

**299-W19-70 (A7770)**  
**Log Data Report**

**Borehole Information:**

<b>Borehole:</b> 299-W19-70 (A7770)		<b>Site:</b> 216-U-8 Crib			
<b>Coordinates (WA St Plane)</b>		<b>GWL<sup>1</sup> (ft):</b> None		<b>GWL Date:</b> 12/10/03	
<b>North</b> 134697.757	<b>East</b> 567615.853	<b>Drill Date</b> 01/51	<b>Elevation (TOC)</b> 697.66 ft	<b>Total Depth (ft)</b> 105	<b>Type</b> Cable

**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	1.65	8 5/8	8	5/16	0	105

**Borehole Notes:**

The logging engineer measured the casing stickup using a steel tape. A caliper was used to measure the outside casing diameters. The caliper and inside casing diameters were measured using a steel tape. Measurements are rounded to the nearest 1/16 inch. Casing thickness was calculated. Logging data acquisition is referenced to the top of casing (TOC).

**Spectral Gamma Logging System (SGLS) Equipment Information:**

<b>Logging System:</b> Gamma 1G	<b>Type:</b> SGLS (35%) SN: 34TP10967A
<b>Calibration Date:</b> 01/04	<b>Calibration Reference:</b> GJO-2004-597-TAC
<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0	

**High Rate Logging System (HRLS) Equipment Information:**

<b>Logging System:</b> Gamma 1C	<b>Type:</b> HRLS SN: 39-A314
<b>Calibration Date:</b> 04/03	<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</b>
Date	03/18/04	03/18/04	03/19/04	03/19/04	03/19/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	90.17	90.0	48.0	45.0	37.0
Finish Depth (ft)	90.17	47.0	46.0	38.0	2.0

<b>Log Run</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Count Time (sec)	200	200	200	20	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A <sup>2</sup>	N/A	N/A	N/A	N/A
Pre-Verification	AG053CAB	AG053CAB	AG055CAB	AG055CAB	AG055CAB
Start File	AG054000	AG054001	AG055000	AG055003	AG055011
Finish File	AG054000	AG054044	AG055002	AG055010	AG055046
Post-Verification	AG054CAA	AG054CAA	AG055CAA	AG055CAA	AG055CAA
Depth Return Error (in.)	N/A	N/A	N/A	N/A	N/A
Comments	No fine-gain adjustment.				

<b>Log Run</b>	<b>6 Repeat</b>				
Date	03/19/04				
Logging Engineer	Spatz				
Start Depth (ft)	20.0				
Finish Depth (ft)	11.0				
Count Time (sec)	200				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	AG055CAB				
Start File	AG055047				
Finish File	AG055056				
Post-Verification	AG055CAA				
Depth Return Error (in.)	N/A				
Comments	No fine-gain adjustment.				

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

<b>Log Run</b>	<b>7</b>	<b>8 Repeat</b>			
Date	03/19/04	03/19/04			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	46.0	40.0			
Finish Depth (ft)	37.0	39.0			
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	AC091CAB	AC091CAB			
Start File	AC091000	AC091010			
Finish File	AC091009	AC091011			
Post-Verification	AG091CAA	AG091CAA			
Depth Return Error (in.)	N/A	N/A			
Comments	No fine-gain adjustment.	No fine-gain adjustment.			

## **Logging Operation Notes:**

Logging was performed in this borehole on March 18 and 19, 2004 with the SGLS and HRLS. Measurements were acquired with each system in a single casing string (8-in.). Logging was conducted with a centralizer on each sonde. Measurements are referenced to the top of casing. Repeat sections were collected in this borehole to evaluate the logging system's performance.

## **Analysis Notes:**

<b>Analyst:</b>	Henwood	<b>Date:</b>	03/29/04	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging systems were performed before and after data acquisition. Acceptance criteria were met for all systems.

A casing correction for 5/16-in.-thick casing (8-in. casing) was applied to the spectral log data (SGLS and HRLS).

SGLS and HRLS spectra were 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 G1GJan04.xls (SGLS) and G1CApr03.xls (HRLS) using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 10.5 percent. Where SGLS dead time exceeds 40 percent, HRLS data were substituted. Correction for water was not needed in this borehole.

