299-E28-18 (A4821)
Log Data Report

Borehole Information:

Borehole:	299-E28-18 (A4821)		Site:	216-B-62	
Coordinates (WA St Plane)		GWL[1] (ft) :	295.6	GWL Date:	12/04/06
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
136767.778	573104.076	07/69	695.90 ft	330	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded Steel	0.5	6 5/8	6	5/16	0	330
Welded Steel	2.7	5 5/8	5	5/16	0	237

Borehole Notes:

Casing diameter and stickup measurements were acquired using a caliper and steel tape. Measurements are rounded to the nearest 1/16 inch. Logging data acquisition is referenced to the top of casing (TOC).

The "Well Construction and Completion Summary As-Built" reports grout between the 5- and 6-in. casing from the ground surface to 237 ft. The 6-in. casing is perforated from 260 to 325 ft.

Logging Equipment Information:

Logging System:	Gamma 1E		Type:	SGLS (70%) SN: 34-TP40587A
Effective Calibration Date:	05/02/06	Calibration Reference:	DOE-EM/GJ1200-2006	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 1C		Type:	HRLS (planar) SN: 39A314
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-04	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 2M		Type:	Neutron Moisture SN: H340207279
Effective Calibration Date:	08/02/06	Calibration Reference:	DOE-EMGJ1283-2006	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	3	4	5	6	7
Date	11/30/06	11/30/06	11/30/06	12/04/06	12/05/06
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	120.0	113.0	35.0	295.0	181.0
Finish Depth (ft)	112.0	34.0	3.0	180.0	119.0
Count Time (sec)	100	20	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A	N/A	N/A	N/A	N/A
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	AE206CAB	AE206CAB	AE206CAB	AE207CAB	AE208CAB

Log Run	3	4	5	6	7
Start File	AE206000	AE206009	AE206089	AE207000	AE208000
Finish File	AE206008	AE206088	AE206121	AE207115	AE208062
Post-Verification	AE206CAA	AE206CAA	AE206CAA	AE207CAA	AE208CAA
Depth Return Error (in.)	N/A	N/A	- 1.8	- 2.5	N/A
Comments	No fine gain adjustment	Dead Time > 40 percent	Fine gain adjustment after -089	No fine gain adjustment	No fine gain adjustment

Log Run	8 Repeat				
Date	12/05/06				
Logging Engineer	Spatz				
Start Depth (ft)	142.0				
Finish Depth (ft)	112.0				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	N/A				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	AE208CAB				
Start File	AE208063				
Finish File	AE208093				
Post-Verification	AE208CAA				
Depth Return Error (in.)	- 0.5				
Comments	No fine gain adjustment				

High Rate Logging System (HRLS) Log Run Information:

Log Run	9	10	11	12 Repeat	
Date	12/05/06	12/06/06	12/07/06	12/08/06	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	43.0	60.0	113.0	45.0	
Finish Depth (ft)	35.0	42.0	59.0	37.0	
Count Time (sec)	300	300	300	300	
Live/Real	R	R	R	R	
Shield (Y/N)	N/A	N/A	N/A	N/A	
MSA Interval (ft)	1.0	1.0	1.0	0.5	
ft/min	N/A	N/A	N/A	N/A	
Pre-Verification	AC165CAB	AC166CAB	AC167CAB	AC168CAB	
Start File	AC165000	AC166000	AC167000	AC168000	
Finish File	AC165009	AC166018	AC167054	AC168016	
Post-Verification	AC165CAA	AC166CAA	AC167CAA	AC168CAA	
Depth Return Error (in.)	0	0	0	0	
Comments	No fine gain adjustment	No fine gain adjustment	Fine gain adjustment after file -020	Fine gain adjustment after file -008	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2 Repeat			
Date	11/22/06	11/22/06			
Logging Engineer	McClellan	McClellan			
Start Depth (ft)	295.0	240.0			
Finish Depth (ft)	230.0	230.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
Sample Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	BM021CAB	BM021CAB			
Start File	BM021000	BM021261			
Finish File	BM021260	BM021301			
Post-Verification	BM021CAA	BM021CAA			
Depth Return Error (in.)	N/A	+ 2.0			
Comments	None	None			

Logging Operation Notes:

Logging was performed in this borehole with the SGLS, HRLS, and NMLS. Logging was conducted with no centralizer on the sondes. Measurements are referenced to the top of casing. Repeat sections were collected in this borehole to evaluate the logging systems' performance.

Analysis Notes:

Analyst:	Henwood	Date:	03/13/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

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 combined casing correction for 0.625-in-thick casing (0.3125+0.3125 for the 5- and 6-in casings) was applied to the spectral log data (SGLS and HRLS) to 237 ft. Below this depth, a correction for a single 0.3125-in. thick casing was applied. The neutron moisture logging data were acquired from 230 to 295 ft. Data were corrected for a single 6-in. casing to derive volumetric moisture. However, the correction for the double cased interval from 230 to 237 ft is not accurate and the data should be considered for relative moisture content, only.

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 G1EMay06.xls and G1CNov06.xls for the SGLS and HRLS, respectively, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations.

Very high gamma activity in the borehole required data to be acquired with the HRLS. Where full energy photo peaks from the SGLS are not exhibited in the spectra or high error is observed, HRLS data are substituted to provide the best representation of the contaminant profile. This generally occurs at about 80 percent SGLS dead time.

Results and Interpretations:

Cs-137 is the manmade contaminant detected in this borehole. Cs-137 is detected in a high activity interval from approximately 35 to 113 ft at concentrations ranging from 200 to 9,000 pCi/g; the maximum

concentration is observed at 43 ft. Cs-137 contamination is also observed from approximately 114 to 145 ft at concentrations less than 2 pCi/g.

The Radionuclide Logging System (RLS) was used by Westinghouse Hanford Company to acquire spectral gamma data in this borehole in 1992. A comparison of these data (after decay of Cs-137 to 2006) with the current SGLS data, indicate some differences in calculations of Cs-137 concentrations. These differences could be the result of applying differing methods for corrections for dead time and casing, insufficient counting times, broadening of spectral peaks in the high activity zones where it was necessary to utilize the HRLS, or other problems. The profiles are sufficiently consistent that it is believed there have been no significant changes since 1992. Total gamma data acquired by PNL in 1982, also show approximately the same profile as in 1992 and 2006.

Neutron moisture measurements indicate some variability.

The repeat sections for the SGLS and NMLS indicate good agreement for the naturally occurring, manmade radionuclides, and moisture.

List of Log Plots:

