

**299-W19-71 (A7771)**  
**Log Data Report**

**Borehole Information:**

<b>Borehole:</b> 299-W11-71 (A7771)		<b>Site:</b> 216-U-8 Crib			
<b>Coordinates</b> (WA State Plane)		<b>GWL (ft)<sup>1</sup>:</b> Not deep enough		<b>GWL Date:</b> 3/23/2004	
<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>
134,679.76 m	567,616.01 m	Jan 1951	212.7 m	117	Cable Tool

**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>
Welded steel	2.9	8 5/8	8	5/16	0	117
The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated.						

**Borehole Notes:**

Borehole coordinates, elevation, and borehole construction information are from measurements by Stoller field personnel, HWIS<sup>3</sup>, and Chamness and Merz (1993). Zero reference is the top of the 8-in. casing.

**Logging Equipment Information:**

<b>Logging System:</b> Gamma 1G	<b>Type:</b> 35% HPGe (34TP10967A)
<b>Calibration Date:</b> 1/2004	<b>Calibration Reference:</b> GJO-2004-597-TAC
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

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

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

<b>Log Run</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 / Repeat</b>
Date	03/23/04	03/23/04	03/23/04	03/23/04	03/23/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	87.91	87.50	45.5	36.5	18.5
Finish Depth (ft)	87.91	46.5	37.5	3.5	9.5
Count Time (sec)	200	200	20	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	N/A <sup>4</sup>	1.0	1.0	1.0	1.0
ft/min	N/A	N/A	N/A	N/A	N/A

Log Run	1	2	3	4	5 / Repeat
Pre-Verification	AG056CAB	AG056CAB	AG056CAB	AG056CAB	AG056CAB
Start File	AG056000	AG056001	AG056043	AG056052	AG056086
Finish File	AG056000	AG056042	AG056051	AG056085	AG056095
Post-Verification	AG056CAA	AG056CAA	AG056CAA	AG056CAA	AG056CAA
Depth Return Error (in.)	N/A	N/A	N/A	0	0
Comments	Sonde tip is just touching bottom of borehole.	No fine-gain adjustment.	High rate zone - dead time > 40% count time change.	No fine-gain adjustment.	Repeat section.

### **High Rate Logging System (HRLS) Log Run Information:**

Log Run	1	2 / Repeat			
Date	03/24/04	03/24/04			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	46.5	40.5			
Finish Depth (ft)	37.5	39.5			
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	AC092CAB	AC092CAB			
Start File	AC092000	AC092010			
Finish File	AC092009	AC092011			
Post-Verification	AC094CAA	AC094CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine-gain adjustment.	Repeat section.			

### **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 ( $^{40}\text{K}$ ,  $^{238}\text{U}$ , and  $^{232}\text{Th}$ ) verifier with serial number 118. HRLS data were collected using Gamma 1C. Pre- and post-survey verification measurements employed the  $^{137}\text{Cs}$  verifier with serial number 1013. Maximum logging depth achieved was 87.91 ft.

### **Analysis Notes:**

<b>Analyst:</b>	Sobczyk	<b>Date:</b>	3/29/04	<b>Reference:</b>	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 the day. All of the verification spectra were within the acceptance criteria. 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 4.5 percent lower and 2.5 percent higher at the end of the day.

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

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. The 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: G1GJan04.xls [SGLS] and G1CApr03.xls [HRLS]). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 8-in. casing with a thickness of 5/16 in. to 87.91 ft (total logging depth). A water correction was not required.

Using the SGLS, dead time greater than 40 percent was encountered in the interval from 38.5 to 46.5 ft. Data from this region are 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. The HRLS was utilized to obtain data where the SGLS dead time exceeded 40 percent. SGLS dead time corrections were applied when dead time surpassed 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. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plots of  $^{137}\text{Cs}$  and uranium are provided to compare the data collected in 1994 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  $^{214}\text{Bi}$  peak at 1764 keV was used to determine the naturally occurring  $^{238}\text{U}$  concentrations on the combination plot rather than the  $^{214}\text{Bi}$  peak at 609 keV because it exhibited slightly higher net counts per second.

