

299-W11-67 (A7309) Log Data Report

Borehole Information:

Borehole: 299-W11-67 (A7309)		Site: 216-T-6 Crib			
Coordinates (WA State Plane)		GWL (ft): Not deep enough		GWL Date: 1/09/2003	
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
136,643.12 m	567,220.72 m	August 1951	216.69 m	75.6	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	0.83	8 5/8	7 15/16	.344	+0.83	75
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). The logging engineer measured the depth-to-bottom. Zero reference is the top of the 8-in. casing. Top of casing is cut evenly. Reference point survey "X"s are located on top and bottom of the casing stickup.

The borehole was swabbed before logging began, and an indication of radon gas was found. Elevated activity was detected on the swab, but after 30 minutes, the activity had diminished.

Logging Equipment Information:

Logging System: Gamma 1D	Type: SGLS (35%)
Calibration Date: 9/2002	Calibration Reference: GJO-2002-385-TAC
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat			
Date	1/09/03	1/10/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	75.0	39.0			
Finish Depth (ft)	1.0	29.0			
Count Time (sec)	200	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			

Log Run	1	2/Repeat			
ft/min	N/A ⁴	N/A			
Pre-Verification	AD041CAB	AD042CAB			
Start File	AD041000	AD042000			
Finish File	AD041074	AD042010			
Post-Verification	AD041CAA	AD043CAA			
Depth Return Error (in.)	-1.5	0			
Comments	No fine-gain adjustment.	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 118. During SGLS logging, fine-gain adjustments were not needed to maintain the 1460-keV (⁴⁰K) photopeak at a pre-described channel. Each day before logging began, the sonde was run up and down the borehole one time to displace any radon gas if present.

Analysis Notes:

Analyst:	Sobczyk	Date:	01/10/03	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. The post-run verification spectra were all within the control limits that were established on 12/05/2002. Pre-run verification spectrum AD041CAB was above the upper control limits for the 609-keV and 1461-keV full-width at half-maximum values. Pre-run verification spectrum AD042CAB was outside five of six control limits. The value for the 1461 counts per second (cps) was within the acceptable range. The peak counts per second 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 5 and 14 percent lower at the end of each day. Examinations of spectra indicate that the detector functioned normally (i.e. decreasing efficiency throughout the day's logging) during all of the logging runs, and the spectra are provisionally accepted.

Log spectra for the SGLS 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 file: G1DSept02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 8-in. casing. On the basis of information from Chamness and Merz (1993), the casing configuration was assumed to be one string of 8-in. casing to total depth (75 ft). The casing correction factor was calculated assuming a casing thickness of 0.344 in. This casing thickness is based upon the field measurement. A water correction was not needed or applied to the data. Dead time corrections are required when dead time exceeds 10.5 percent. As the dead time did not exceed 10.5 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (⁴⁰K, ²³⁸U, and ²³²Th), 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 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 is less affected by the presence of radon gas inside the casing.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface (1 to 2 ft) with a maximum concentration of 1.7 pCi/g.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi , under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn . When radon is present, ^{214}Bi will tend to “plate” onto the casing wall and will quickly reach equilibrium with ^{222}Rn . Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609-keV photopeak relative to the 1764-keV photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) The effects of radon appear to be small in log run 1. The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb . This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609-keV photopeak between run 1 and the repeat section (run 2).

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.

In the repeat log, the SGLS showed good repeatability except for the 609-keV photopeak. The repeat log run (log run 2) was run the day after the original log run. The ^{238}U values based on 609 keV are consistently lower on the repeat log than on the original log. This variation is attributed to the effects of radon. The ^{40}K , ^{232}Th , and ^{238}U (1764 keV) concentrations agree well.

Recognizable changes in the KUT logs occurred in this borehole. Changes of about 4 pCi/g in apparent ^{40}K activities occur at about 11 and 38 ft. The increase in ^{40}K activities at about 38 ft may represent the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. About a 1/4-pCi/g increase in ^{232}Th concentrations occurs at 38 ft, which also corresponds with the H1 to H2 interface. Elevated KUT concentrations occur between 58 and 63 ft.