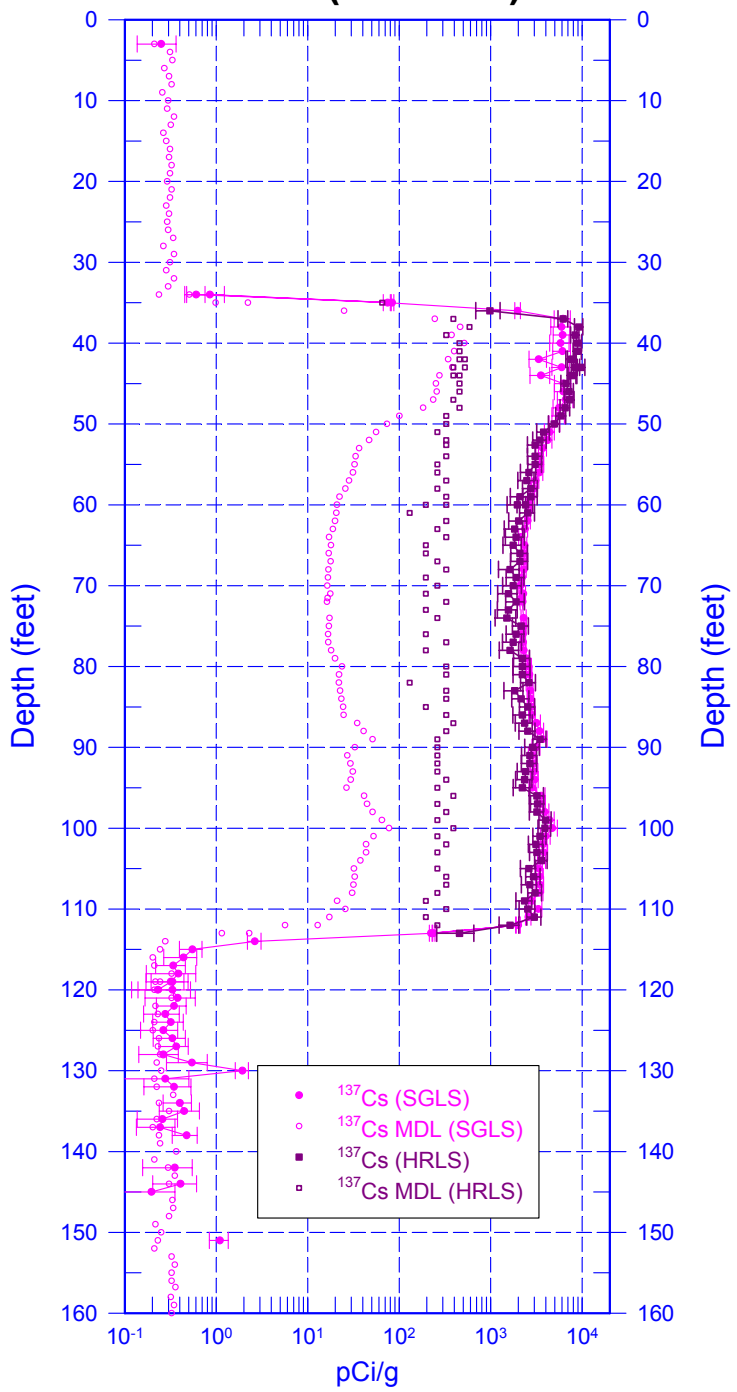
Depth Reference is top of casing
Depth Scale - 20 ft/inch except for repeat logs

Cs-137 (662 keV)
Natural Gamma Logs
Combination Plot
Combination Plot (0-300 ft)
Total Gamma & Dead Time
Total Gamma & Moisture
Cs-137 (662 keV) SGLS/RLS Comparison
Cs-137 (662 keV) Repeat Section
Repeat Section of Natural Gamma Logs
Moisture Repeat Section

[1] GWL – groundwater level

299-E28-18 (A4821)

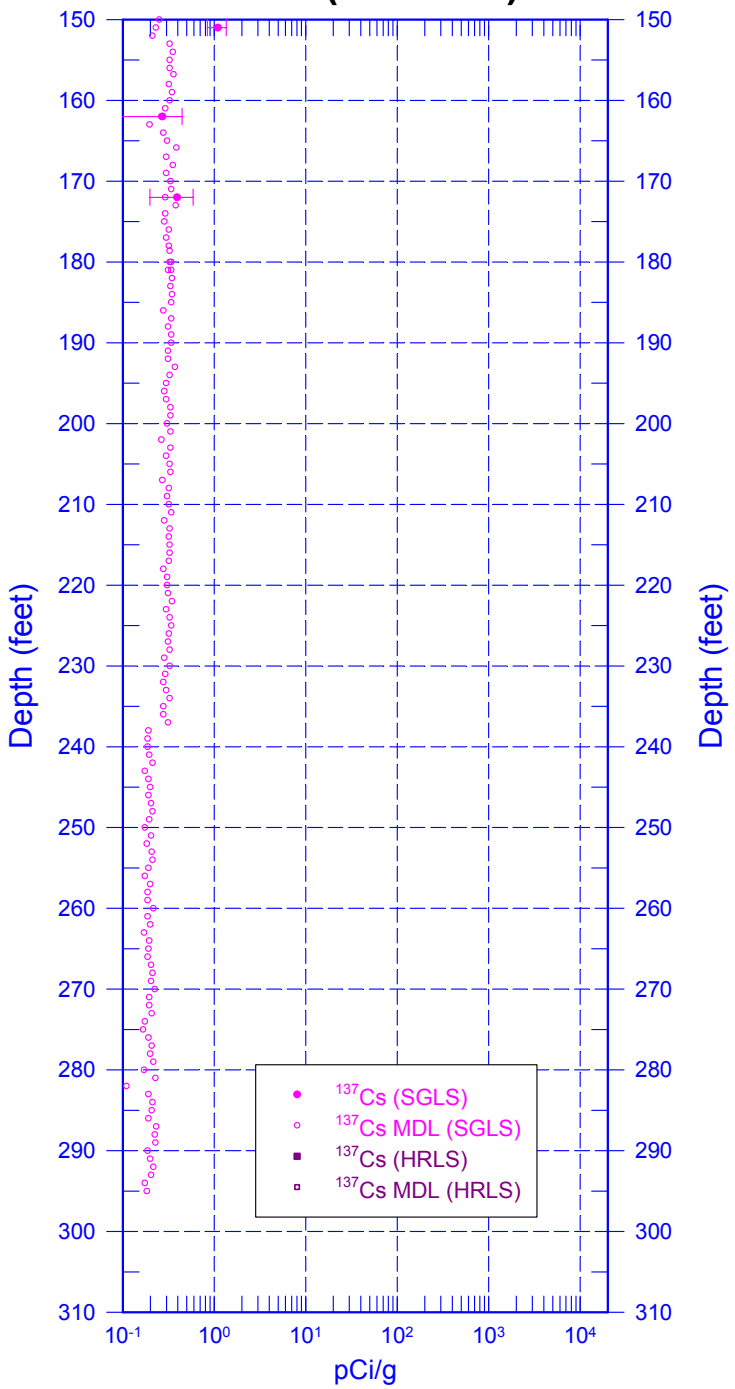
^{137}Cs (662 keV)



Zero Reference = Top of Casing

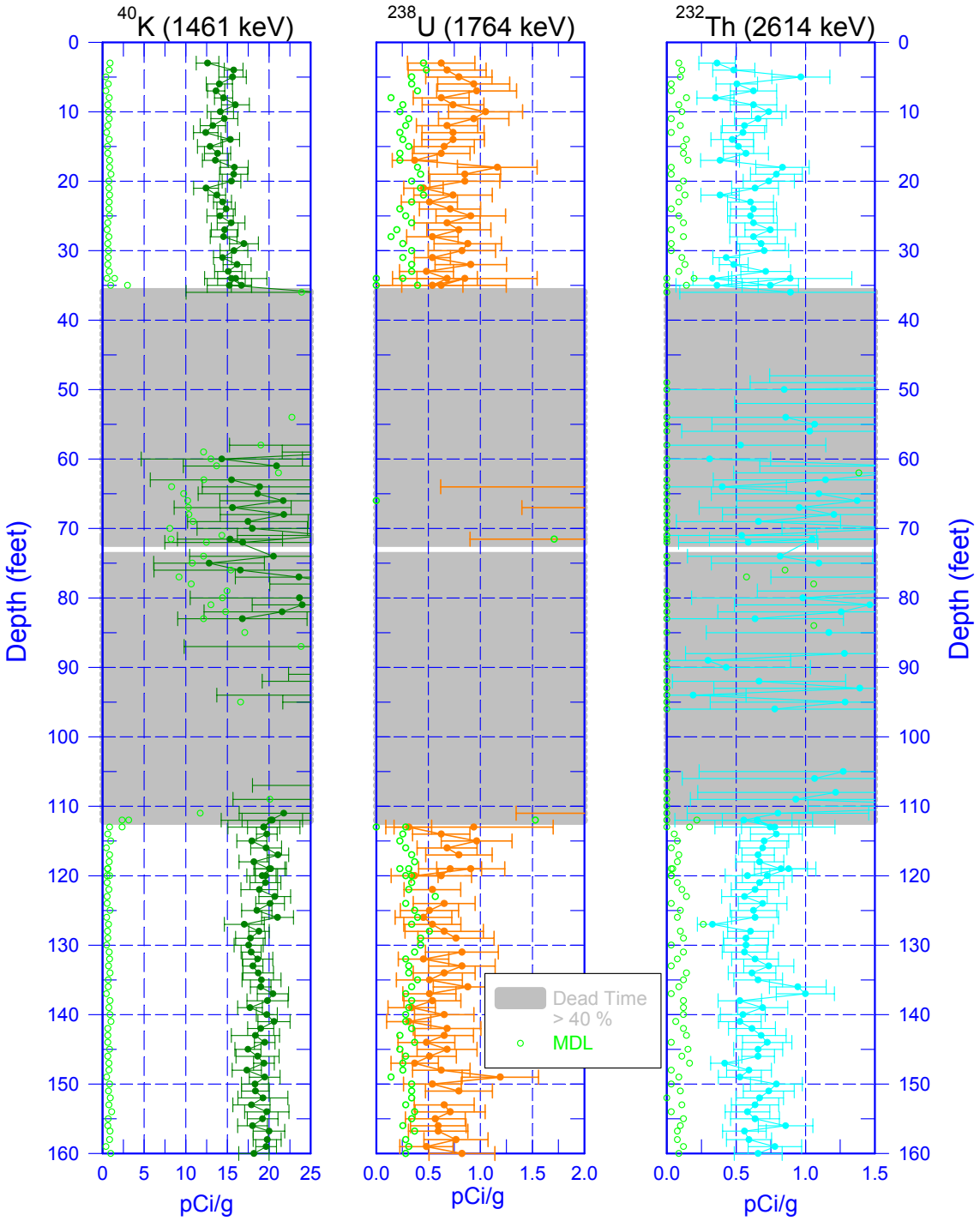
299-E28-18 (A4821)

