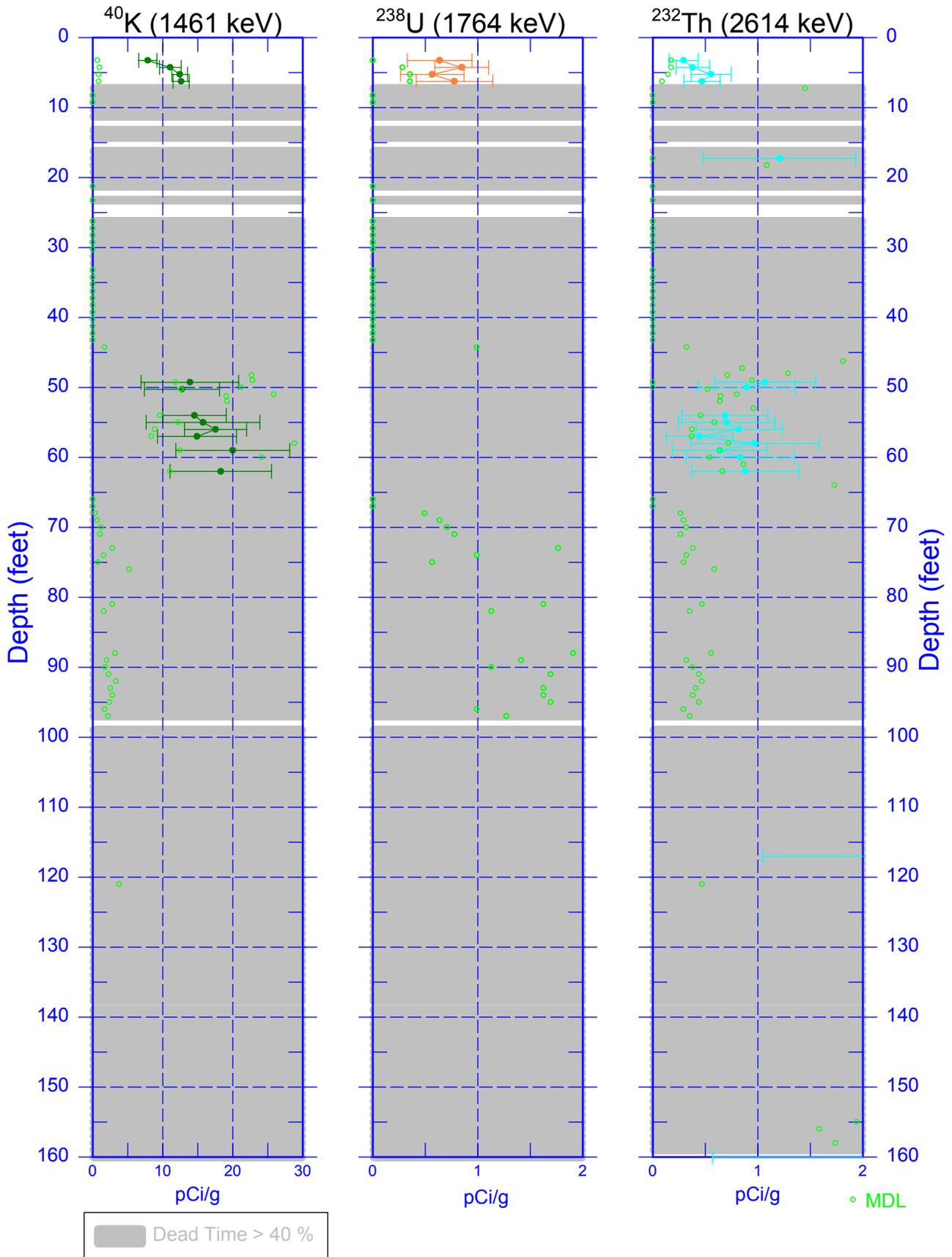
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Man-Made Radionuclide Concentrations