Comparison log plots of data collected in 1995 by Westinghouse Hanford Company and in 2003 by Stoller are included. The 1995 concentration data for ^{137}Cs are decayed to the date of the SGLS logging event in January 2003. Since 1995, ^{137}Cs activities appear to have decreased as predicted by radioactive decay.

References:

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

¹ GWL – groundwater level

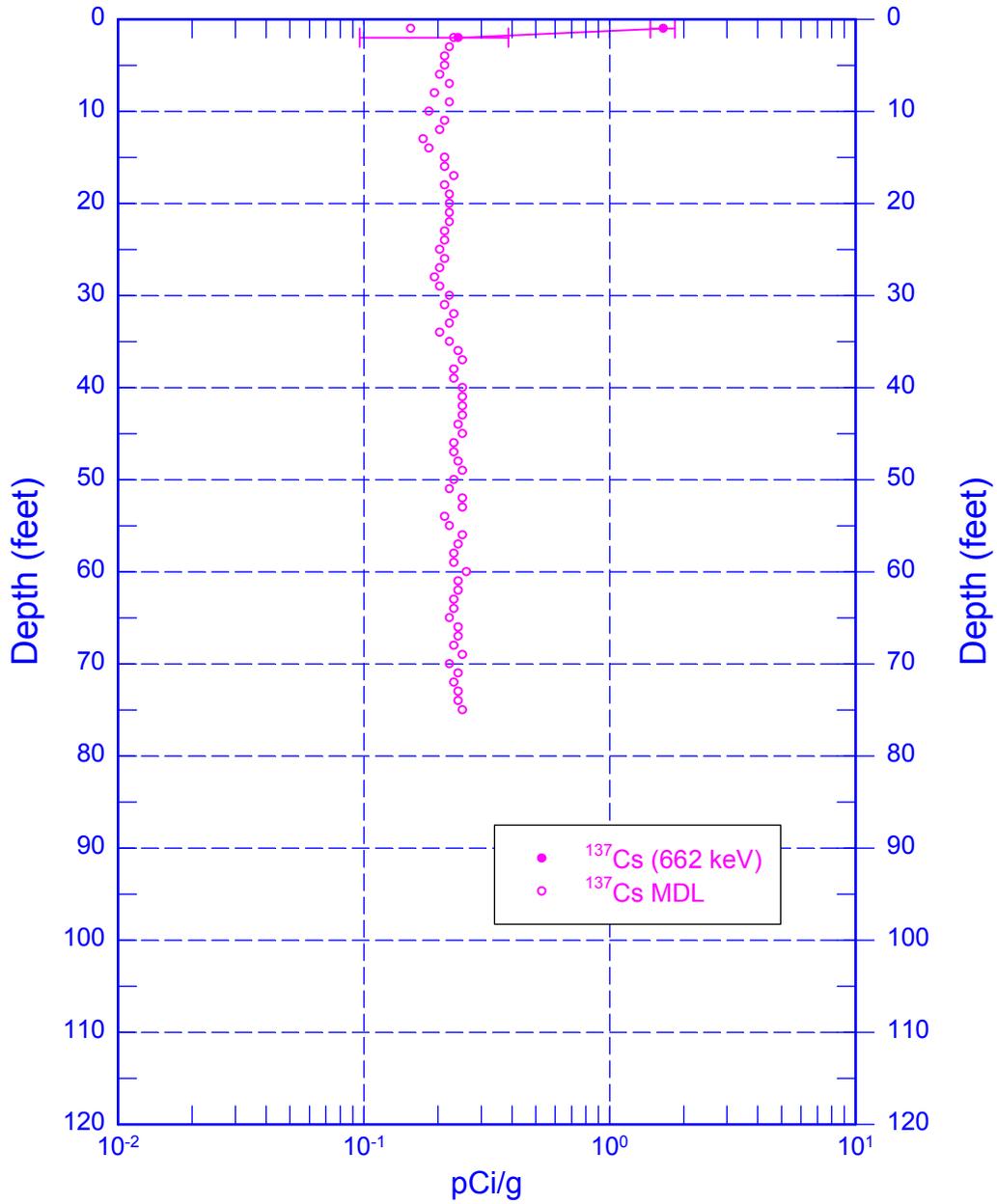
² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