## **Log Plot Notes:**

Separate log plots are provided for the man-made radionuclides ( $^{137}\text{Cs}$  and processed uranium [ $^{235}\text{U}$  and  $^{238}\text{U}$ ]) detected in the borehole, naturally occurring radionuclides ( $^{40}\text{K}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$  [KUT]), a combination of man-made, KUT, and dead time, and total gamma plotted with dead time. 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. Repeat log sections are also included where appropriate. A comparison plot of the Radionuclide Logging System (RLS) data acquired in 1994 and current SGLS log data is provided.

## **Results and Interpretations:**

$^{137}\text{Cs}$  was detected in this borehole between 3 and 13 ft and between 34 and 90 ft. The maximum concentration was measured at approximately 71,000 pCi/g at 39 ft in depth.  $^{238}\text{U}$  was detected sporadically between 45 and 90 ft. The maximum  $^{238}\text{U}$  concentration is approximately 1,400 pCi/g at 45 ft in depth. The relatively high  $^{137}\text{Cs}$  concentrations between 34 and 90 ft effectively raises the MDL for  $^{238}\text{U}$  and  $^{235}\text{U}$  resulting in the inability to quantify these radionuclides. It is likely  $^{238}\text{U}$  exists in the depth interval between 34 and 45 ft at concentrations in excess of 1,400 pCi/g. Between 50 and 90 ft it is likely  $^{238}\text{U}$  exists at each depth interval at concentrations near and below an approximate MDL of 15 pCi/g.  $^{235}\text{U}$  also exists where the  $^{238}\text{U}$  is detected. Logging experience regarding processed uranium suggests the  $^{235}\text{U}/^{238}\text{U}$  ratio is approximately 20:1. It would be necessary to acquire spectra at significantly longer counting times to quantify the processed uranium at low concentrations.

The repeat sections for the SGLS indicate good agreement for the naturally occurring radionuclides.

A comparison plot of 1994 RLS data with the current SGLS and HRLS data shows good agreement in concentrations. The  $^{238}\text{U}$  comparison shows the same general profile, although concentrations at each

depth interval do not necessarily match because the radionuclide is detected at the margins of the detection limits of the separate systems. It appears no movement of contamination has occurred in the area of the borehole since 1994.

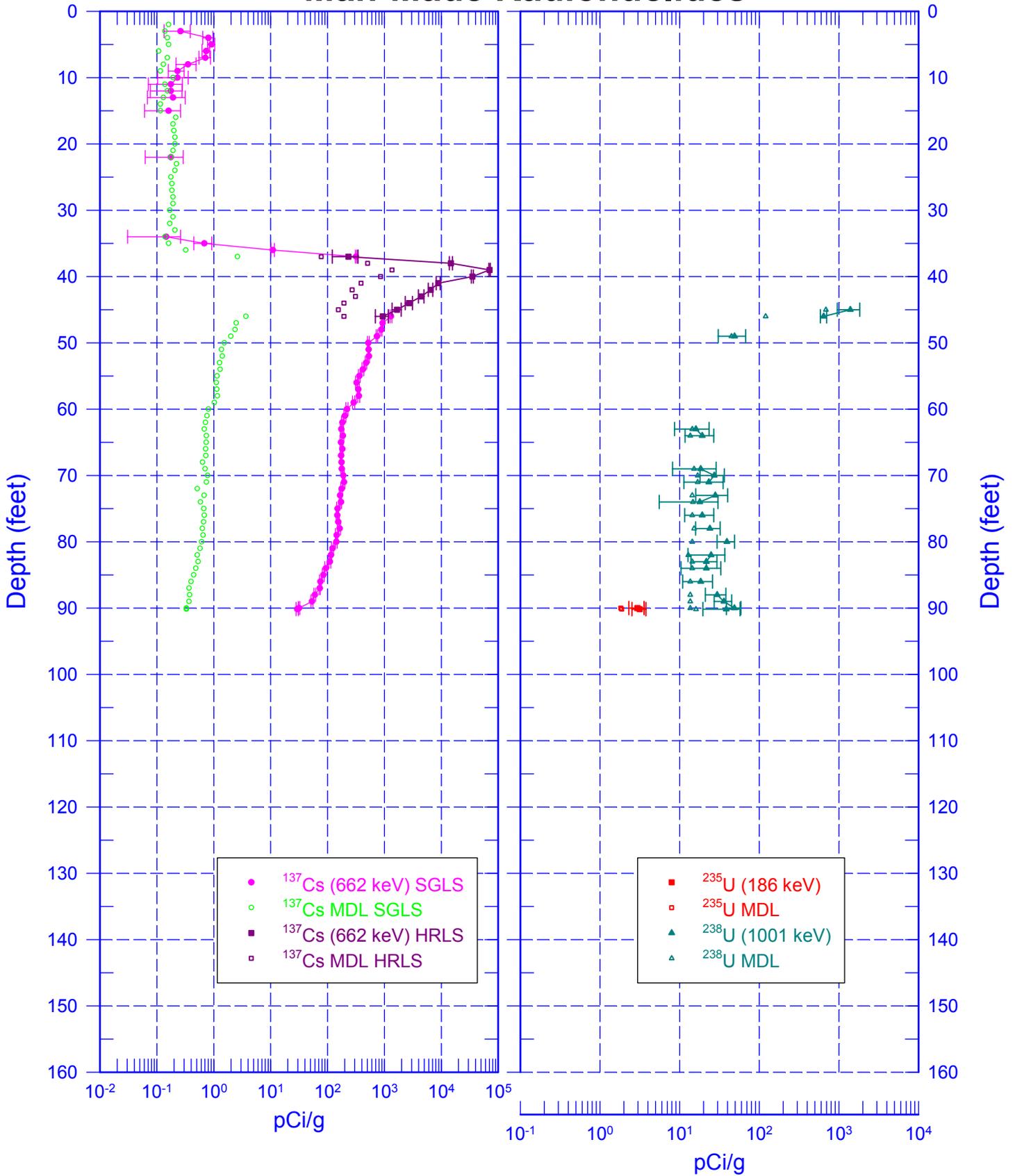
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<sup>1</sup> GWL – groundwater level

