

299-W11-54 (A7296) Log Data Report

Borehole Information:

Borehole: 299-W11-54 (A7296)		Site: 216-T-6 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: Not deep enough		GWL Date: 1/30/2003	
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
136,661.79 m	567,193.58 m	May 1947	218.151 m	155.33	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	3.25	8 5/8	7 15/16	0.343	+3.25	150
The logging engineer measured the casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS³, and Chamness and Merz (1993). Zero reference is the top of the 8-in. casing. A reference point survey "X" is located at the top of the casing stickup.

Logging Equipment Information:

Logging System: Gamma 2A	Type: SGLS (35%)
Calibration Date: 9/2002	Calibration Reference: GJO-2002-383-TAC
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Logging System: Gamma 1C	Type: High Rate Detector
Calibration Date: 04/2003	Calibration Reference: GJO-2003-429-TAC
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4/Repeat
Date	2/10/03	2/11/03	2/12/03	2/12/03
Logging Engineer	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	46.0	154.0	84.0	75.0
Finish Depth (ft)	4.0	83.0	45.0	60.0
Count Time (sec)	200	200	200	200
Live/Real	R	R	R	R
Shield (Y/N)	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0

Log Run	1	2	3	4/Repeat	
ft/min	N/A ⁴	N/A	N/A	N/A	
Pre-Verification	BA197CAB	BA199CAB	BA200CAB	BA200CAB	
Start File	BA198000	BA199000	BA200000	BA200040	
Finish File	BA198042	BA199071	BA200039	BA200055	
Post-Verification	BA198CAA	BA199CAA	BA201CAA	BA201CAA	
Depth Return Error (in.)	0	0	N/A	0	
Comments	Fine-gain adjustment made after file -024.	No fine-gain adjustment.	Fine-gain adjustment made after files -000, -007, and -010.	No fine-gain adjustment.	

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2/Repeat			
Date	06/10/03	06/10/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	42.0	37.0			
Finish Depth (ft)	27.0	34.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	AC074CAB	AC074CAB			
Start File	AC075000	AC0750016			
Finish File	AC075015	AC075019			
Post-Verification	AC075CAA	AC075CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine-gain adjustment.				

Logging Operation Notes:

Zero reference was top of the 8-in. casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 082. Pre- and post-survey verification measurements were acquired for the HRLS in the Cs-137 verifier SN 1013. During SGLS logging, fine-gain adjustments were needed. Before SGLS logging began on 2/11/03, the sonde was run down to total depth then back to the ground surface one time in an attempt to displace any radon gas.

Analysis Notes:

Analyst:	Sobczyk	Date:	06/16/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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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 established on 12/05/2002. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as

compared to the pre-run verification spectra for each day were between 2 percent lower and 1 percent higher at the end of the day.

HRLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The spectra were within the acceptance criteria for the field verification of the Gamma 1C logging system (HRLS).

Log spectra for both the SGLS and HRLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source files: G2AFeb03.xls and G1CApr03.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 8-in. casing. On the basis of Chamness and Merz (1993), the casing configuration was assumed to be one string of 8-in. casing to the maximum depth of the logging (154 ft). The casing correction factor was calculated assuming a casing thickness of 0.343 in. This casing thickness is based upon the field measurement. A water correction was not required.

Using the SGLS, dead time greater than 40 percent was encountered in the interval from 28 to 41 ft. Data from this region were considered unreliable. At SGLS dead time greater than 40 percent, peak spreading and pulse pile-up effects may result in underestimation of activities. This effect is not entirely corrected by the dead time correction, and the extent of error increases with increasing dead time. SGLS dead time corrections were applied when dead time reached 10.5 percent. The HRLS was utilized to obtain data where the SGLS dead time exceeded 40 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plot of man-made radionuclides is provided to compare the data collected in 1993 and 1995 by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. 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}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and processed ^{238}U were the only man-made radionuclides detected in this borehole. ^{137}Cs was detected from the ground surface to a log depth of 70 ft. The range of concentrations was from the MDL (0.2 pCi/g) to 9,600 pCi/g, which was measured at 34 ft. ^{137}Cs was also detected near the MDL intermittently from 71 ft to total depth (154 ft). ^{238}U was detected at 45 ft with a concentration of 34 pCi/g. The MDL for ^{238}U was 16 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. Changes of 4 pCi/g or more in apparent ^{40}K concentrations occur at approximately 89, 122, 129, 140, and 144 ft. Between 105 and 122 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 (75 cps) and ^{232}Th (0.5 pCi/g). There is about an 8-pCi/g decrease in ^{40}K concentrations in the intervals between 122 through 129 ft and 140 through 144 ft. ^{238}U increases by approximately 2 pCi/g in the interval between 140 and 144 ft. On the basis of low ^{40}K concentrations, the carbonate-rich paleosols of the Cold Creek Unit are interpreted as being in the intervals between 122 and 129 ft and 140 and 144 ft. The caliche layer, characterized by high uranium content (greater than

2.0 pCi/g), is present between 140 and 144 ft. ²³²Th decreases by approximately 0.3 pCi/g in the interval between 140 and 149 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for ¹³⁷Cs (662 keV) and natural radionuclides (609, 1461, 1764, and 2614 keV). The ²³²Th concentration based on 2614-keV photopeak does not repeat at 61 ft.