### **Results and Interpretations:**

$^{137}\text{Cs}$ ,  $^{235}\text{U}$ , and  $^{238}\text{U}$  were the man-made radionuclides detected in this borehole.  $^{137}\text{Cs}$  was detected in the intervals between 3.5 and 14.5 ft and 31.5 and 87.91 ft at concentrations ranging from the MDL (0.2 pCi/g) to 28,500 pCi/g. The maximum concentration of  $^{137}\text{Cs}$  was measured at 39.5 ft.  $^{235}\text{U}$  and  $^{238}\text{U}$  were detected in the intervals between 46.5 and 68.5 ft and 79.5 and 87.91 ft.  $^{238}\text{U}$  concentrations, based on the 1001-keV photopeak, ranged from 24 pCi/g to 184 pCi/g, which was measured at 46.5 ft.  $^{235}\text{U}$  concentrations, based on the 186-keV photopeak, ranged between 1.7 pCi/g to 12 pCi/g, which was measured at 56.5 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the HRLS and SGLS data.  $^{137}\text{Cs}$  (662 keV) concentrations are comparable between the repeat and original log runs for the HRLS and SGLS. The natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV are comparable between the repeat and original SGLS log runs.

Comparison log plots of data collected in 1994 by Westinghouse Hanford Company (WHC) and in 2004 by Stoller are included. The RLS data were shifted downward 8 ft to agree with the SGLS probably because of the addition of fill at the ground surface between the logging runs. The WHC concentration data for  $^{137}\text{Cs}$  are decayed to the date of the SGLS logging event in March 2004. Since 1994,  $^{137}\text{Cs}$  activities appear to have decreased as predicted by radioactive decay. Uranium was detected by the RLS and not by the SGLS in a 2.0-ft interval above 46.5 ft. This interval is within the zone of high SGLS dead time. Otherwise,  $^{238}\text{U}$

(<sup>235</sup>U and <sup>238</sup>U) concentrations as measured by the SGLS in 2004 appear to agree with those measured in 1994 with the RLS.

**References:**

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

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<sup>1</sup> GWL – groundwater level