<sup>2</sup> N/A – not applicable

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## Man-Made Radionuclides

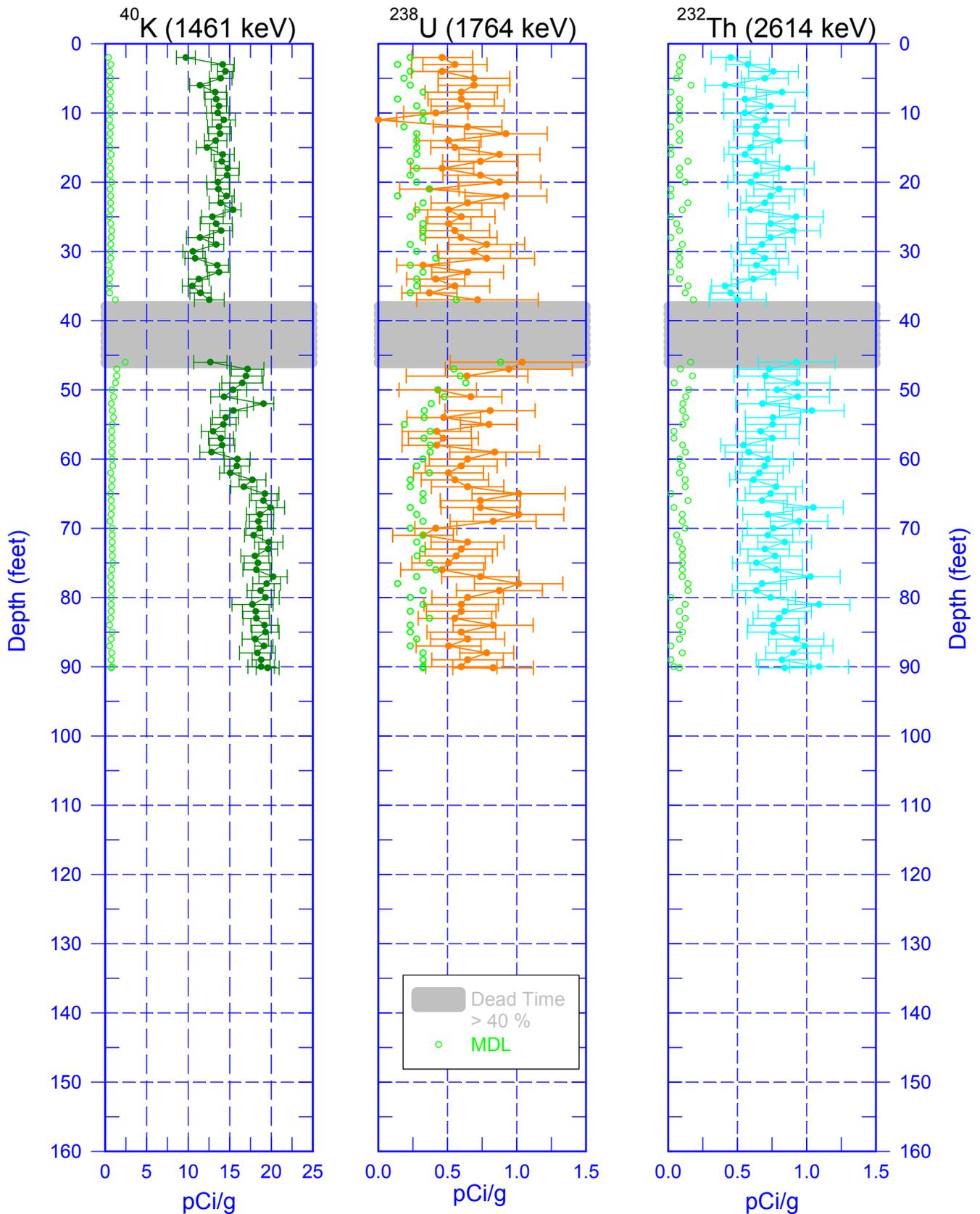


Zero Reference = Top of Casing