Gross gamma logs from Fecht et al. (1977) (attached) indicate that the sediments surrounding this borehole contained significant amounts of man-made gamma radiation from 1958 through at least 1976. The logs from 2/26/58, 4/26/63, and 5/6/76 appear to detect relatively high gamma activity in the interval from the ground surface to 56 ft (17 m). The SGLS detected ¹³⁷Cs from the surface through 70 ft.

Comparison log plots of data collected in 1993 and 1995 by Westinghouse Hanford Company (WHC) and in 2003 by Stoller are included. The WHC concentration data for ¹³⁷Cs are decayed to the date of the SGLS logging event in February 2003. Comparison of the ¹³⁷Cs concentrations indicates that the RLS data appear to overestimate the radionuclide concentrations in the interval between 29 and 40 ft. ¹³⁷Cs concentrations as measured by the RLS are higher than that predicted when compared to the 2003 log in the high-activity zone. A casing thickness of 0.322 in. was used to estimate the ¹³⁷Cs concentrations based on the 1993 RLS data, versus 0.313 in. for the 1995 RLS data and 0.343 in. for the 2003 SGLS and HRLS data. Since 1993, ¹³⁷Cs activities in the interval between 29 and 40 ft may have decreased more rapidly than is predicted by radioactive decay alone. Differences in apparent ¹³⁷Cs concentrations in the high rate zone may occur, because these concentrations are at the limit of the RLS's range.

Because of the possibility that movement of ¹³⁷Cs has occurred in the vadose zone, it is recommended that this borehole is logged periodically to verify that the change observed in the contaminant profile over the last 10 years has occurred. The interval from ground surface to total depth should be logged again in 5 years.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

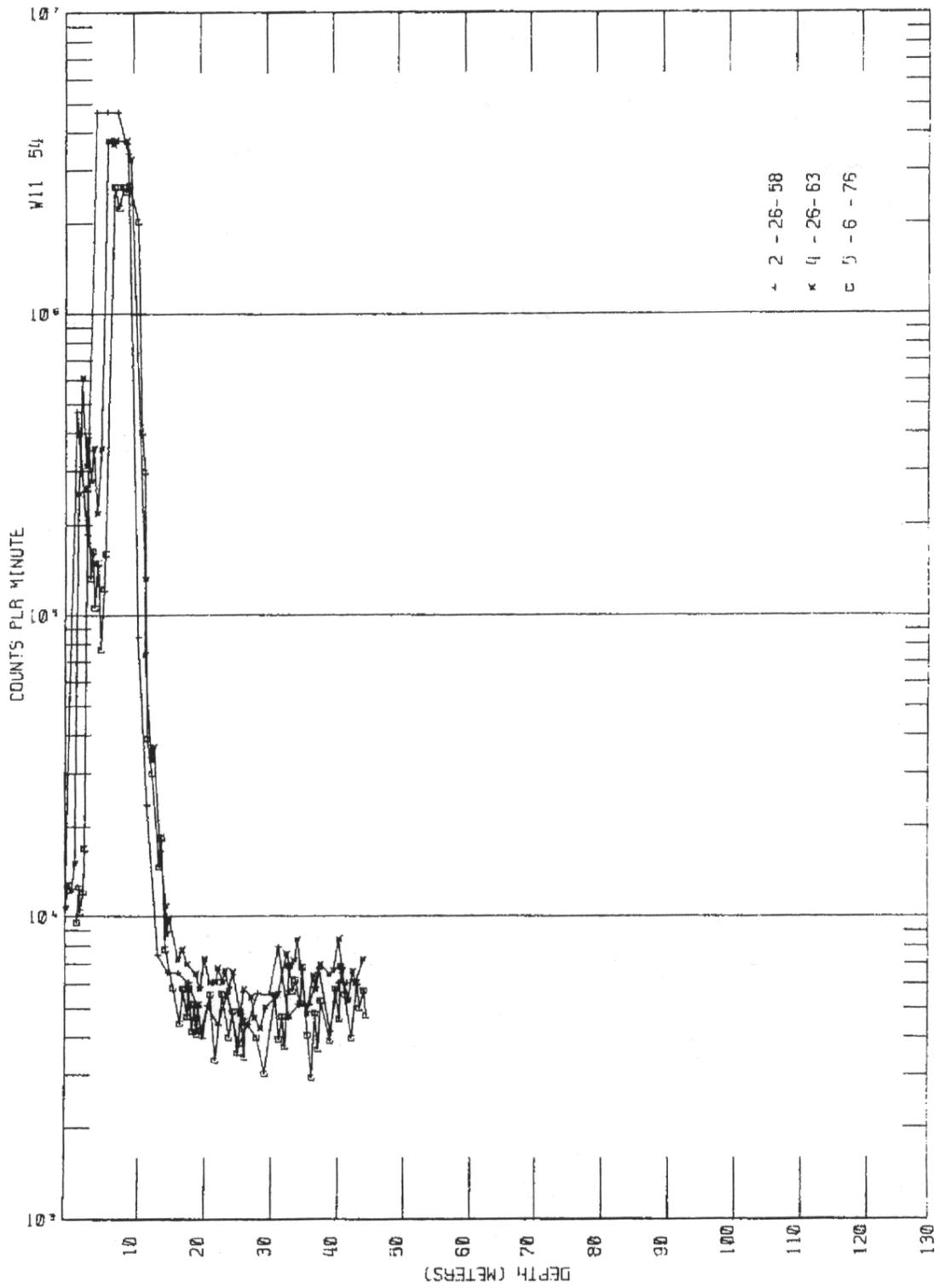
Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