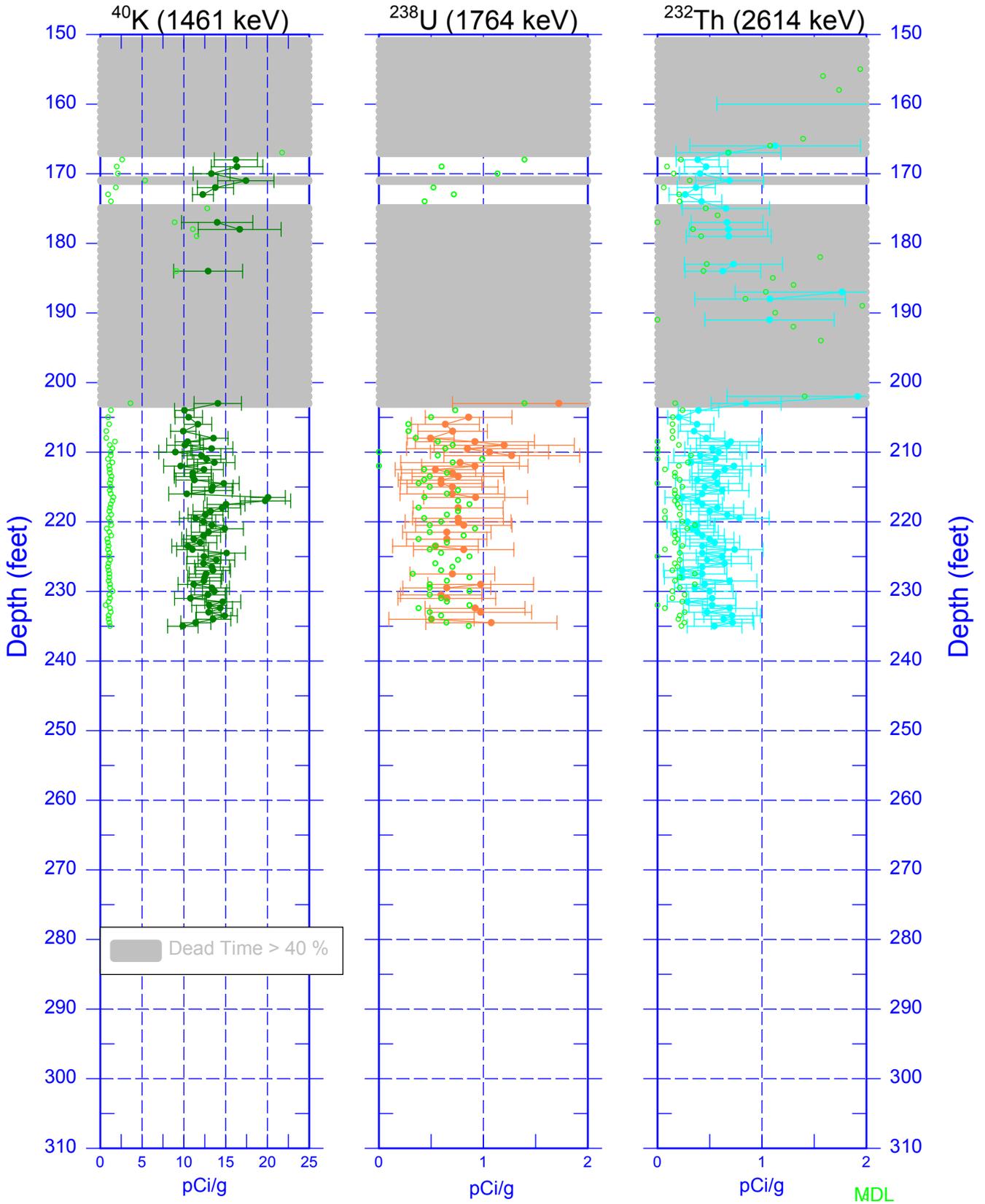
299-E33-22 (A6856)