^{137}Cs (662 keV)



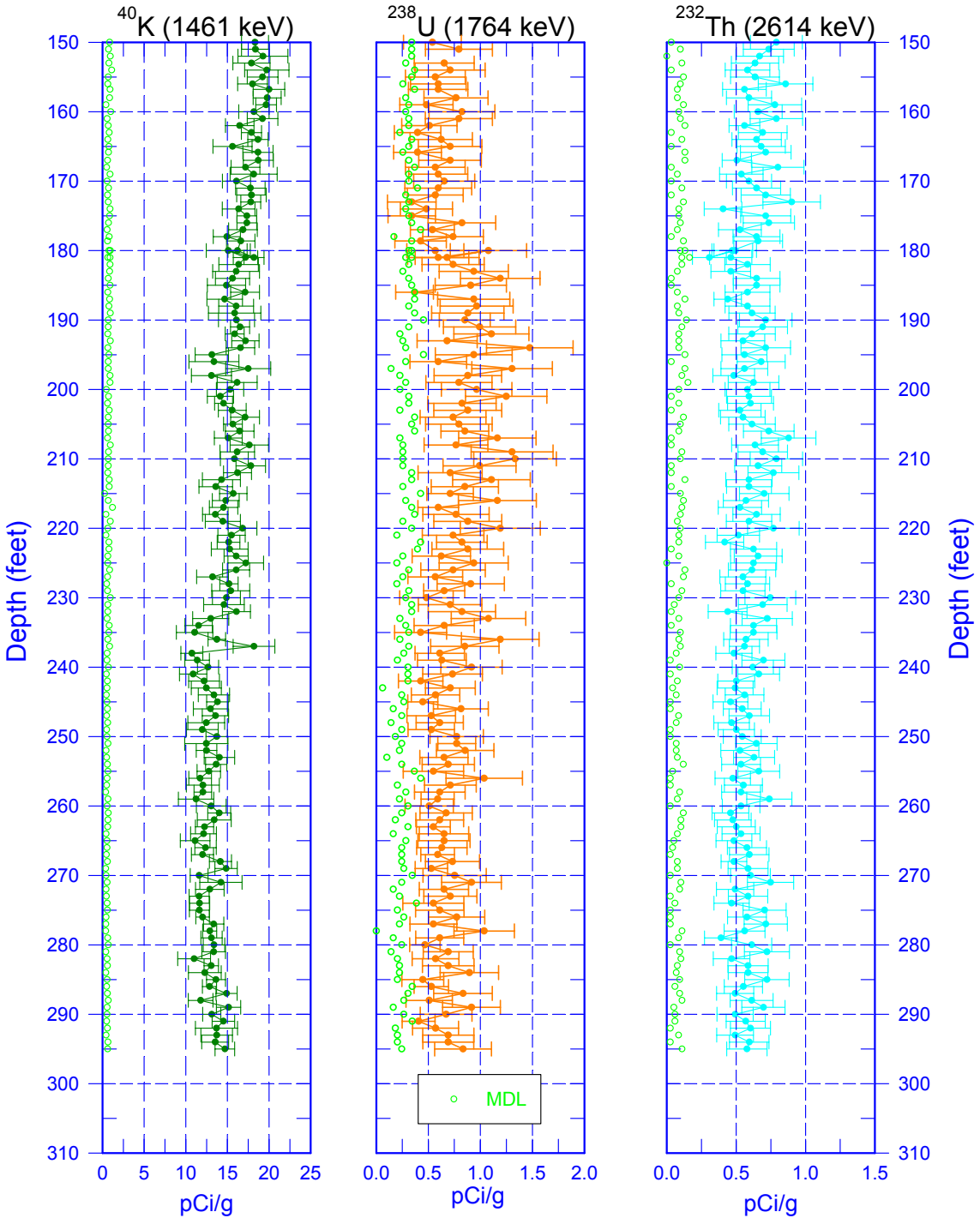
Zero Reference = Top of Casing

299-E28-18 (A4821)
Natural Gamma Logs



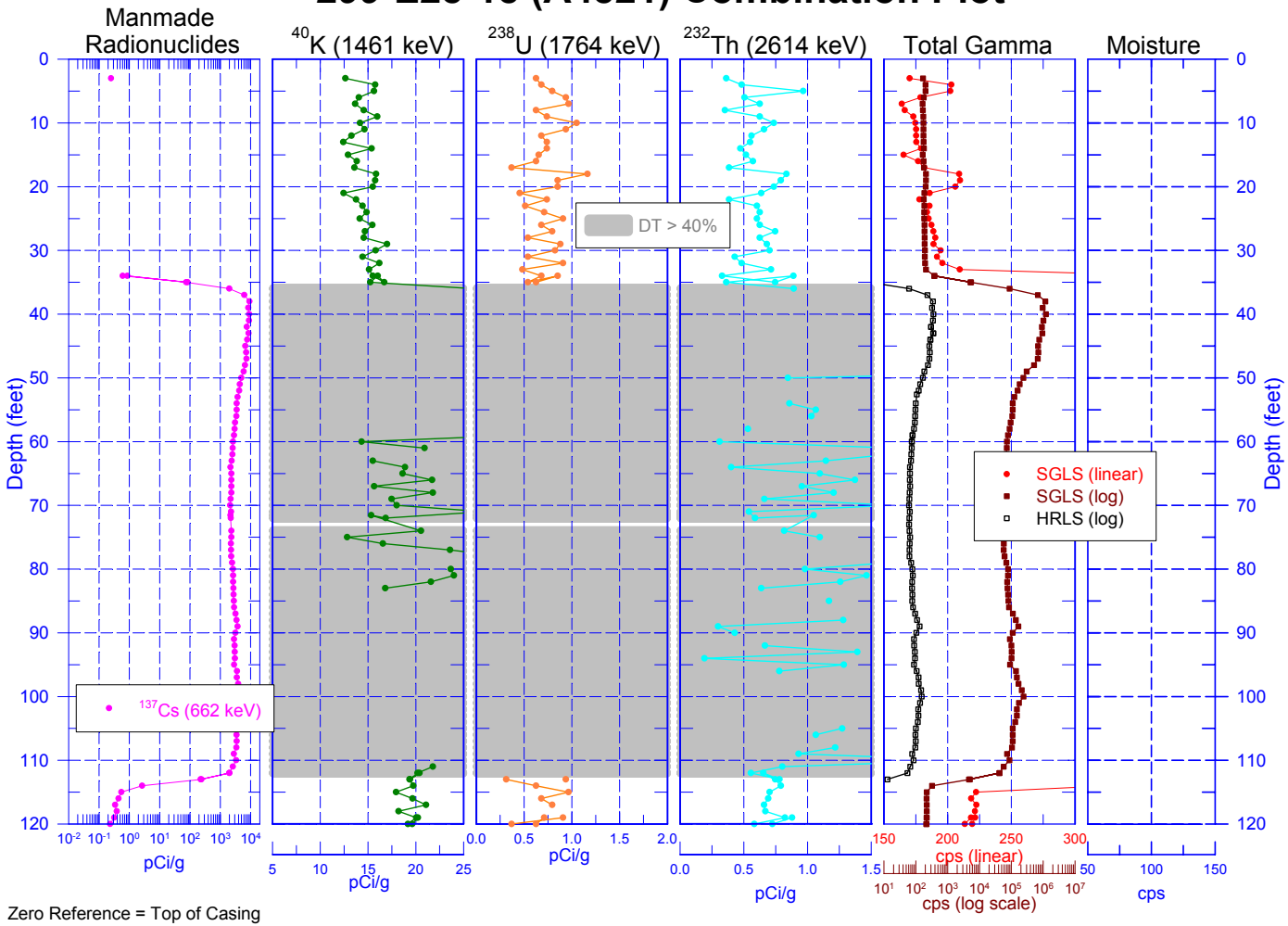
Zero Reference = Top of Casing

299-E28-18 (A4821)