¹ GWL – groundwater level

² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

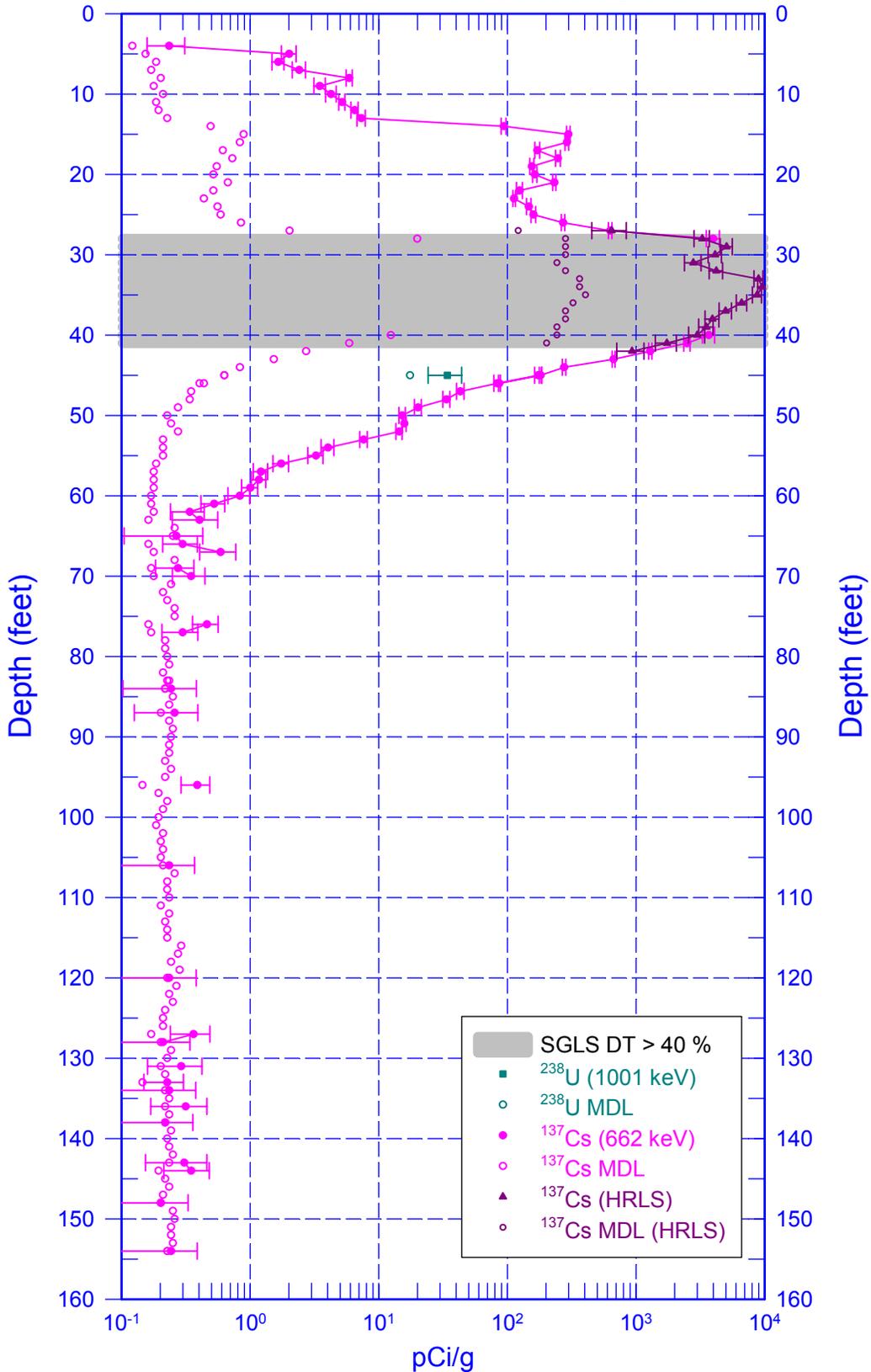


from Fecht et al. (1977)

Scintillation Probe Profiles for Borehole 299-W11-54, Logged on 2/26/58, 4/26/63, and 5/6/76