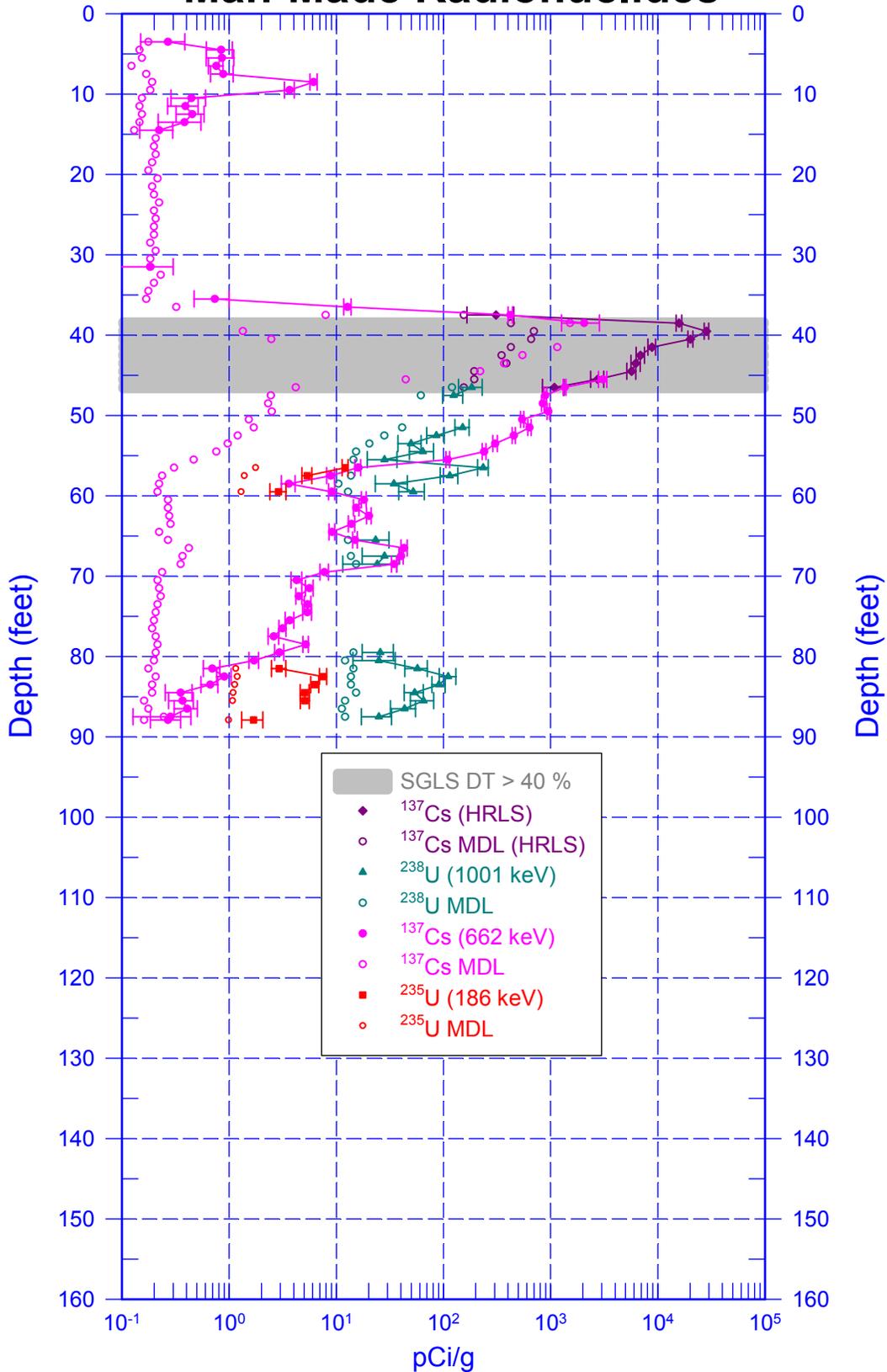
<sup>2</sup> TOC – top of casing

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

<sup>4</sup> N/A – not applicable