Natural Gamma Logs



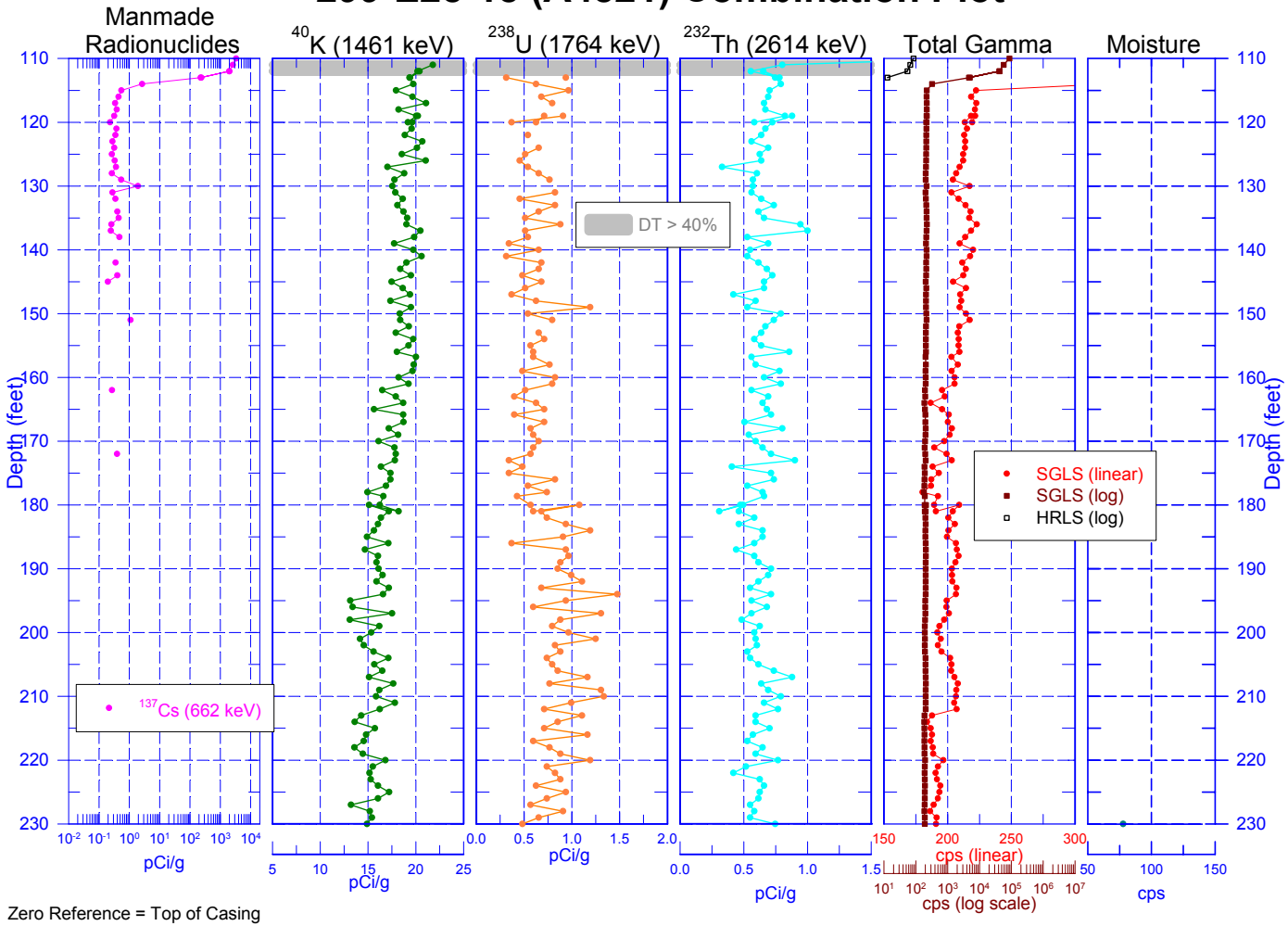
Zero Reference = Top of Casing

299-E28-18 (A4821) Combination Plot



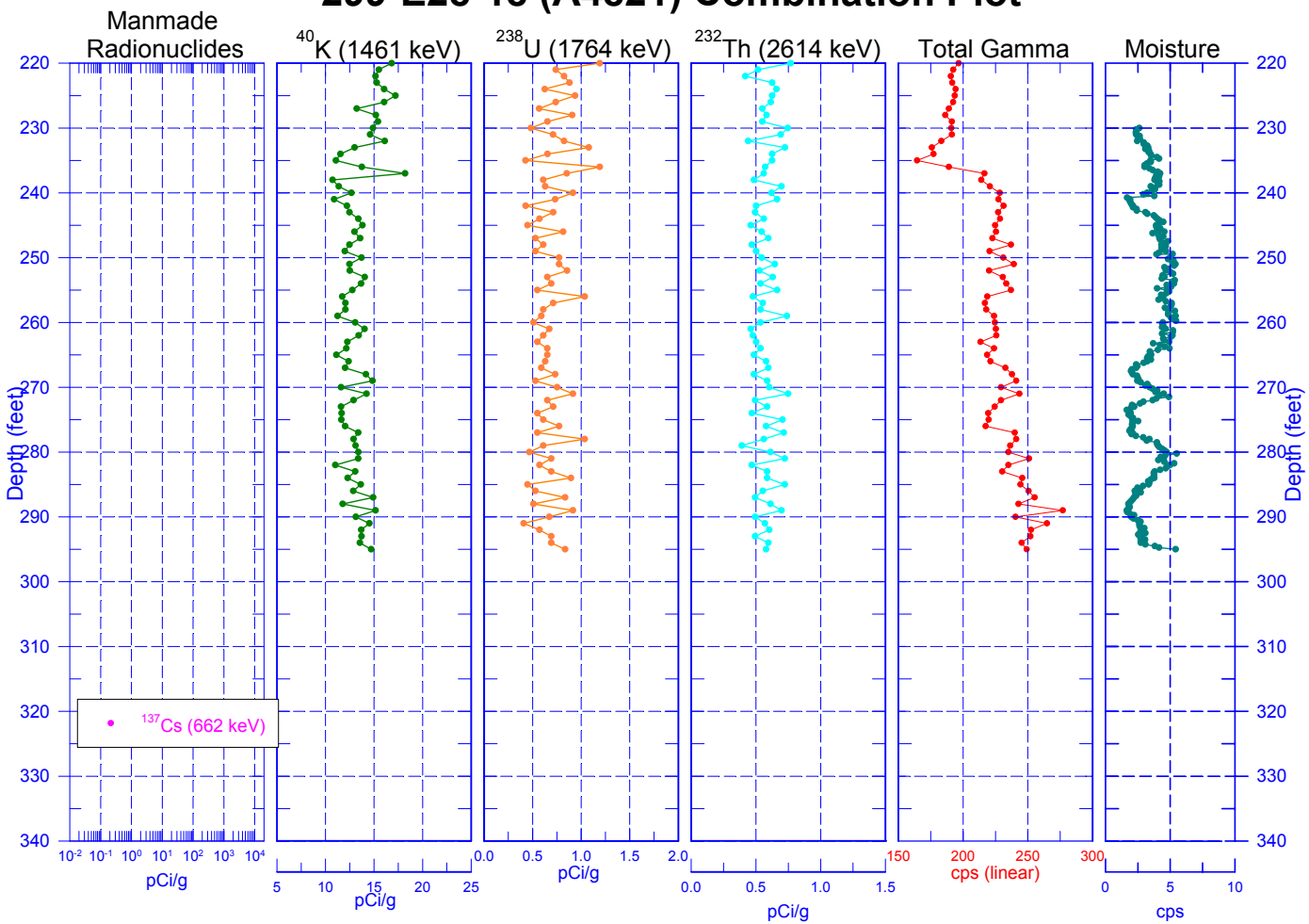
Zero Reference = Top of Casing

299-E28-18 (A4821) Combination Plot