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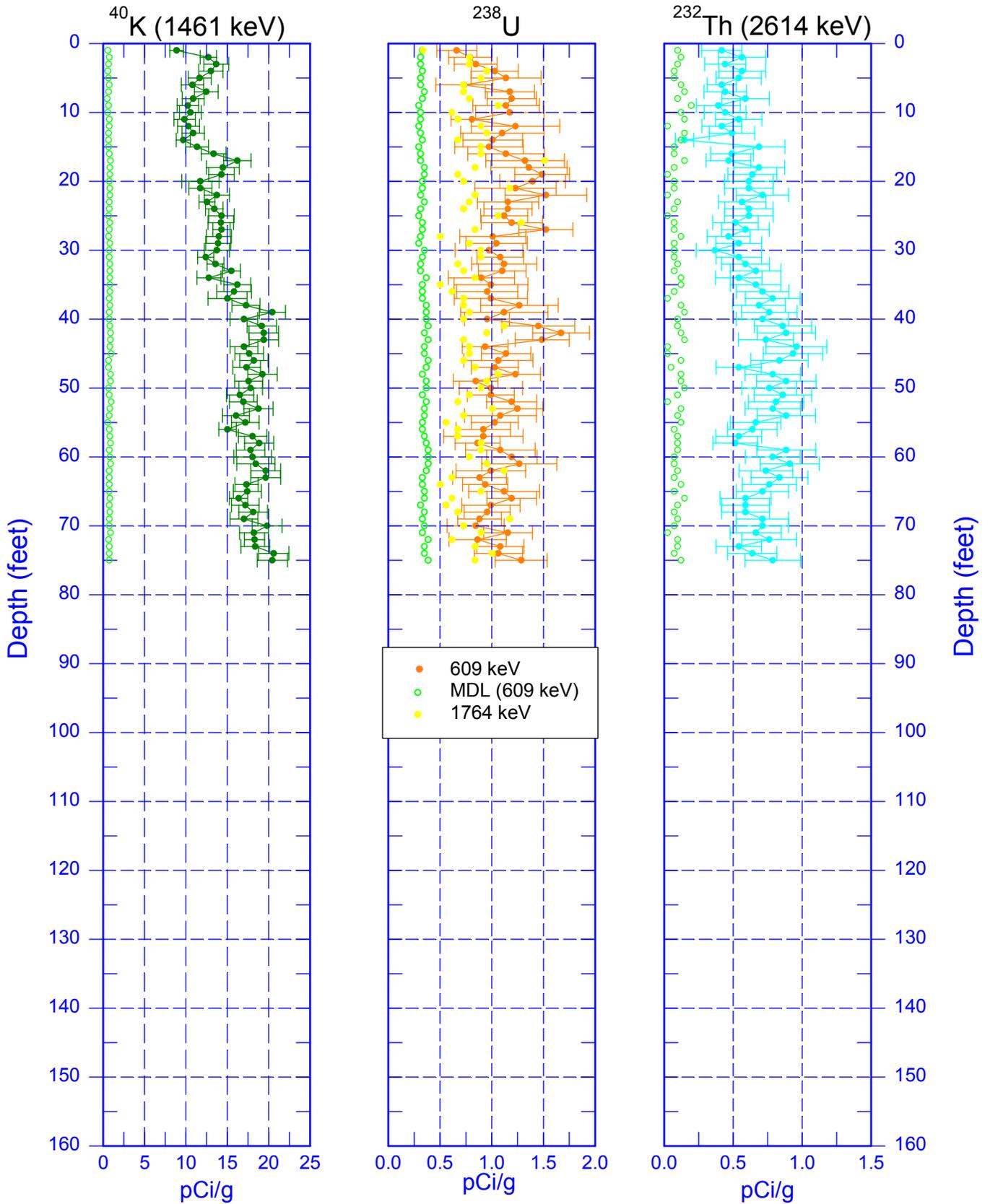
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
1/09/2003