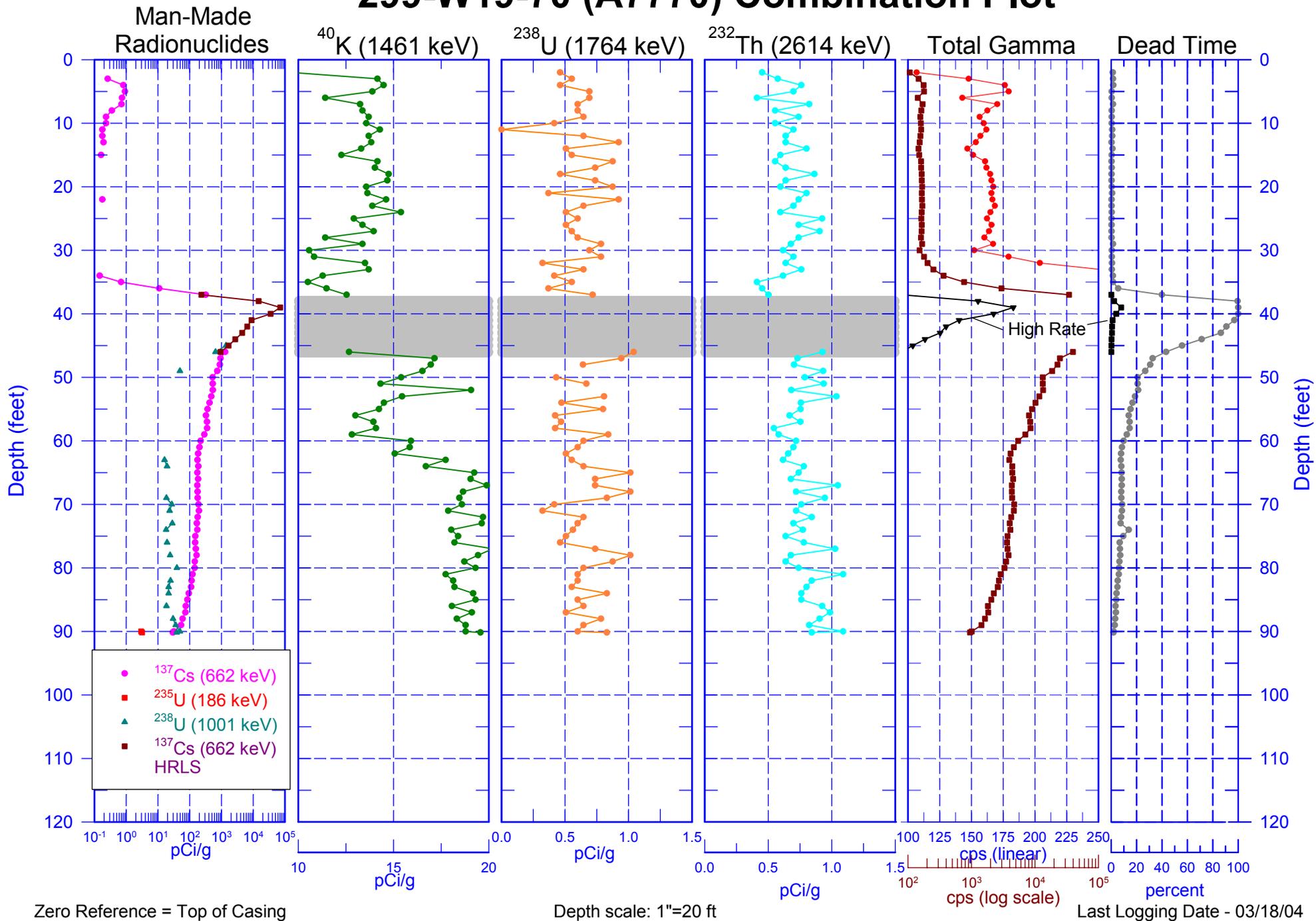
Depth Scale: 1"=20 ft

Last Log Date - 03/18/04

# 299-W19-70 (A7770) Natural Gamma Logs

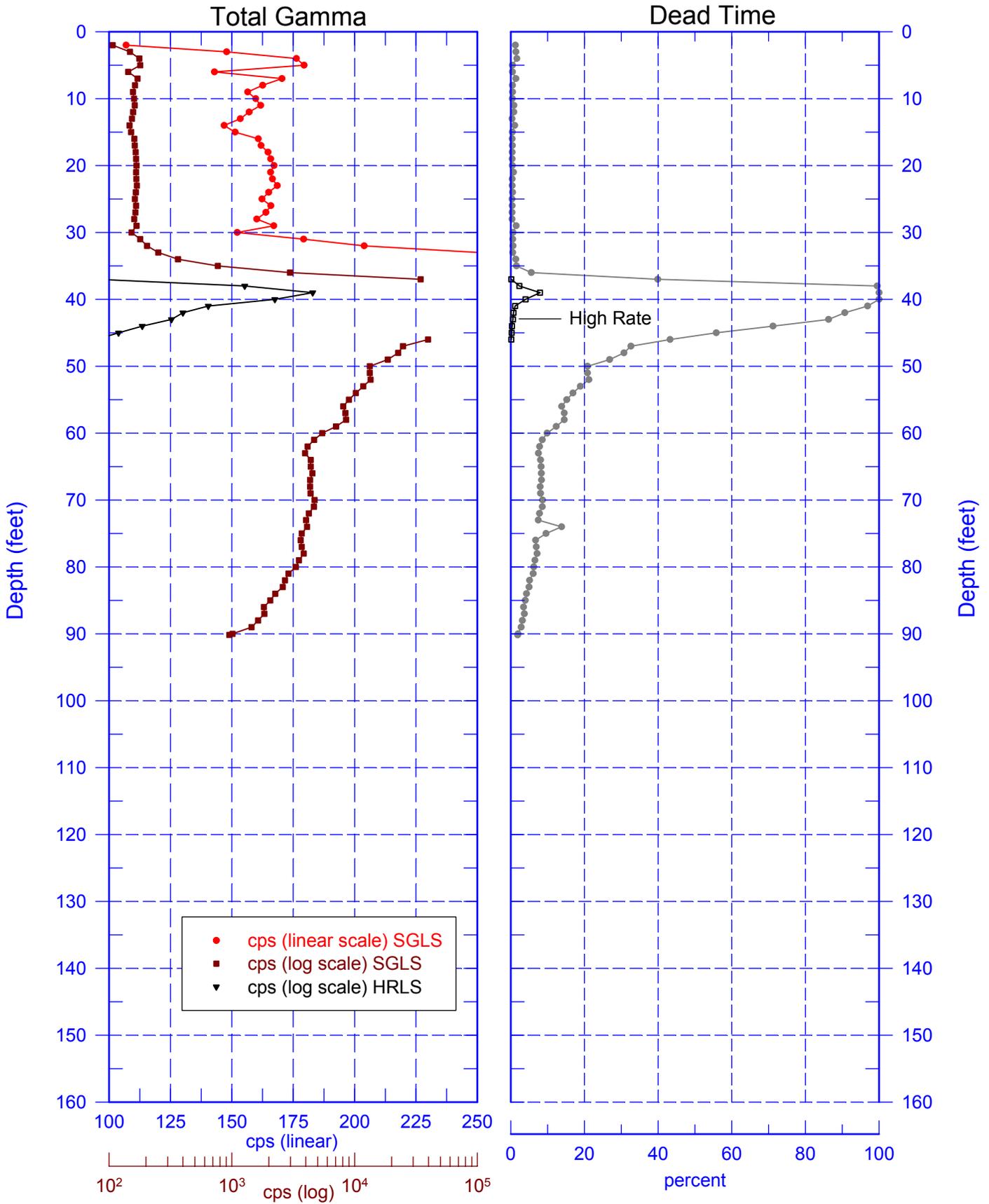