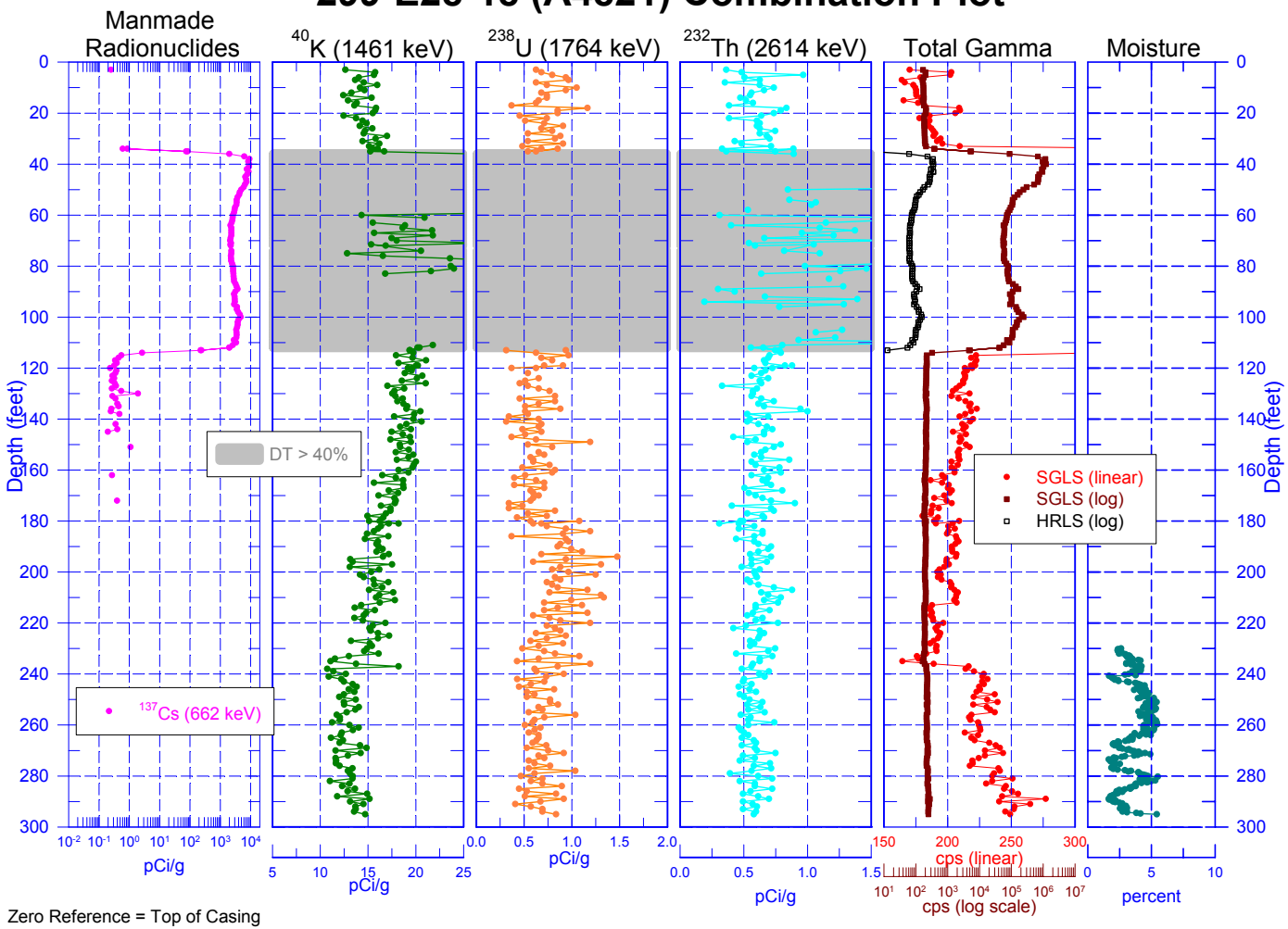
Zero Reference = Top of Casing

299-E28-18 (A4821) Combination Plot



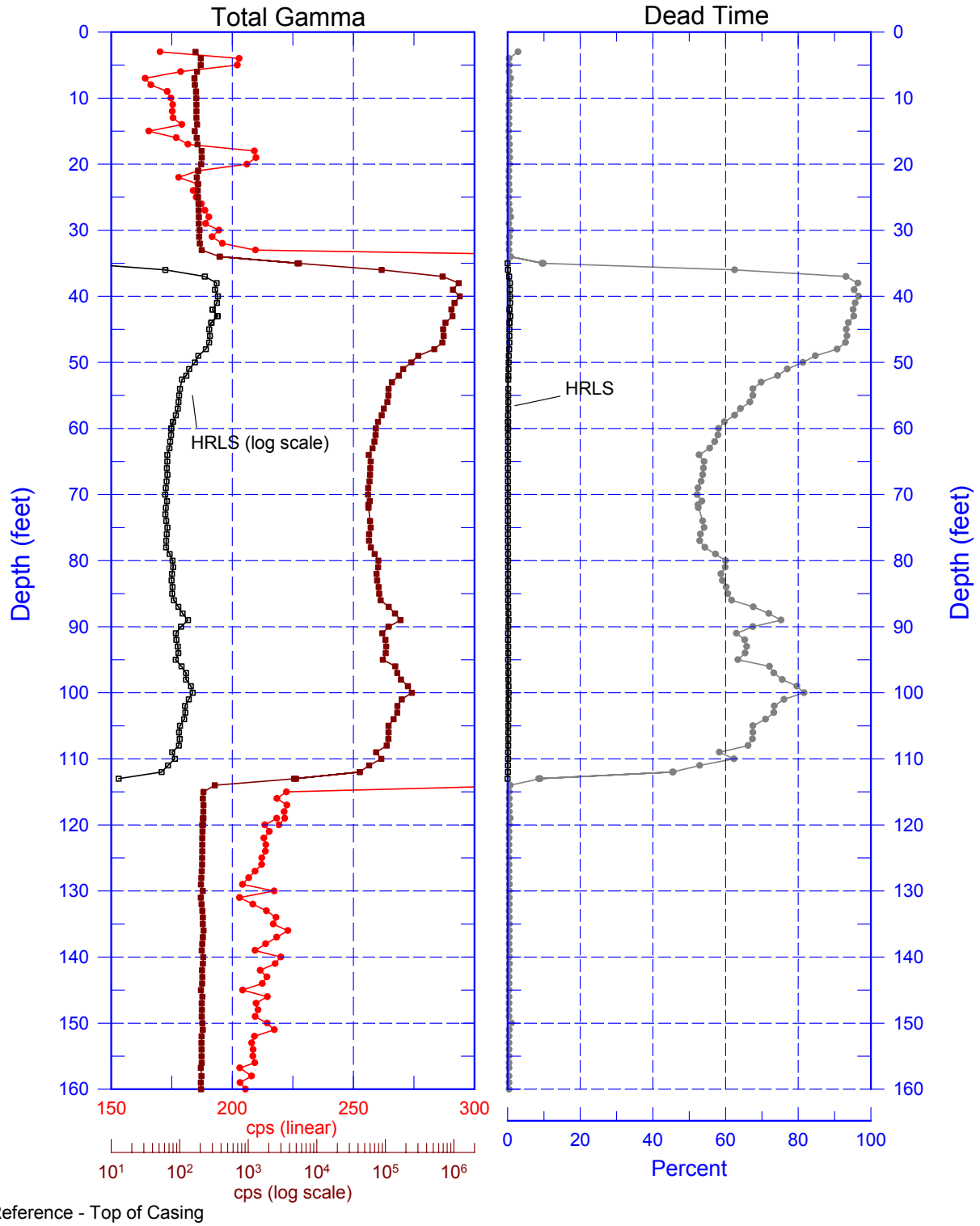
Zero Reference = Top of Casing

299-E28-18 (A4821) Combination Plot