# 299-W19-71 (A7771)

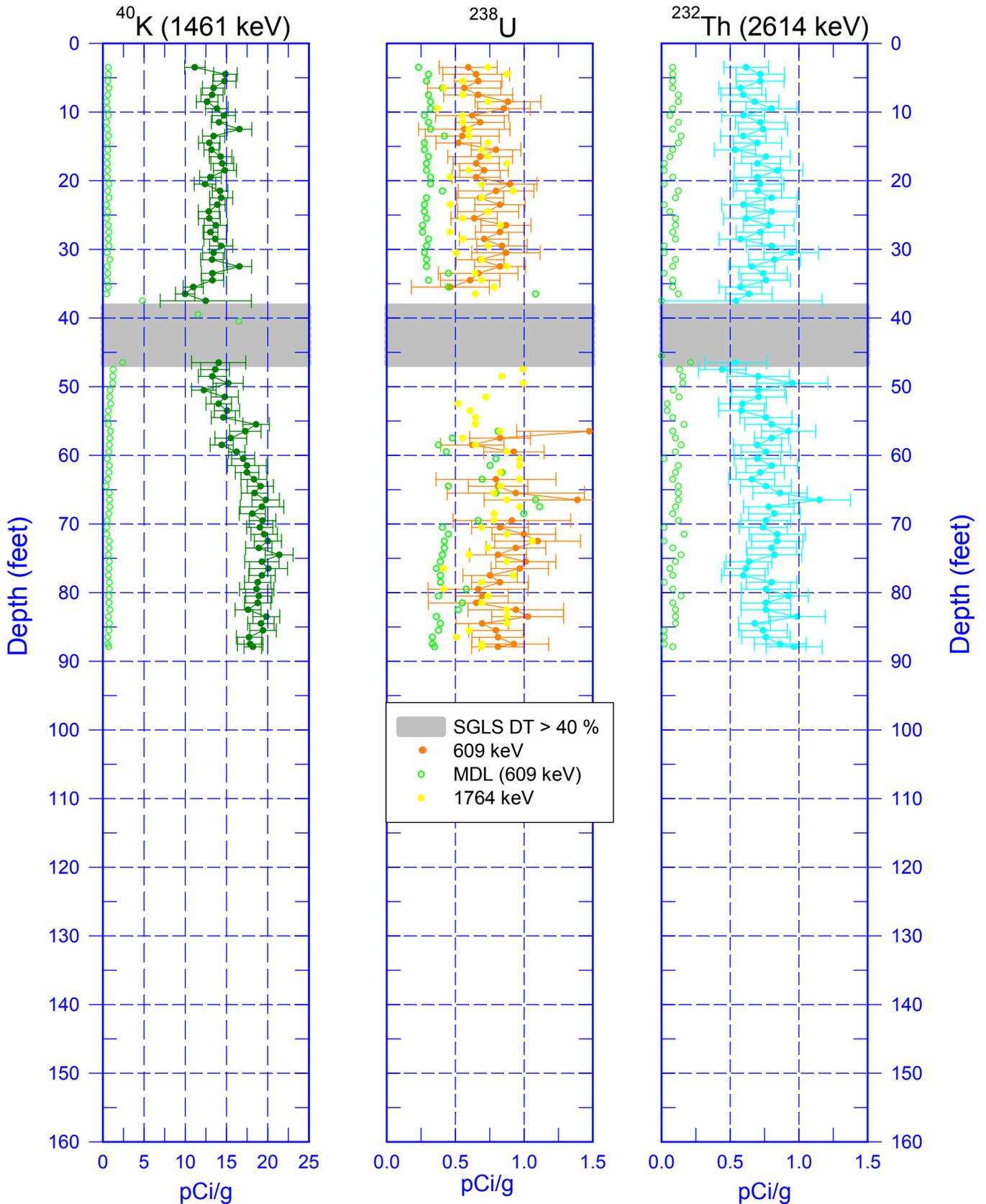
## Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run  
3/24/2004