Natural Gamma Logs

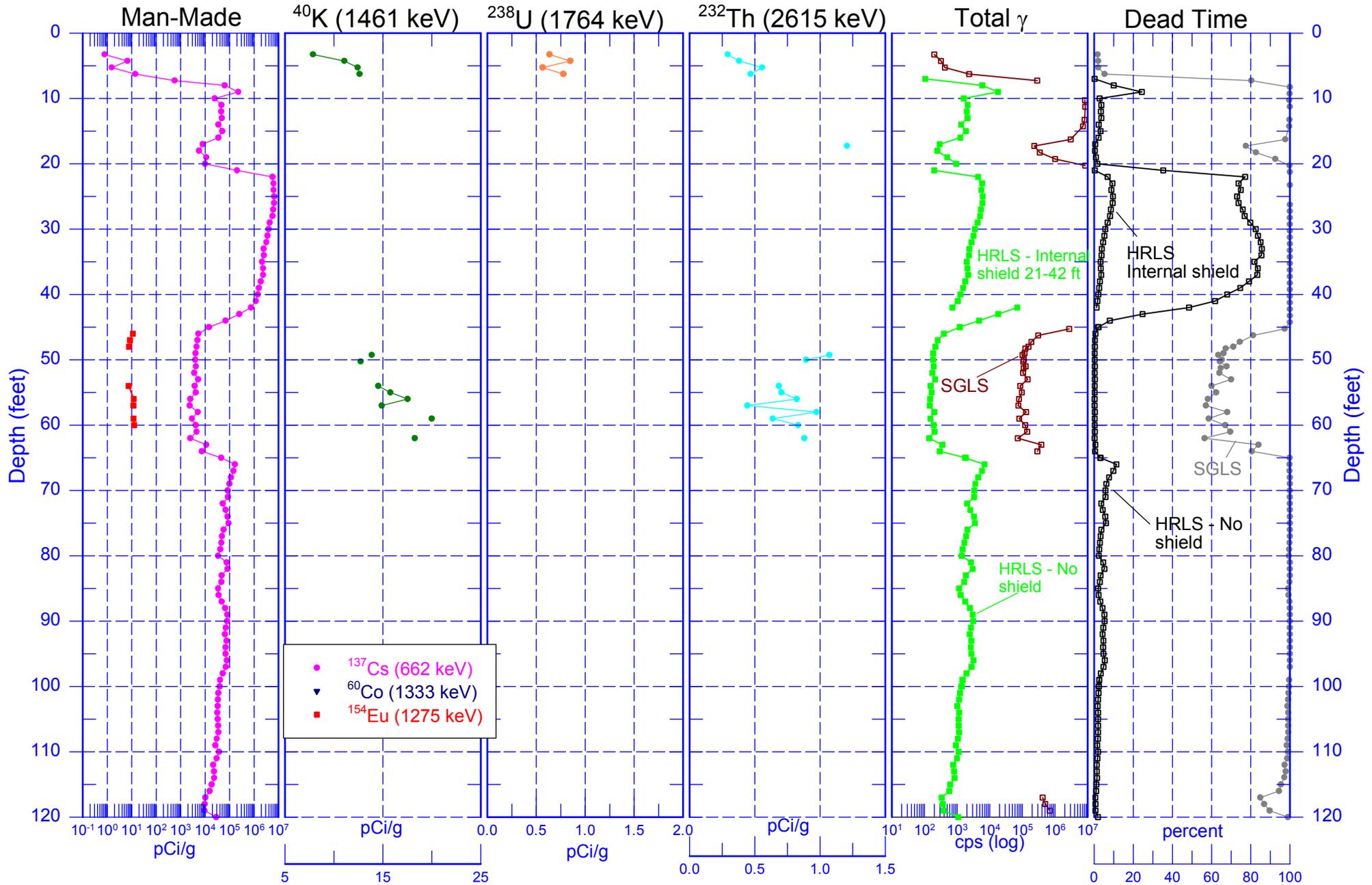


299-E33-22 (continued)