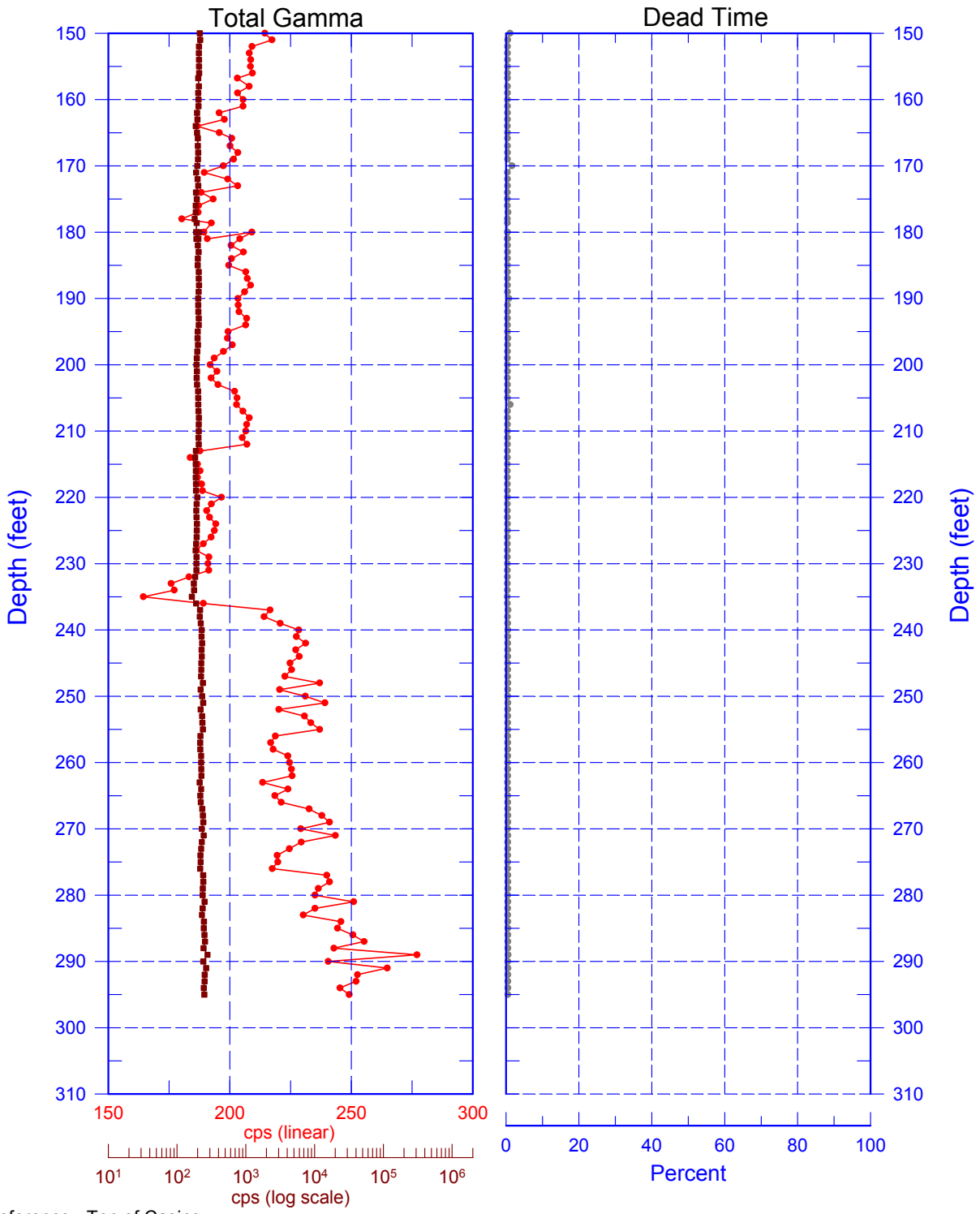
Zero Reference = Top of Casing

299-E28-18 (A4821)
Total Gamma & Dead Time



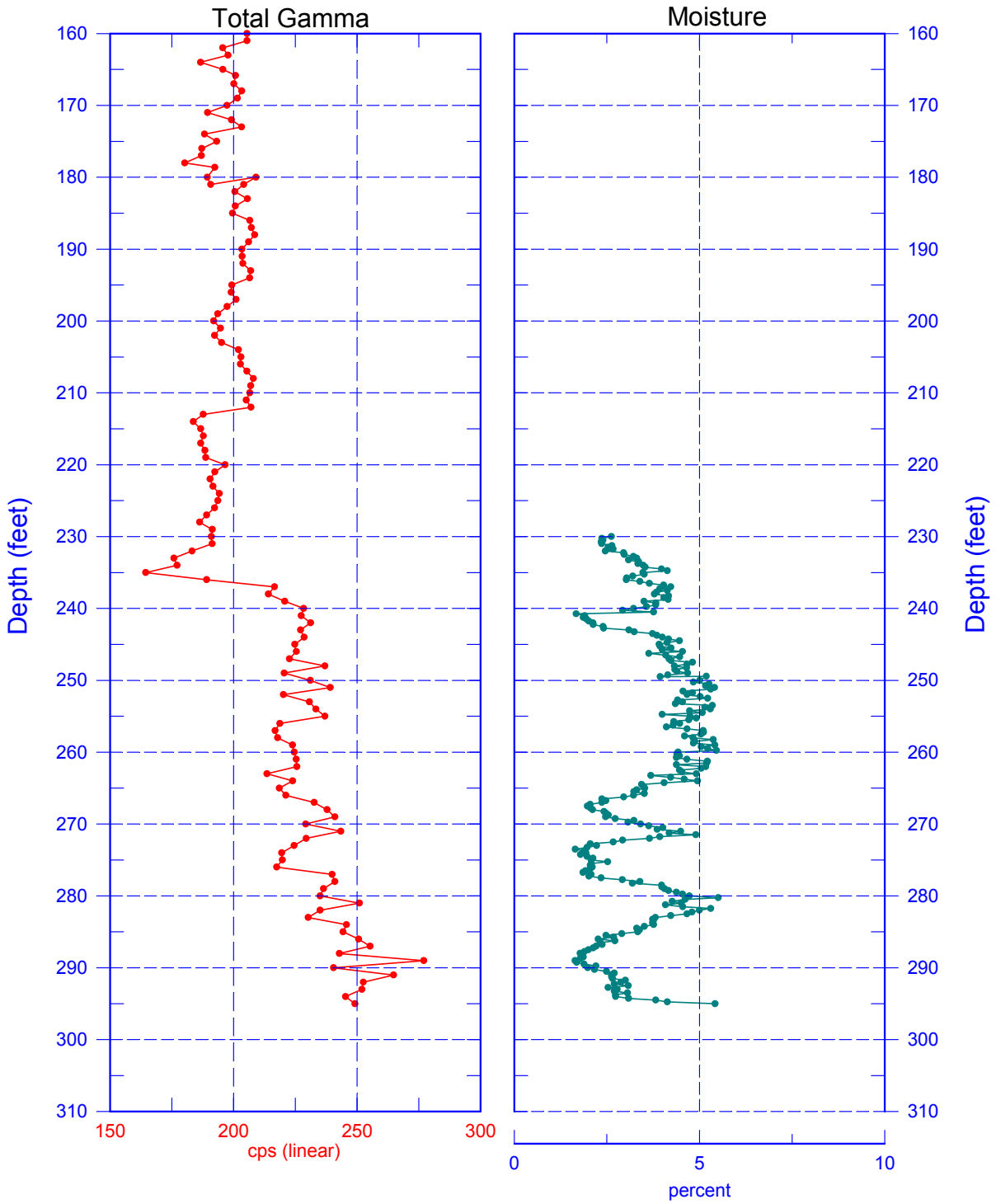
Reference - Top of Casing

299-E28-18 (A4821)
Total Gamma & Dead Time