# 299-W19-71 (A7771) Natural Gamma Logs



○ MDL

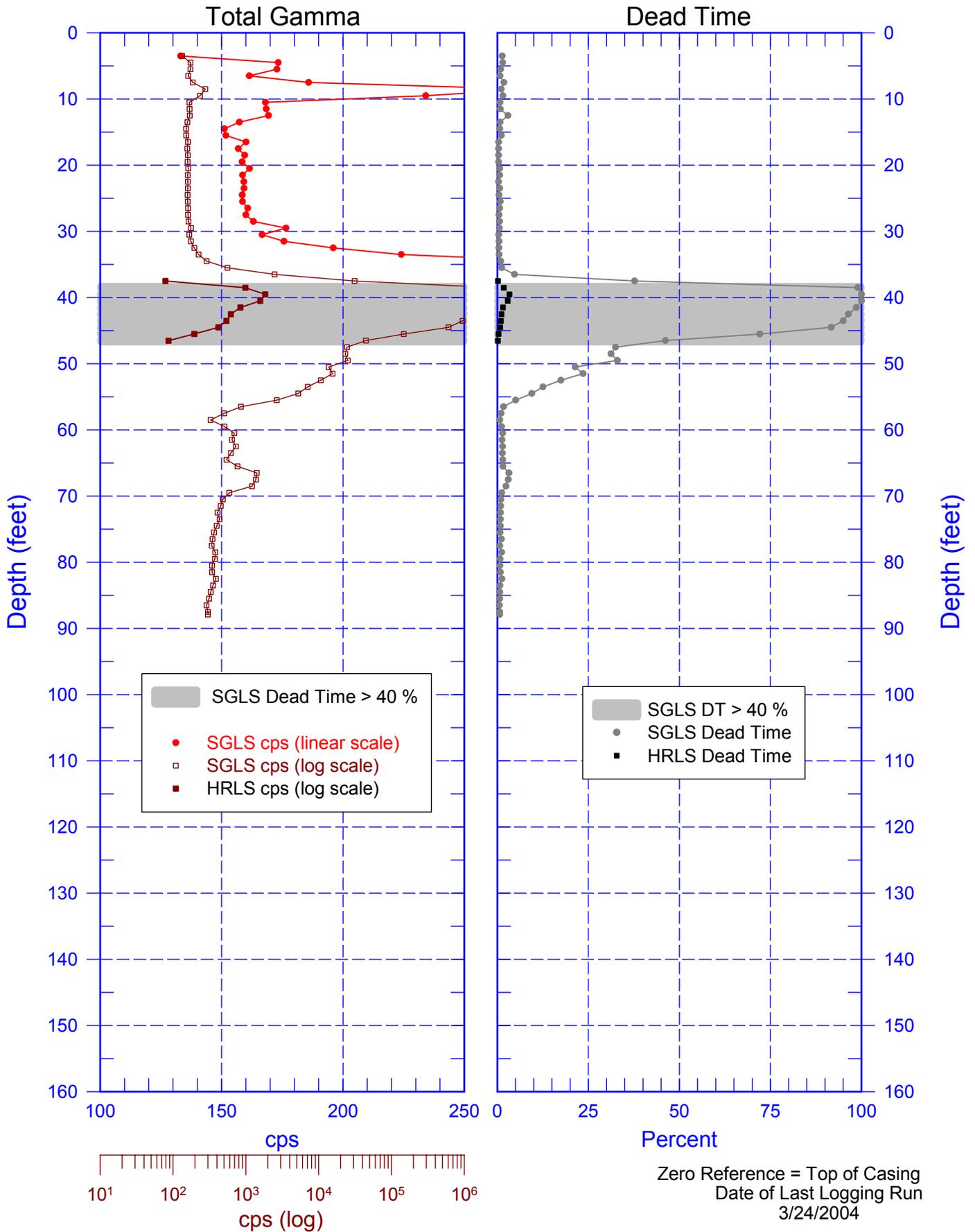
Zero Reference = Top of Casing

Date of Last Logging Run  
3/23/2004