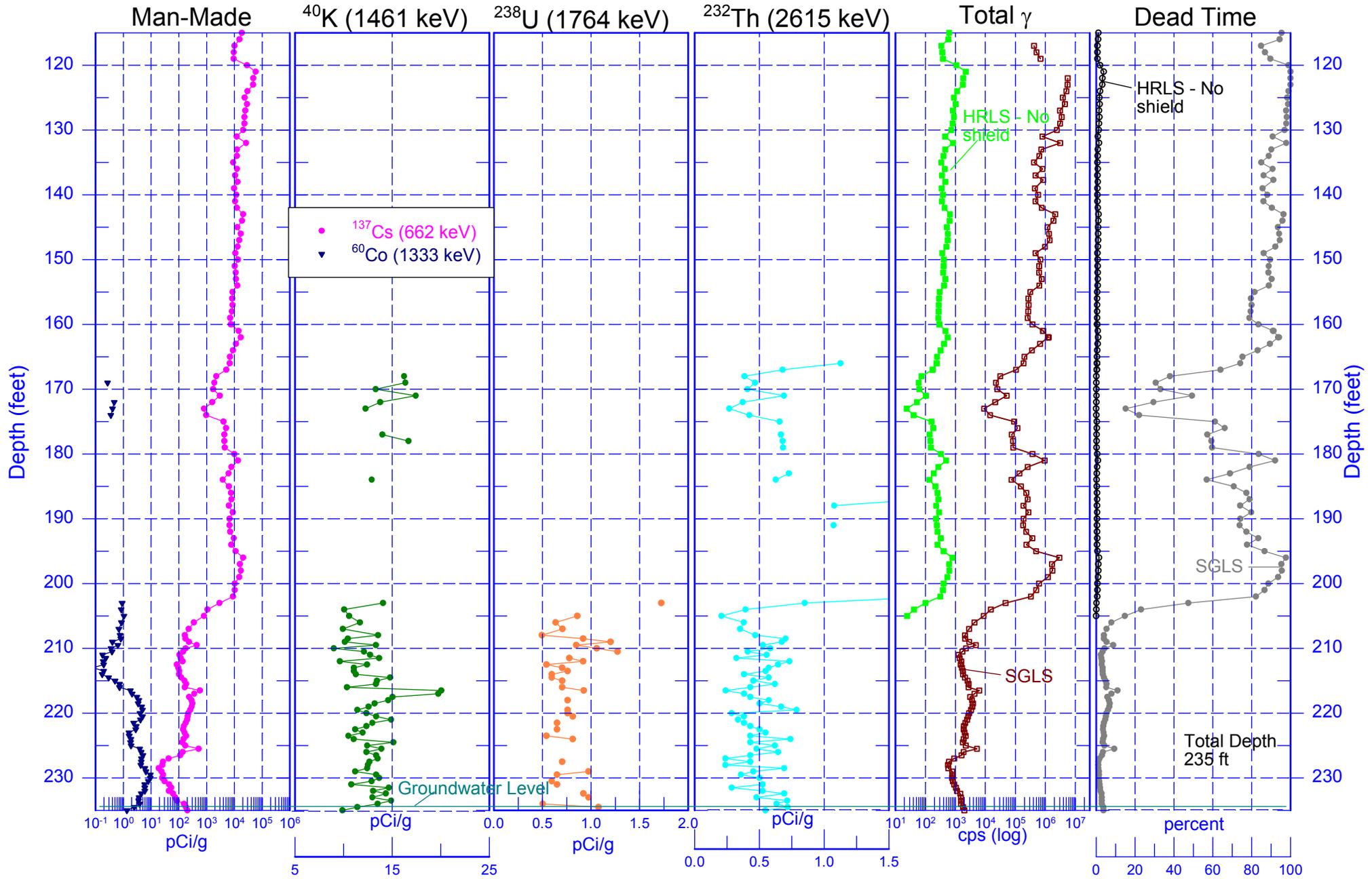
Natural Gamma Logs



299-E33-22 (A6856) Combination Plot