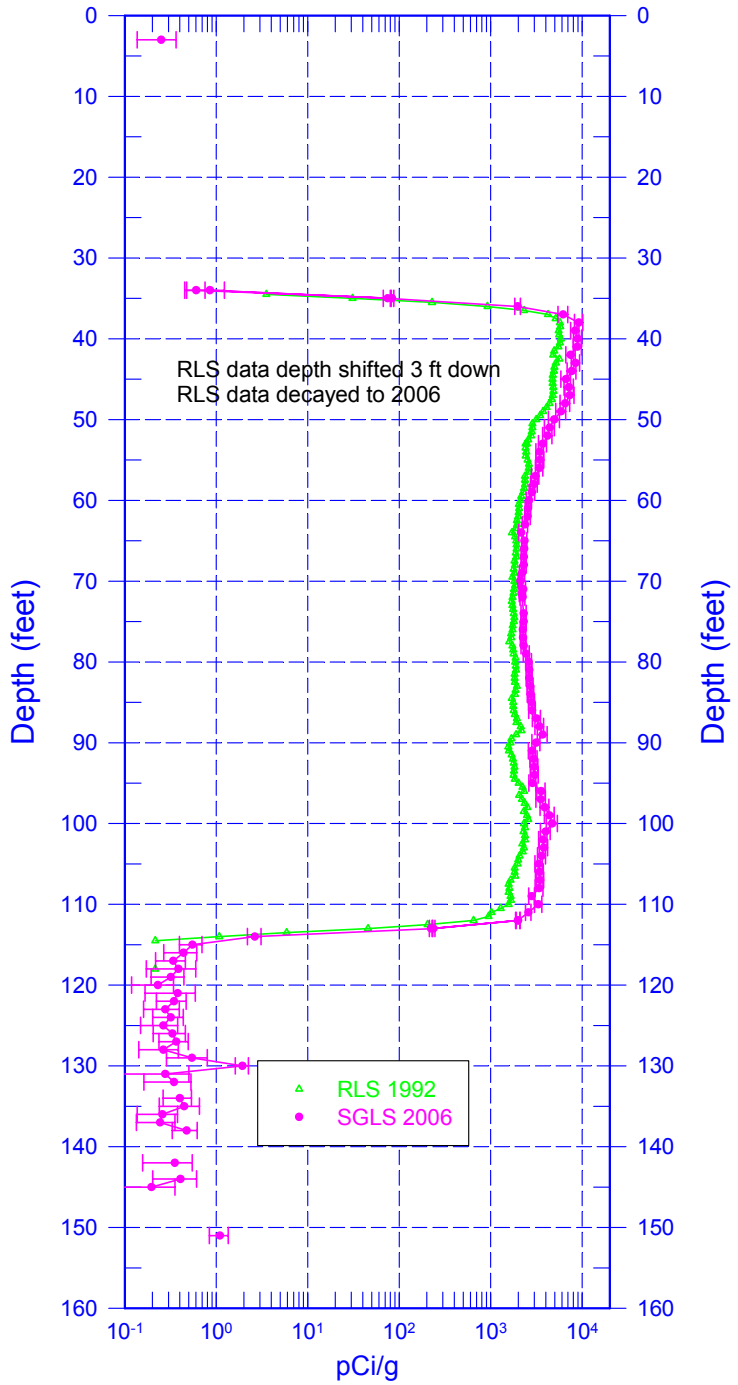
Reference - Top of Casing

299-E28-18 (A4821)
Total Gamma & Moisture



Reference - Top of Casing

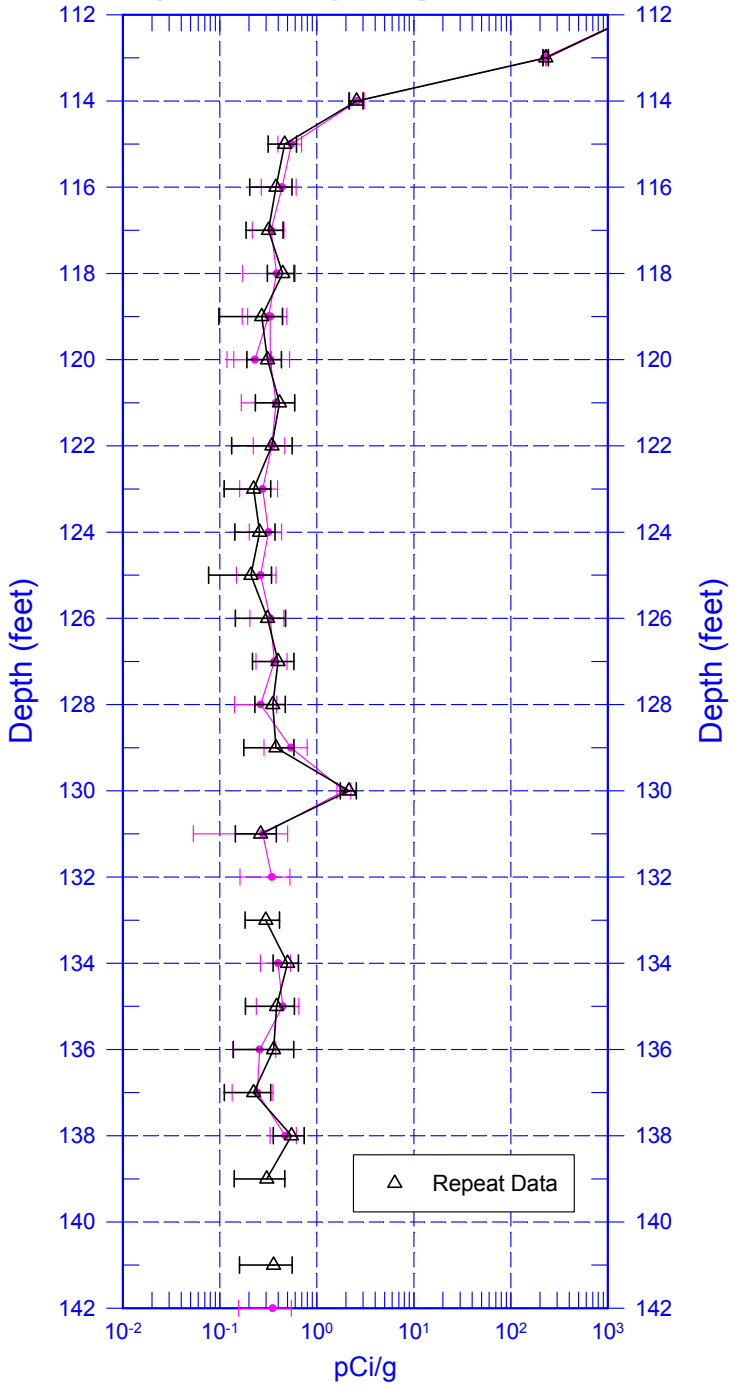
299-E28-18 (A4821)
^{137}Cs (662 keV) SGLS/RLS Comparison