# 299-W19-71 (A7771)

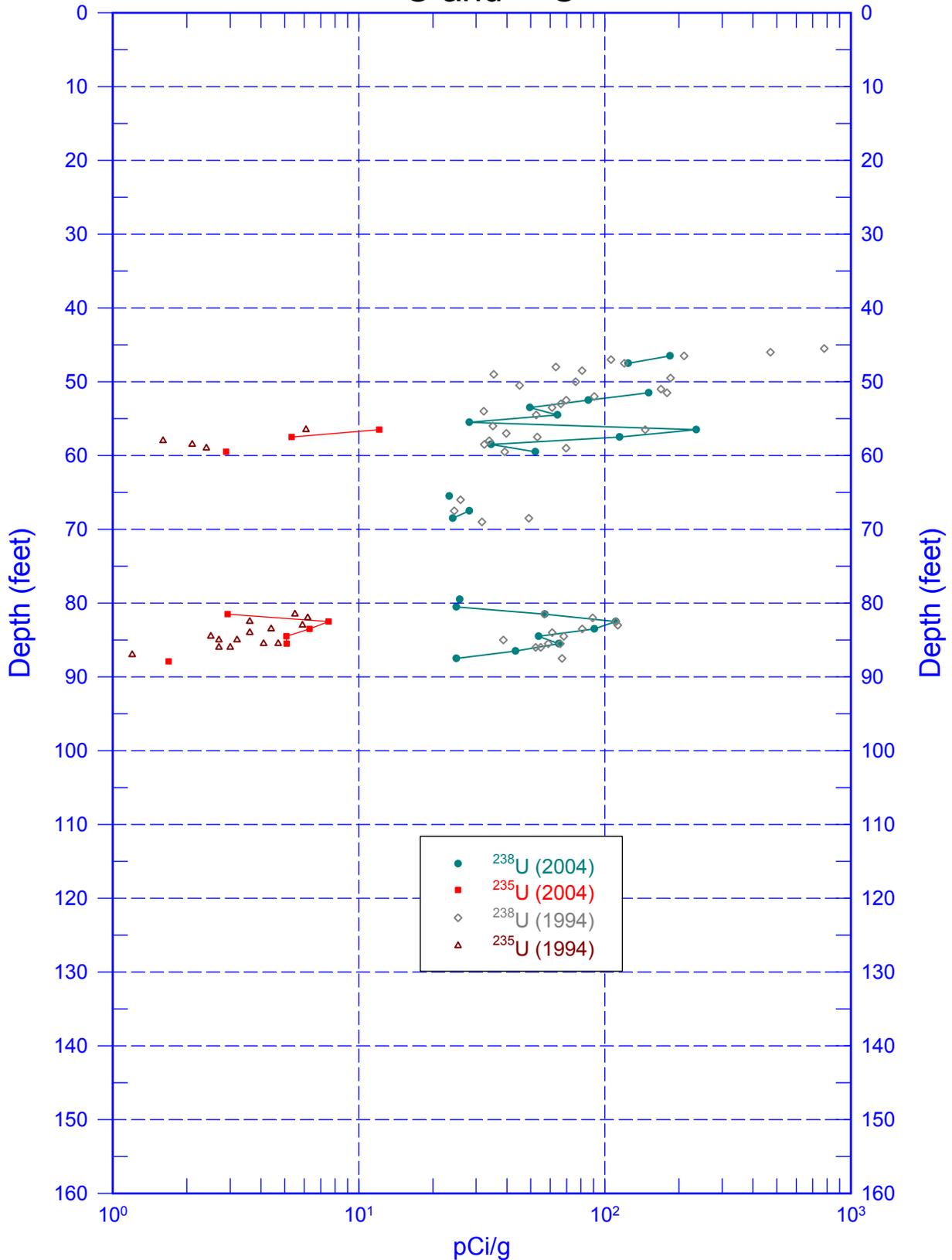
## Total Gamma & Dead Time



# 299-W19-71 (A7771)

RLS Data Compared to SGLS & HRLS Data

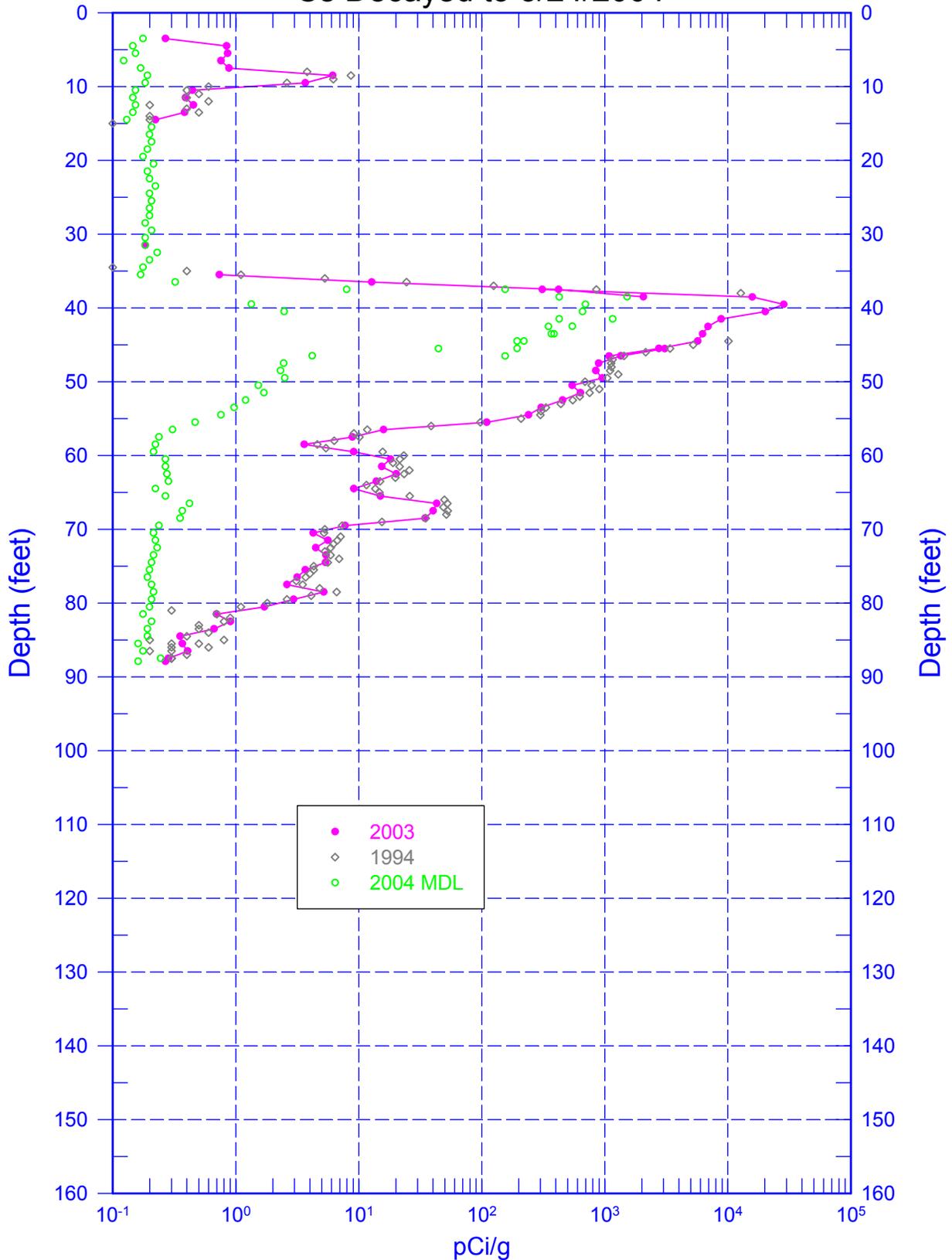
$^{235}\text{U}$  and  $^{238}\text{U}$



Zero Reference = Top of Casing (2004 SGLS & HRLS)  
1994 RLS shifted downward 8.0 ft to align with the SGLS & HRLS