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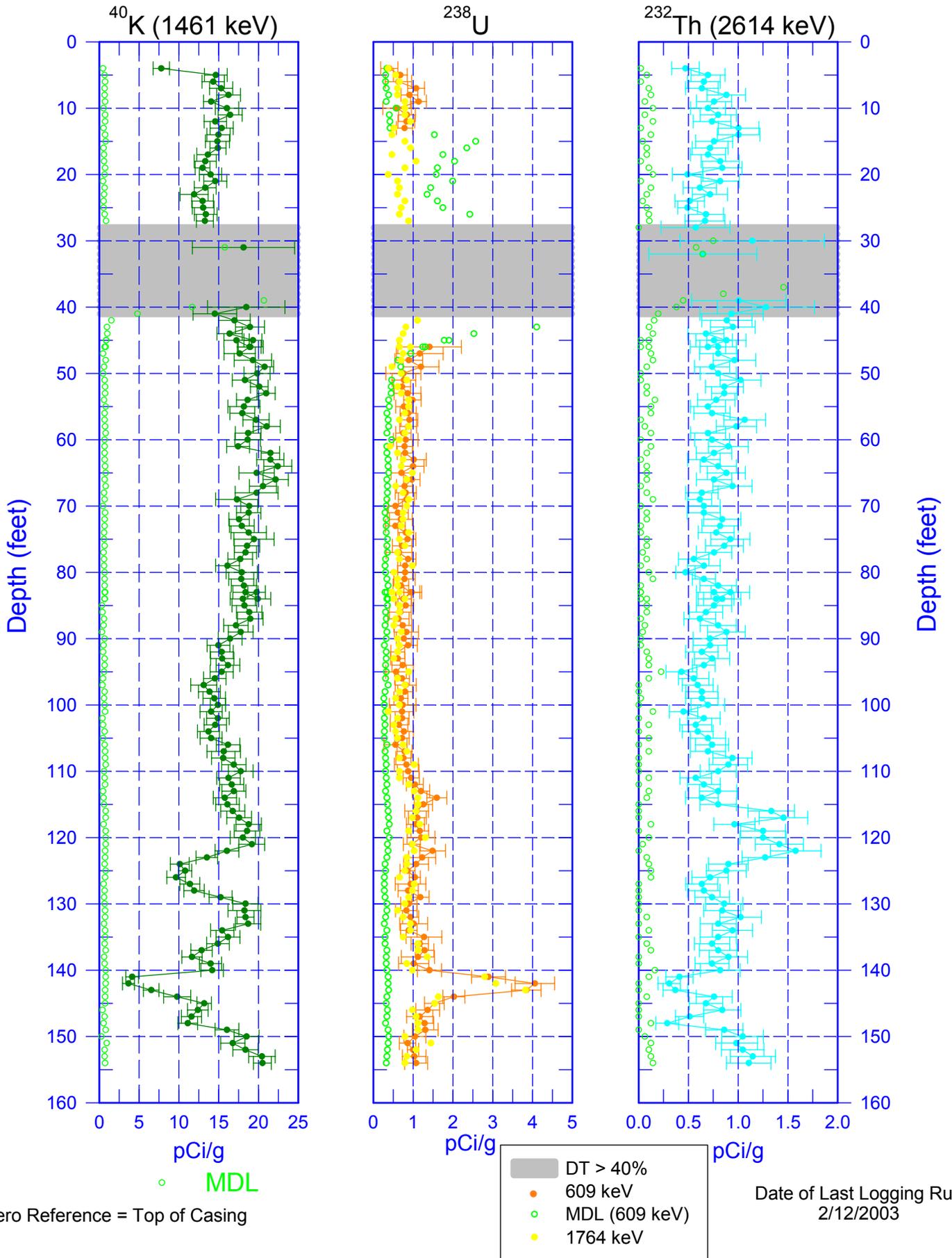
Man-Made Radionuclides