299-W11-67 (A7309) Natural Gamma Logs

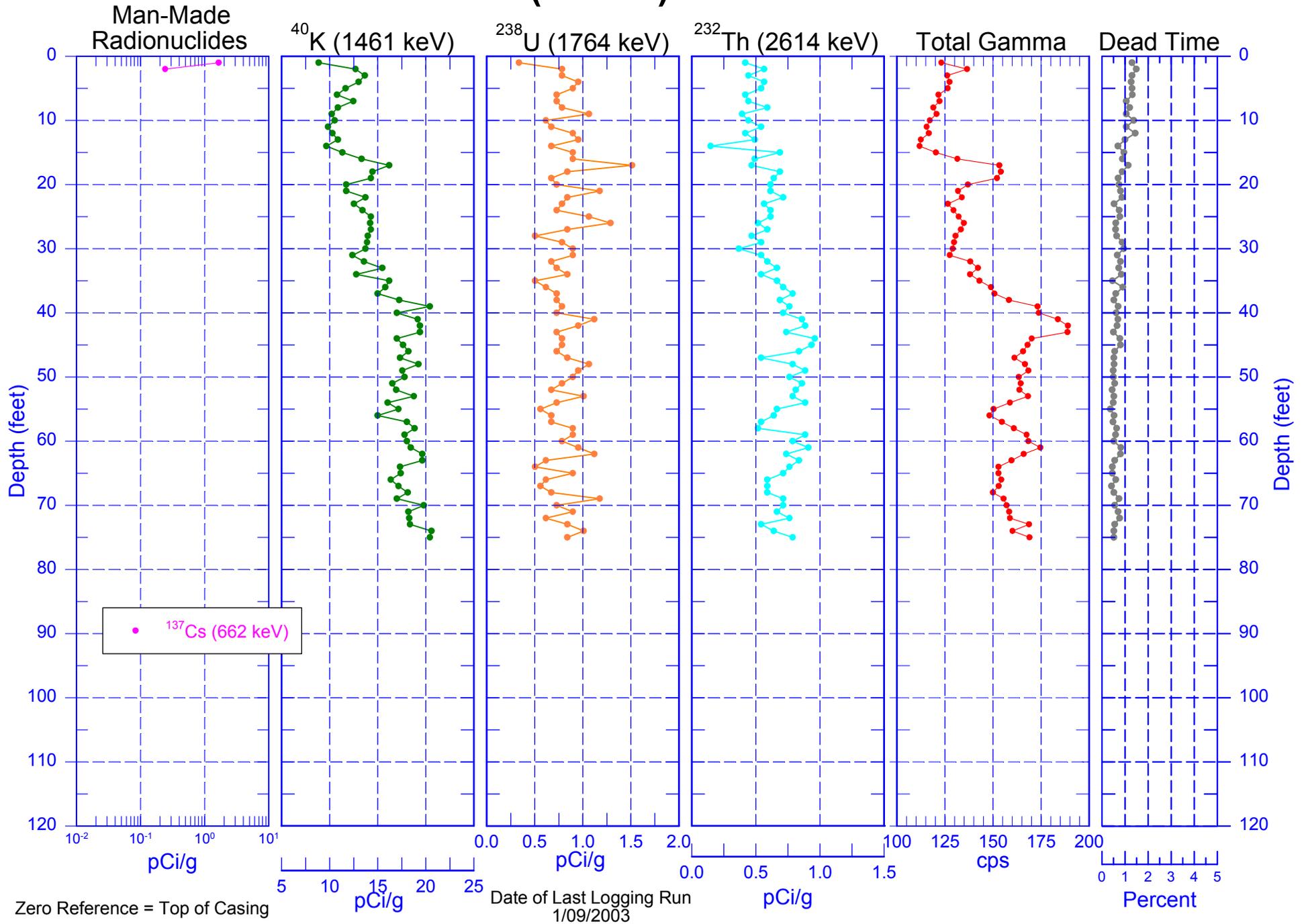


○ MDL

Zero Reference = Top of Casing