# 299-W19-71 (A7771)

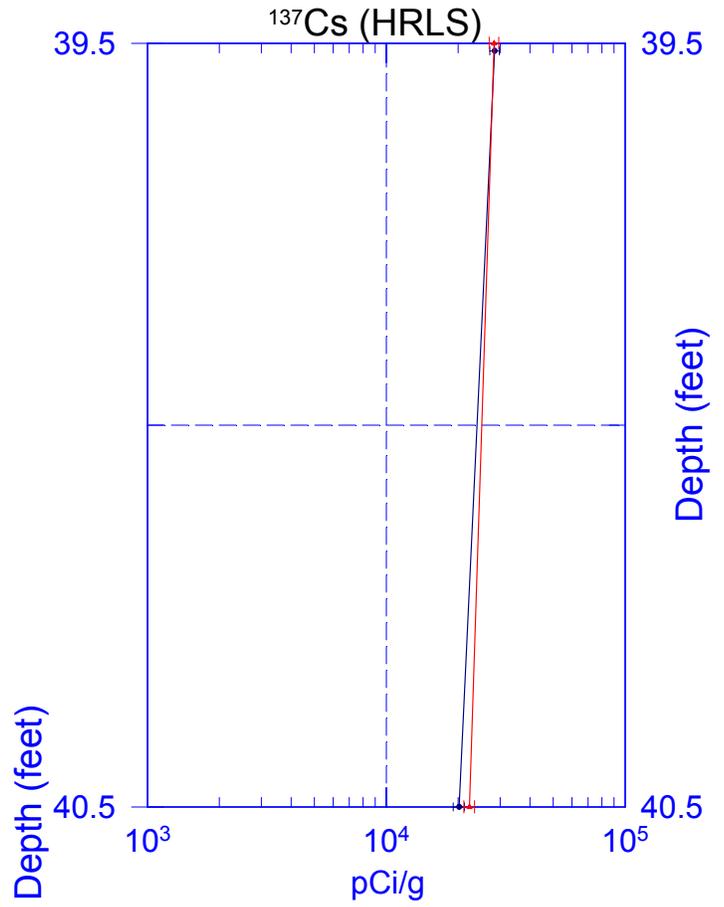
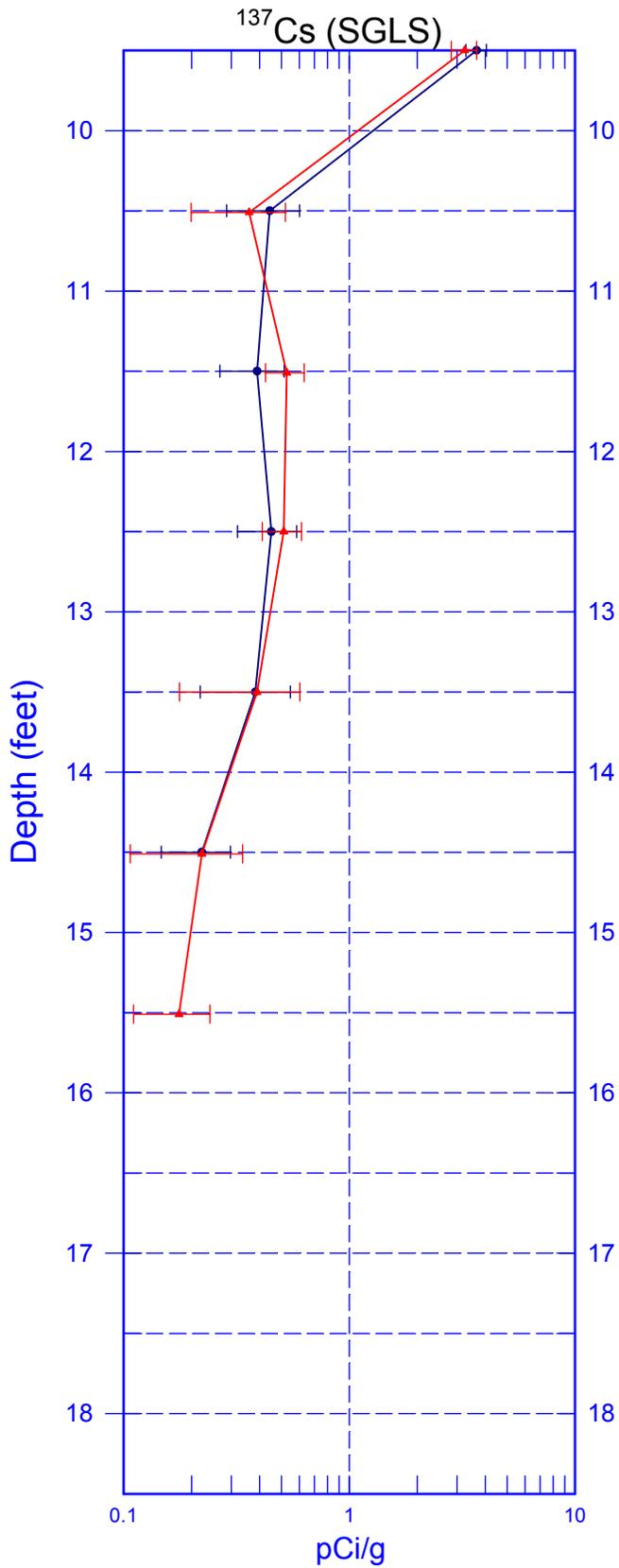
RLS Data Compared to SGLS & HRLS Data  
<sup>137</sup>Cs Decayed to 3/24/2004



Zero Reference = Top of Casing (2004 SGLS & HRLS)  
1994 RLS shifted downward 8.0 ft to align with the SGLS & HRLS

# 299-W19-71 (A7771)

## Rerun of Man-Made Radionuclides



—●— Original Log Run  
—▲— Repeat Log Run

# 299-W19-71 (A7771)

## Rerun of Natural Gamma Logs (18.5 to 9.5 ft)