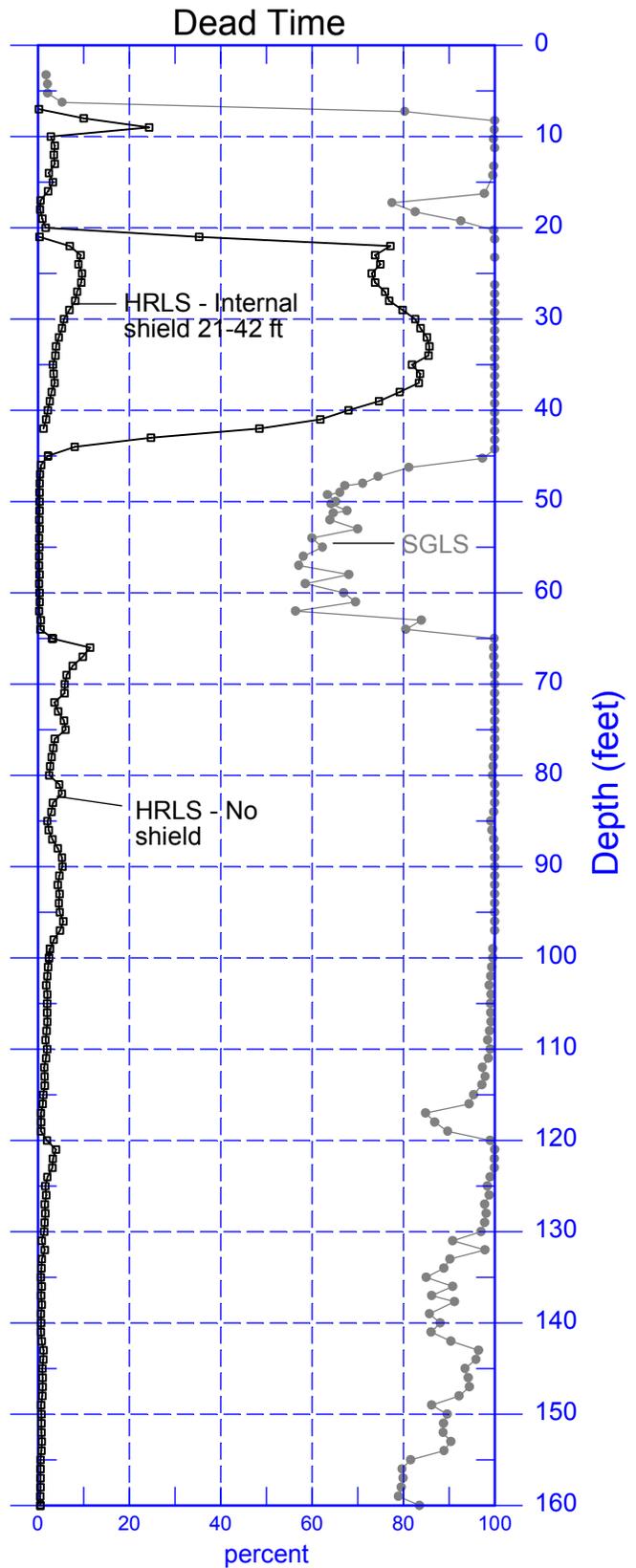
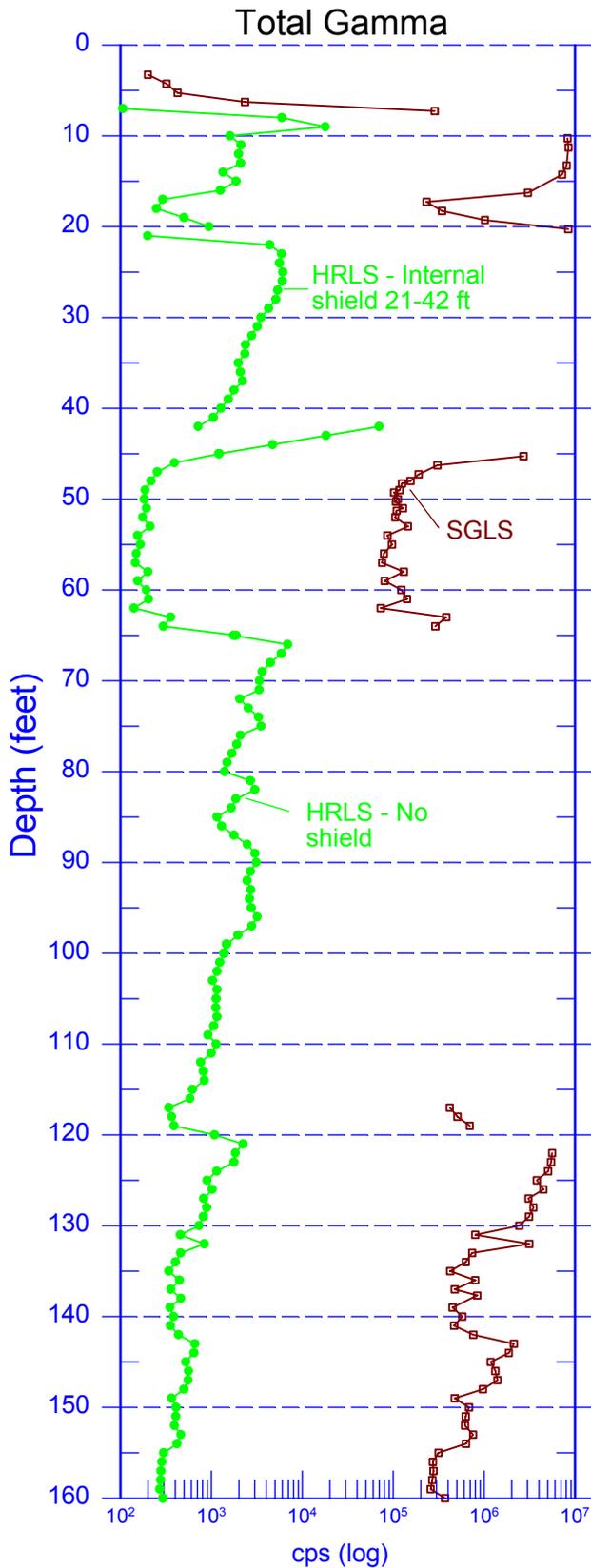