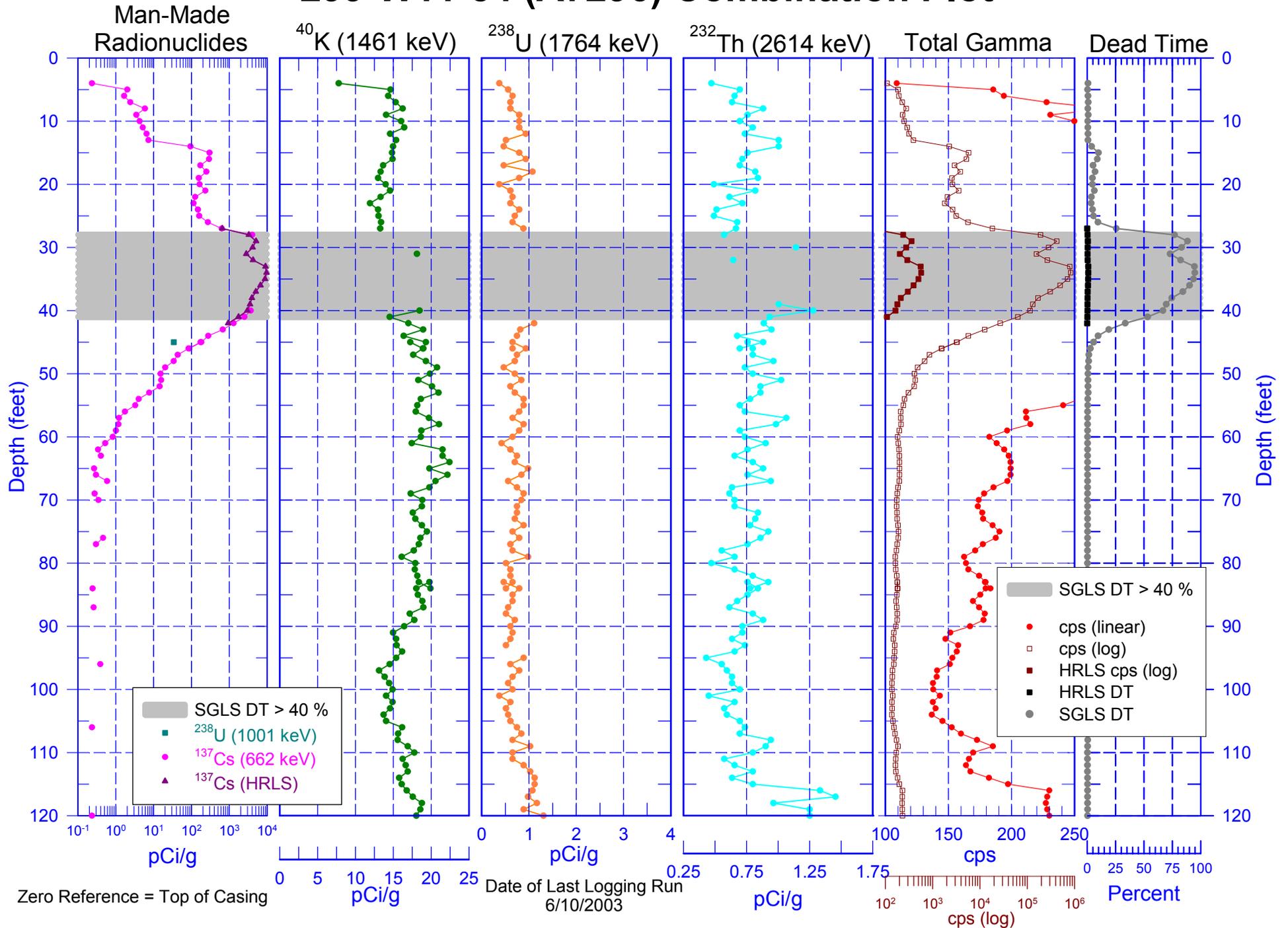
Zero Reference = Top of Casing

Date of Last Logging Run
6/10/2003

299-W11-54 (A7296) Natural Gamma Logs