Zero Reference = Top of Casing

299-E28-18 (A4821)

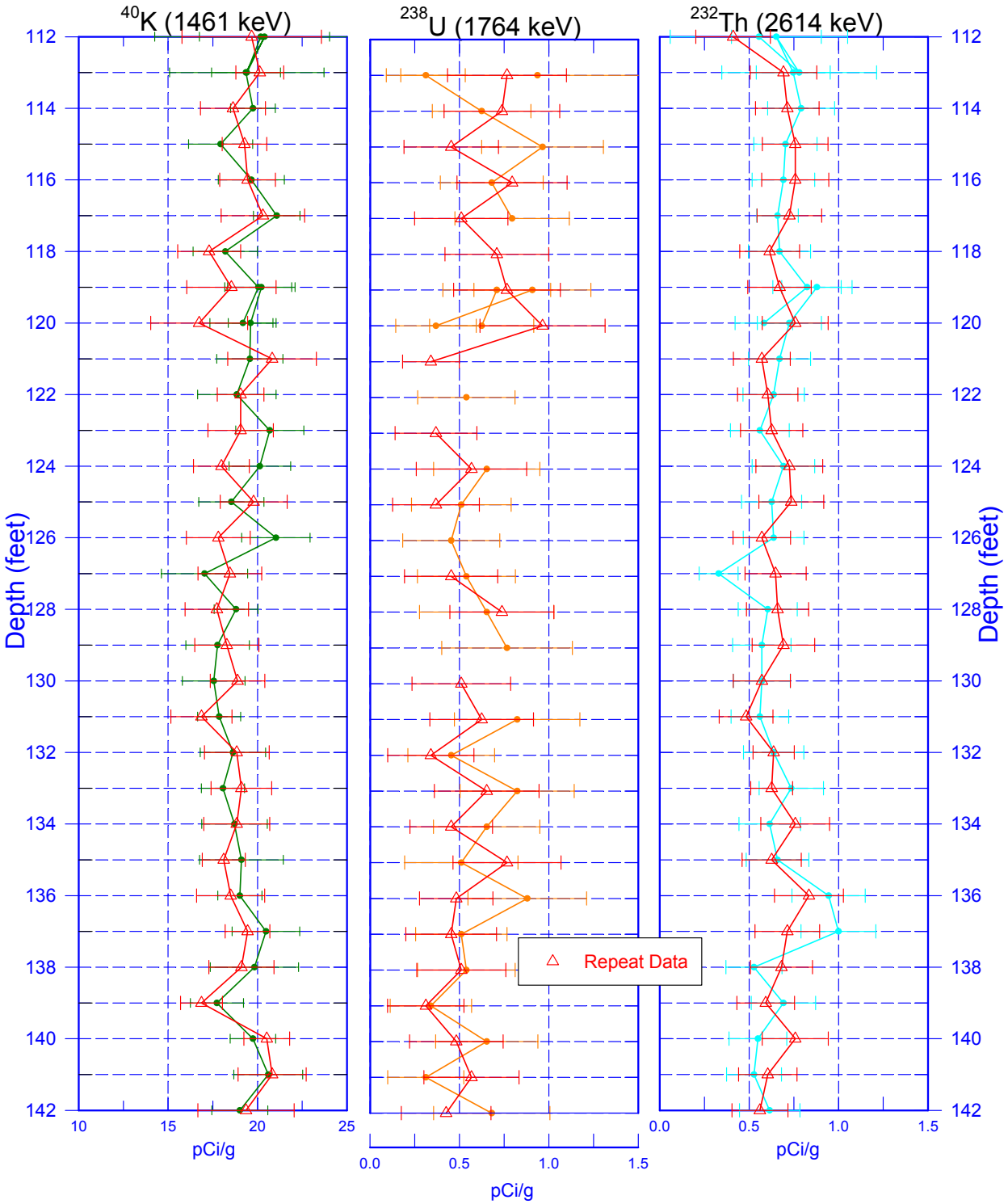
^{137}Cs (662 keV) Repeat Section



Zero Reference = Top of Casing

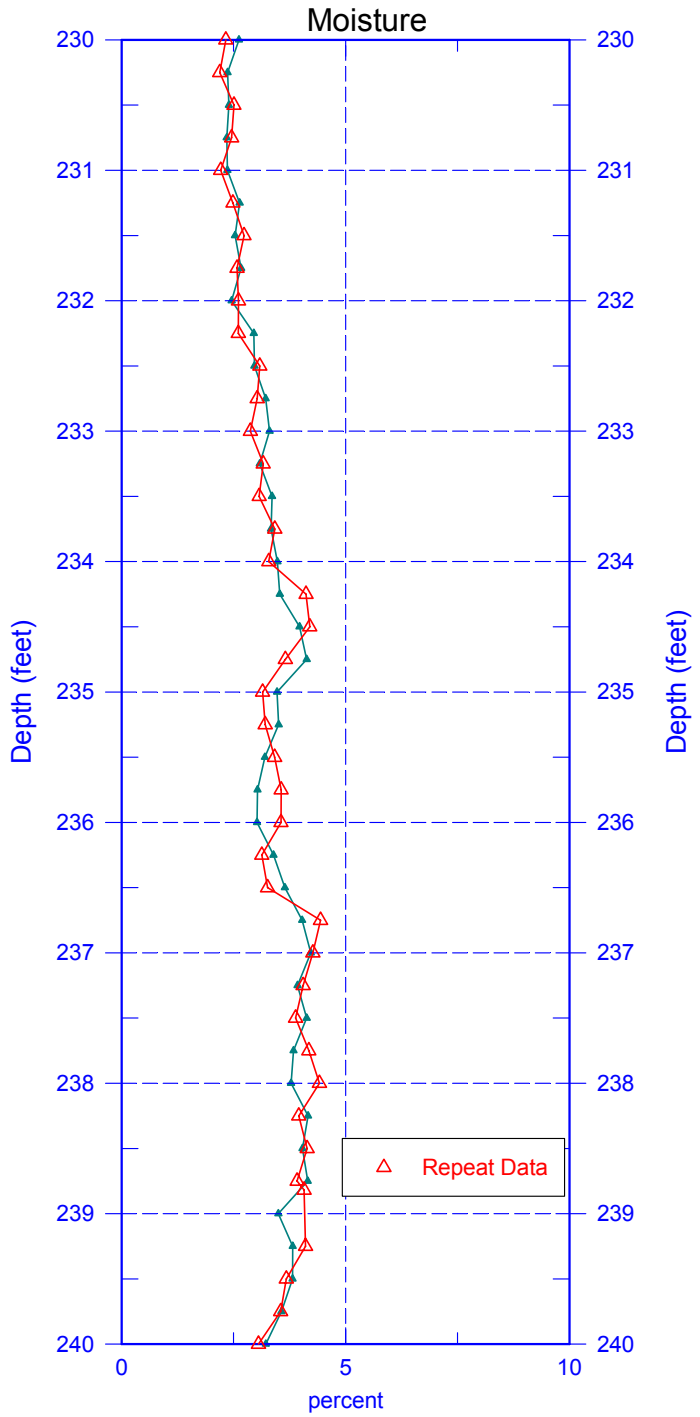
299-E28-18 (A4821)

Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing

299-E28-18 (A4821)
Moisture Repeat Section



Reference - Top of Casing