299-E33-22 (A6856) Combination Plot



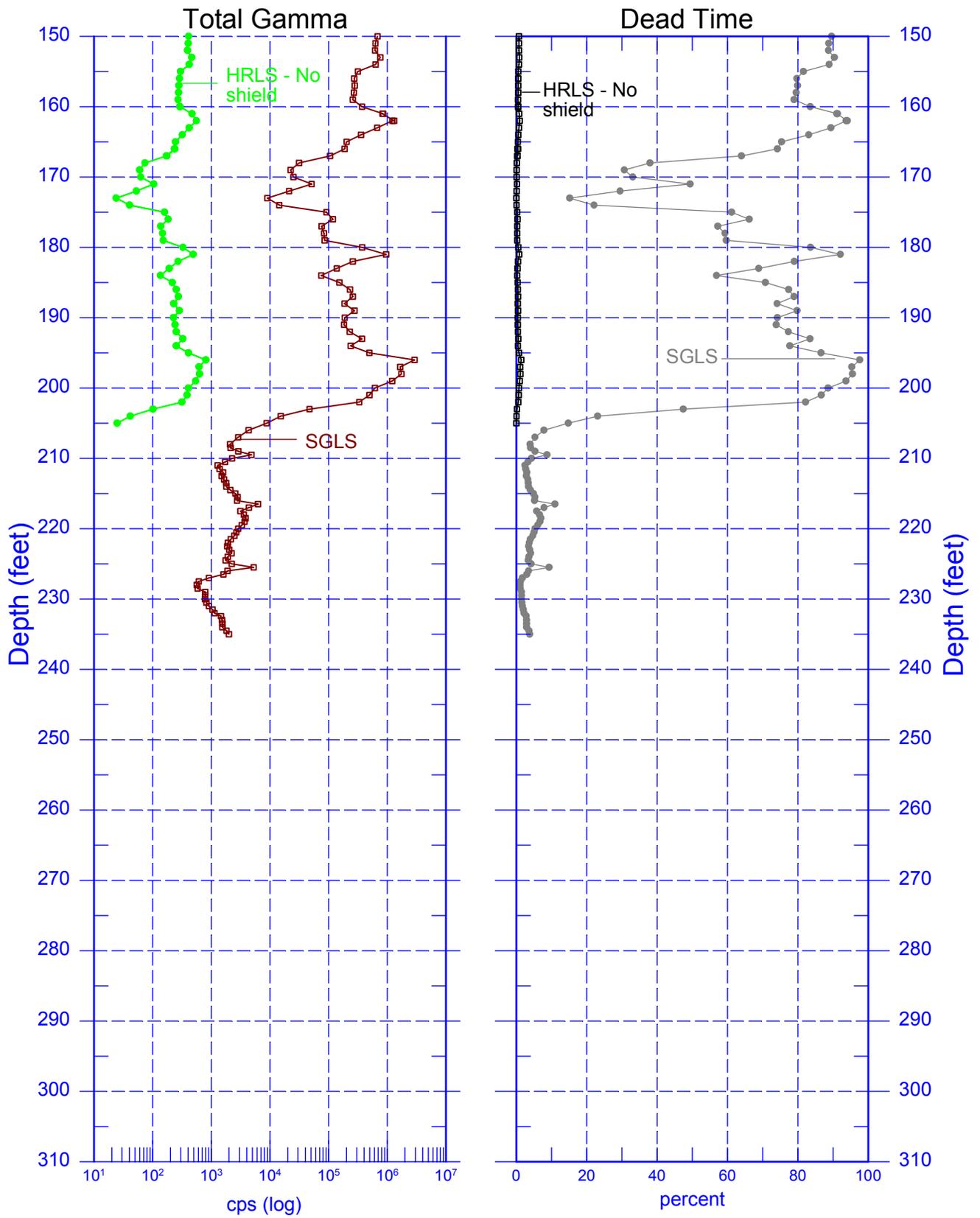
299-E33-22 (A6856)