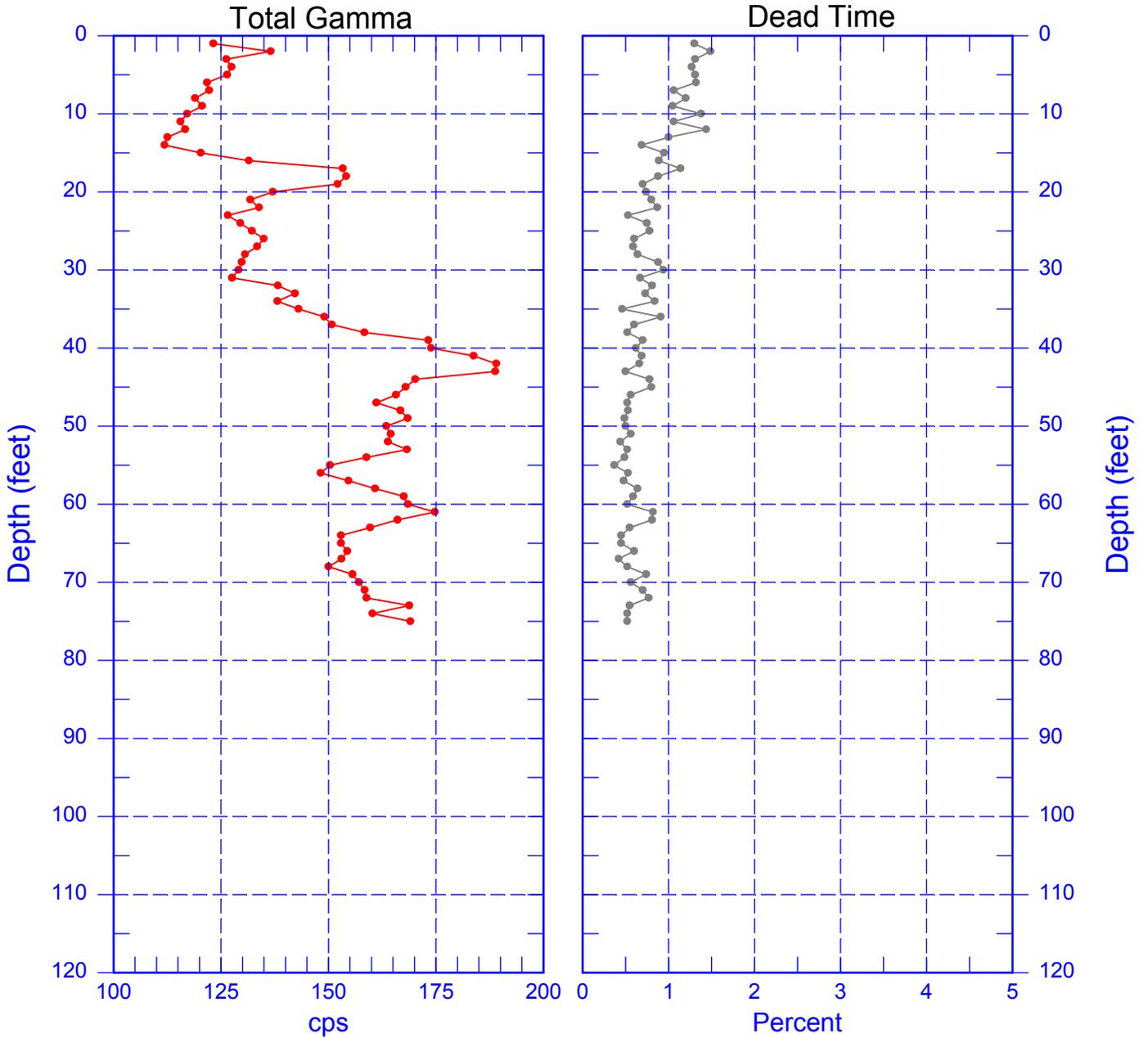
Date of Last Logging Run
1/09/2003

299-W11-67 (A7309) Combination Plot



299-W11-67 (A7309)