# 299-W19-70 (A7770) Combination Plot



# 299-W19-70 (A7770)

## Total Gamma & Dead Time



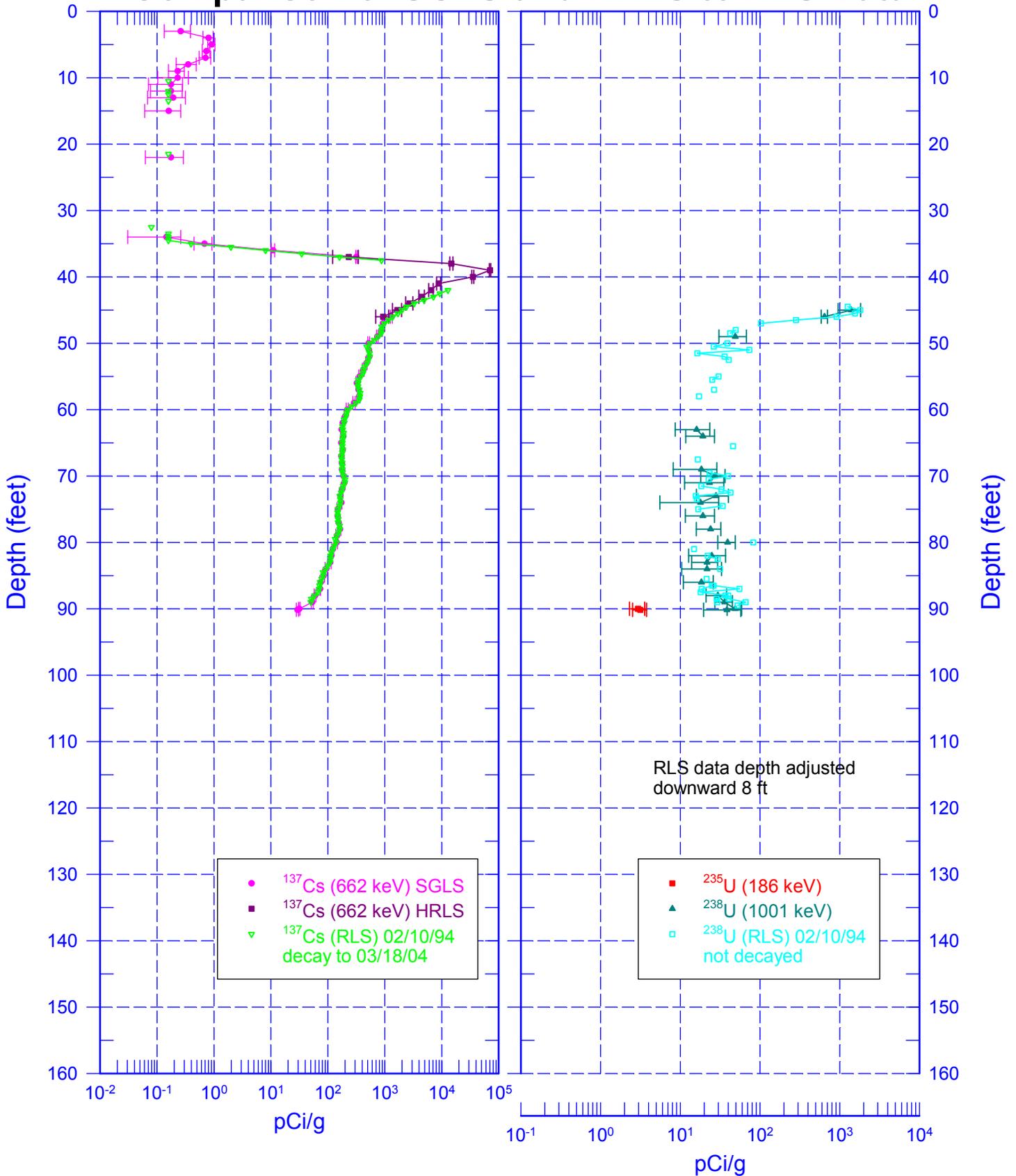
Depth scale: 1"=20 ft

Reference - Top of Casing

Last Log Date - 03/18/04

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## Comparison of SGLS and HRLS to RLS Data



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## Repeat Section of Natural Gamma Logs