Total Gamma & Dead Time

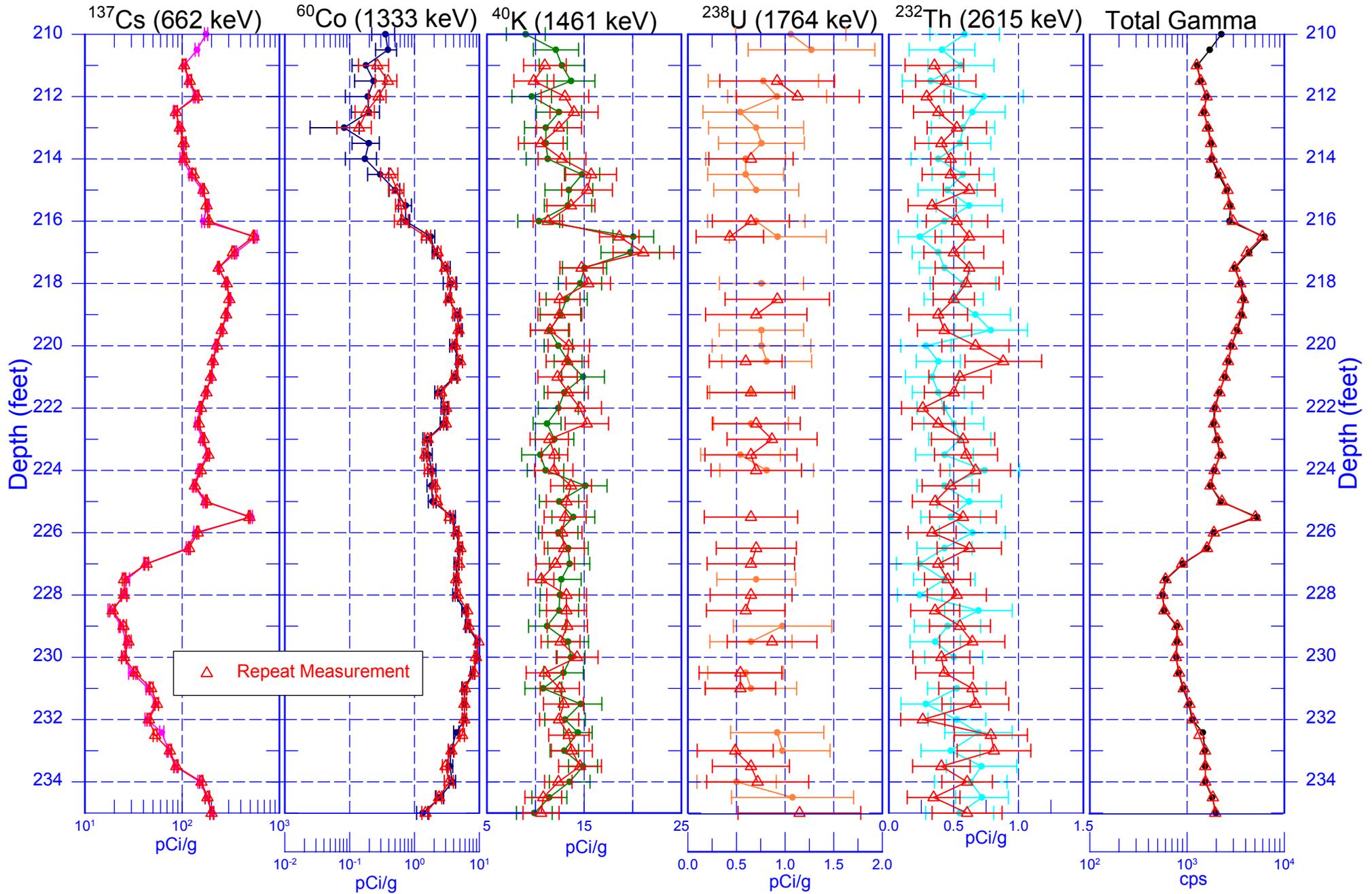


299-E33-22 (A6856)