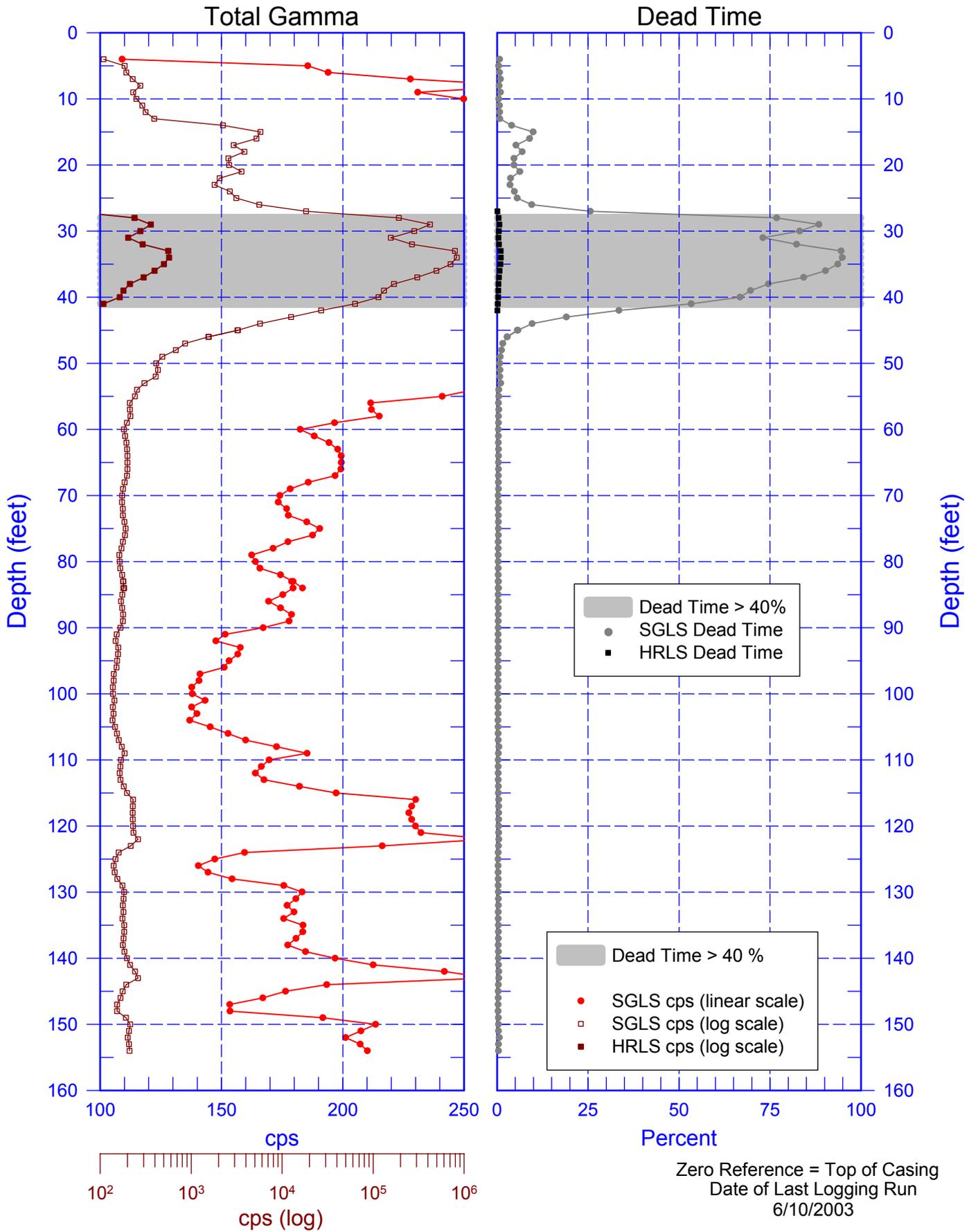


299-W11-54 (A7296) Combination Plot



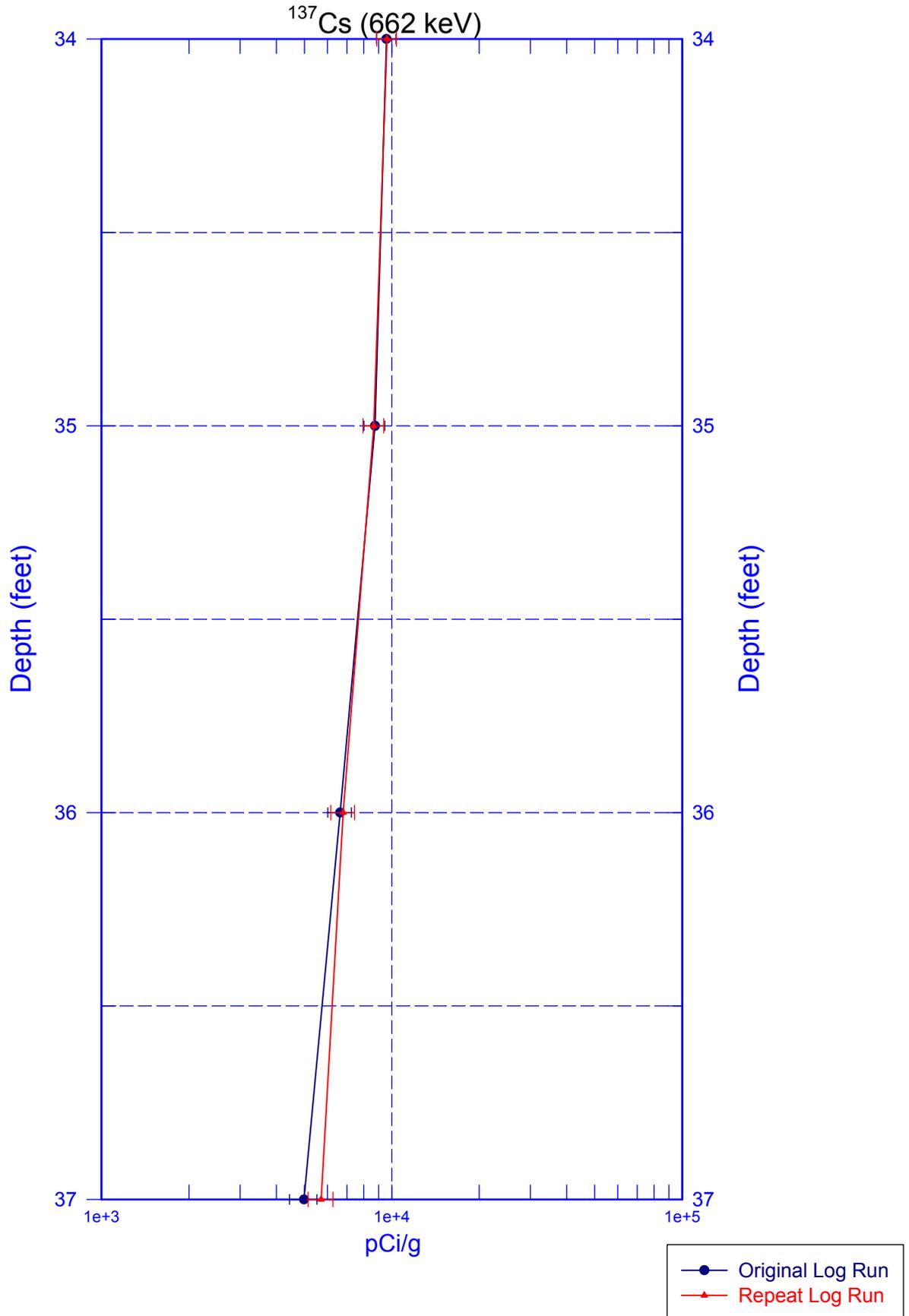
299-W11-54 (A7296)