Total Gamma & Dead Time

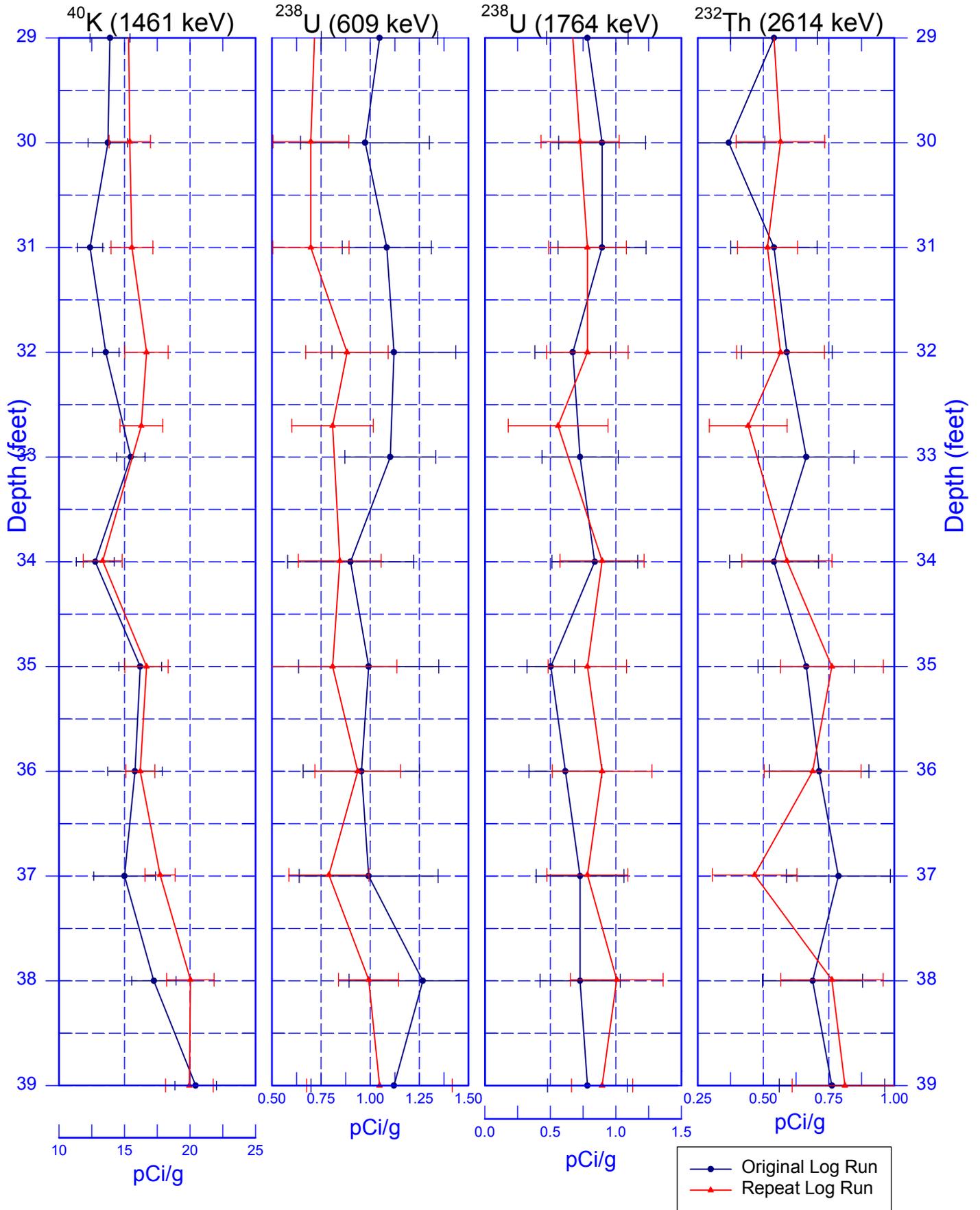


Zero Reference = Top of Casing

Date of Last Logging Run
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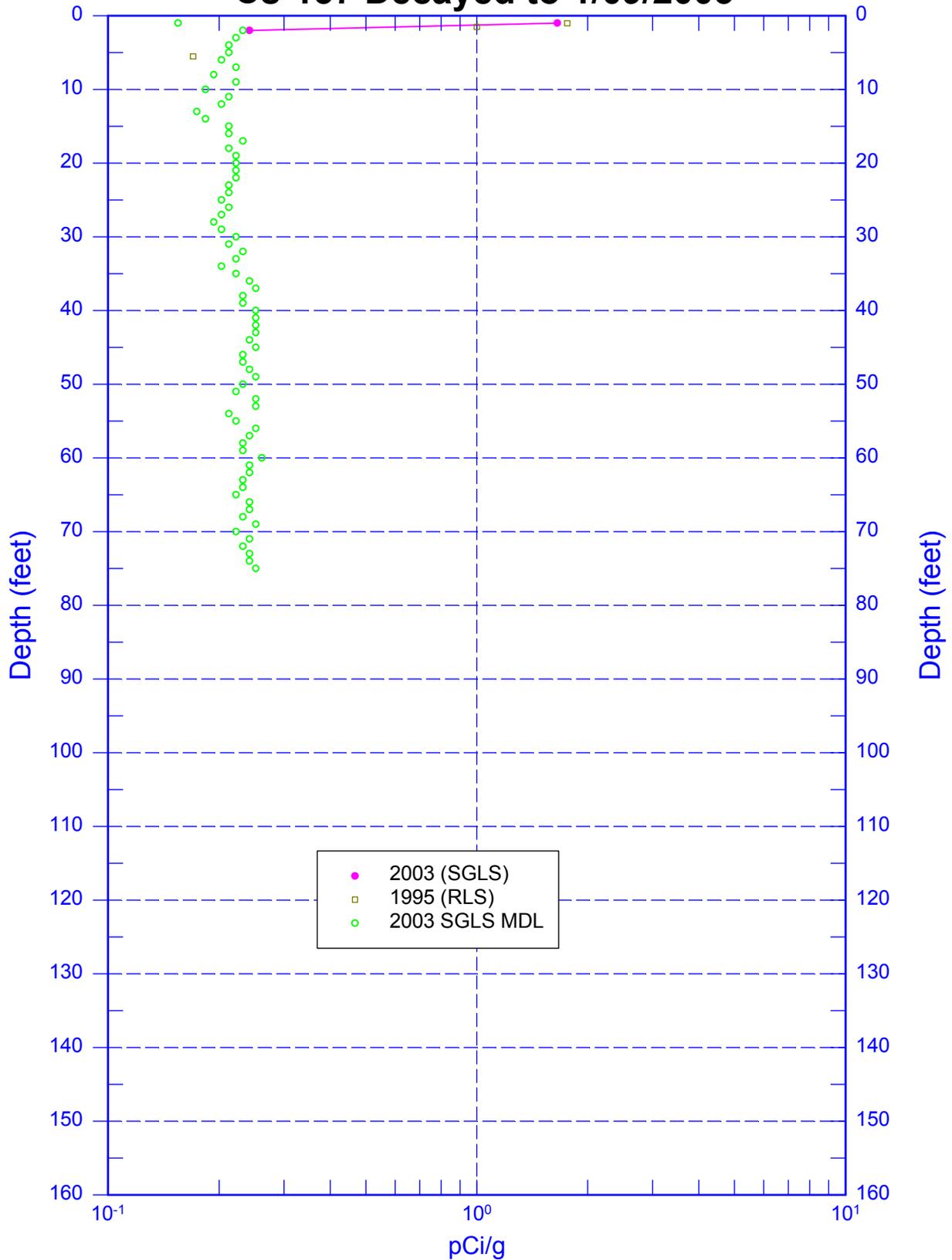
Rerun of Natural Gamma Logs (39.0 to 29.0 ft)



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RLS Data Compared to SGLS Data

Cs-137 Decayed to 1/09/2003



Zero Reference = Top of Casing (2003 SGLS & 1995 RLS)