Total Gamma & Dead Time

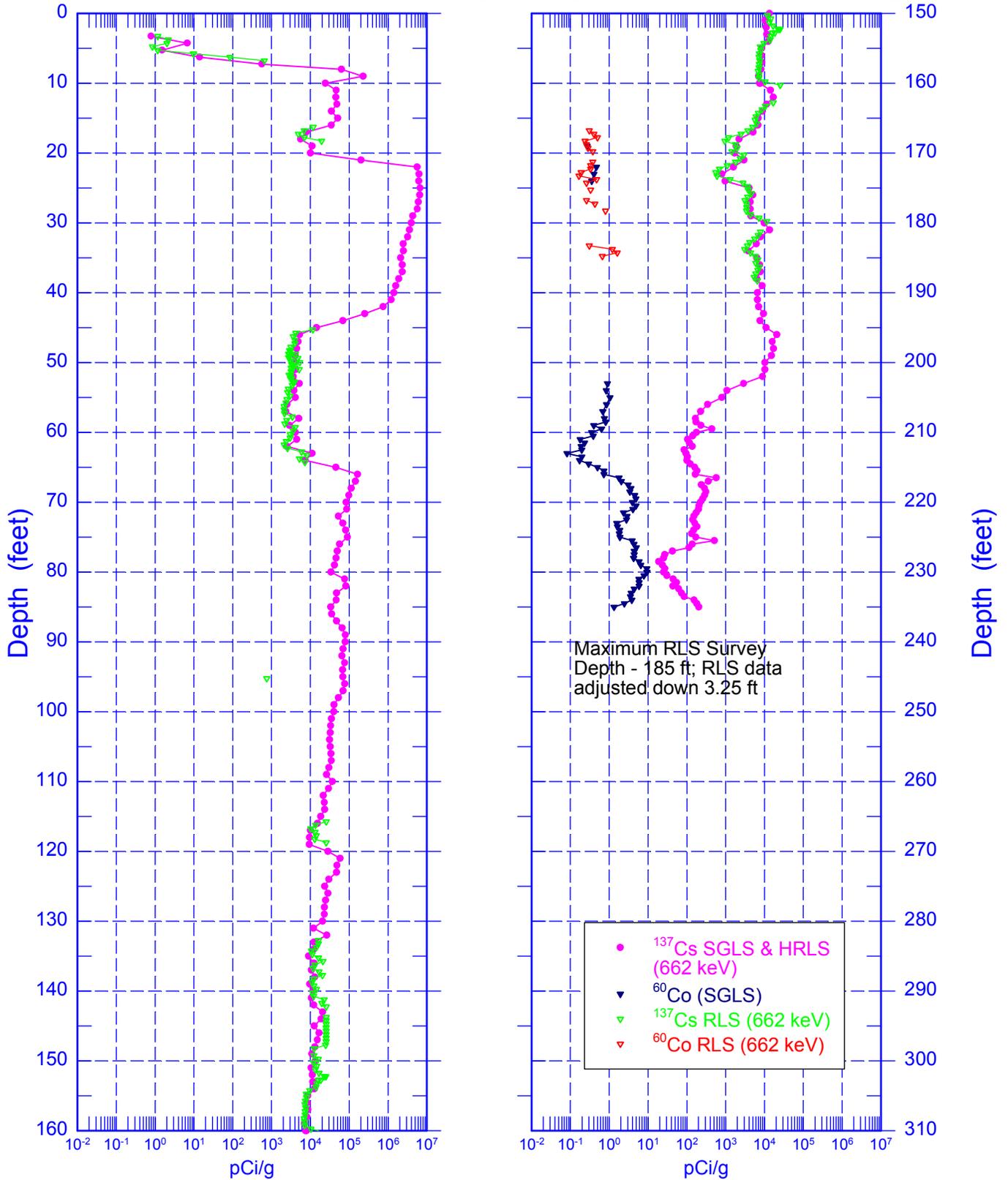


299-E33-22 (A6856) Repeat Section



299-E33-22 (A6856)

RLS (1991) and SGLS (2002) Comparison Logs



All concentrations decayed to 09/09/02