Total Gamma & Dead Time



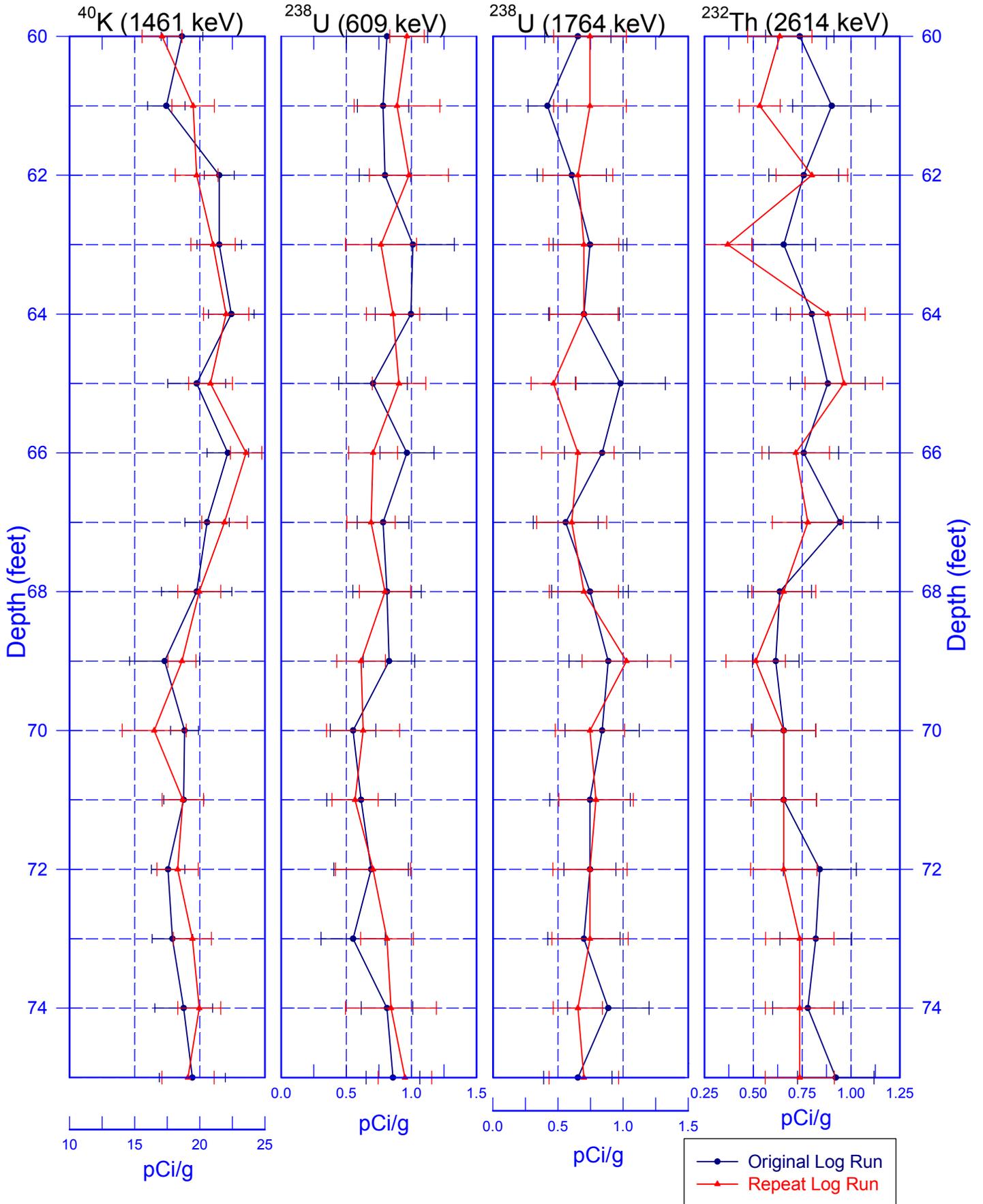
299-W11-54 (A7296)

Rerun of Man-Made Radionuclides (37.0 to 34.0 ft)



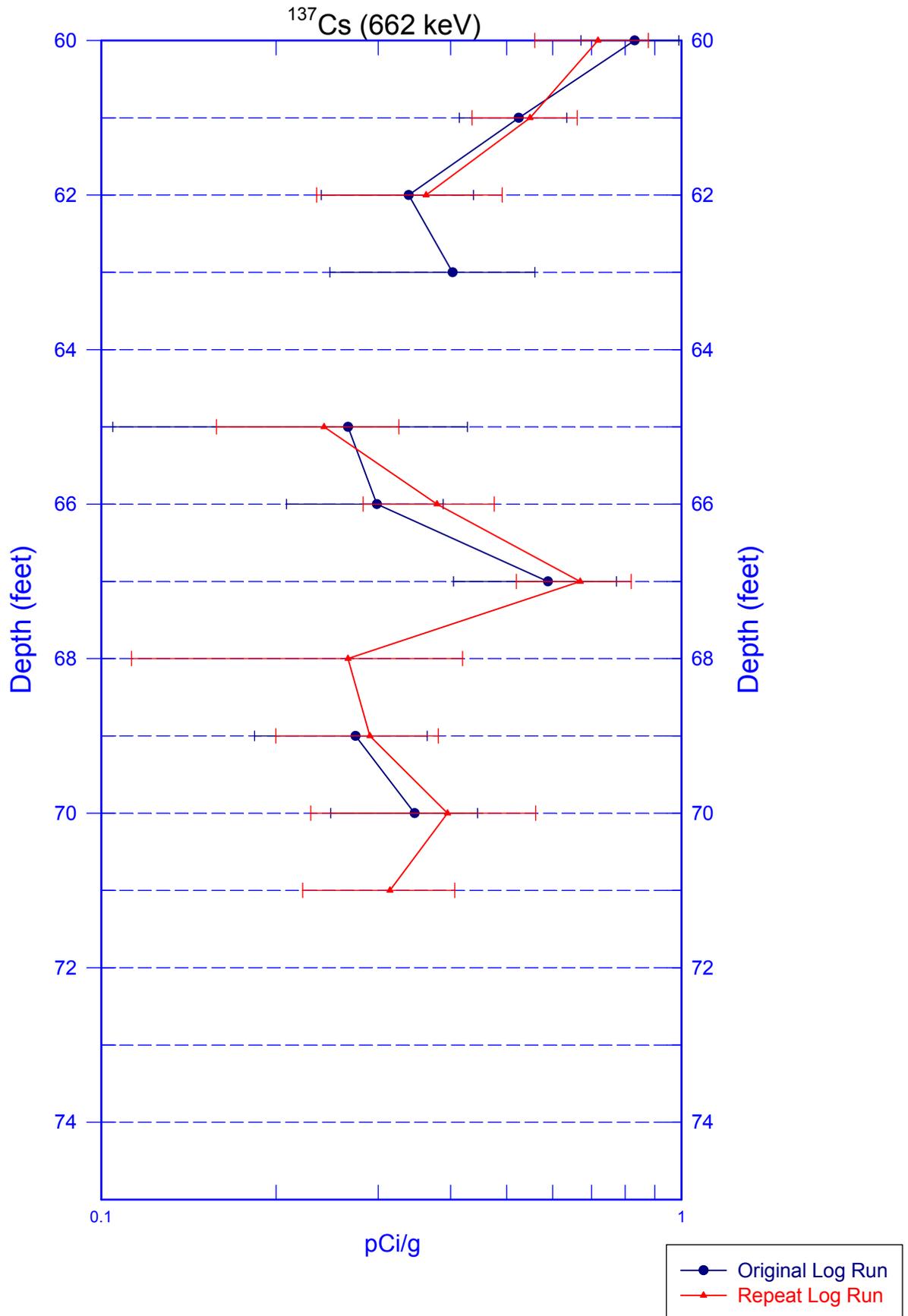
299-W11-54 (A7296)

Rerun of Natural Gamma Logs (75.0 to 60.0 ft)



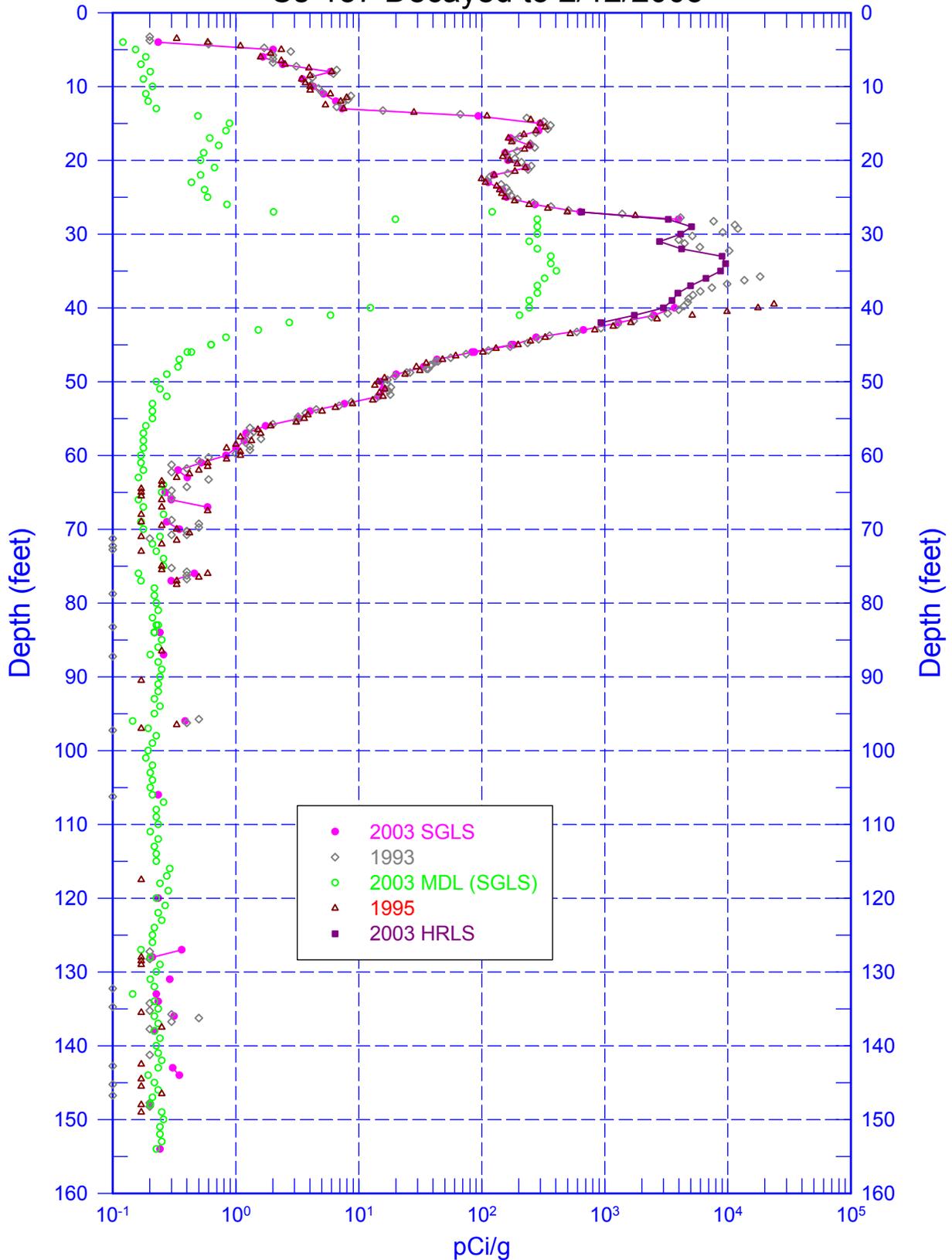
299-W11-54 (A7296)

Rerun of Man-Made Radionuclides (75.0 to 60.0 ft)



299-W11-54 (A7296)

RLS Data Compared to SGLS Data
Cs-137 Decayed to 2/12/2003



Zero Reference = Top of Casing (2003 SGLS & 1995 RLS)
1993 RLS shifted +3.25 ft to align with the SGLS