Stoller
Hanford Office
established 1959

HGLP-LDR-090

C5515
Log Data Report

Borehole Information:

Borehole:	C5515		Site:	216-A-2 Crib	
Coordinates (WA St Plane)		GWL[1] (ft) :	313.9	GWL Date:	08/23/07
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
Not Available	Not Available	08/07	Not Available	322	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	2.2	1 ¾	9 5/8	9/16	2.2	85
Not Available	4.0	8 3/4	7 ¾	½	4.0	321.9

Borehole Notes:

The logging engineer measured the casing diameters using a caliper and steel tape. The driller provided the casing depth. Logging data acquisition is referenced to the ground surface.

The first casing string (10-in.) was logged in July 2007. The casing was internally contaminated during drilling. To remove the contamination before logging, the casing was swabbed with wet "towels." As a further precaution, the logging sondes and cable were sleeved to prevent contamination of equipment. After completion of logging, the borehole was deepened with an 8-in. casing. Additional logging was conducted from 84 to 322 ft during August 2007.

Logging Equipment Information:

Logging System:	Gamma 1E		Type:	SGLS (70%) SN: 34TP40587A
Effective Calibration Date:	05/22/07	Calibration Reference:	HGLP-CC-016	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	Gamma 4L		Type:	SGLS (60%) SN: 47TP32211A
Effective Calibration Date:	07/09/07	Calibration Reference:	HGLP-CC-020	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	Gamma 1C		Type:	HRLS SN: 39-A314
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-004	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	G Gamma 4 H (with AmBe source)		Type:	NMLS SN: H310700352
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-002	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	G Gamma 4 H (with AmBe source)		Type:	PNLS SN: H310700352
Effective Calibration Date:	NA	Calibration Reference:	None required.	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat
Date	07/30/07	07/30/07	07/30/07	07/30/07
Logging Engineer	Pearson	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	22.0	36.0	69.0
Finish Depth (ft)	22.0	37.0	85.0	79.0
Count Time (sec)	100	20	100	100
Live/Real	R	R	R	R
Shield (Y/N)	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0
ft/min	N/A[2]	N/A	N/A	N/A
Pre-Verification	AE227CAB	AE227CAB	AE227CAB	AE227CAB
Start File	AE227000	AE227023	AE227039	AE227089
Finish File	AE227022	AE227038	AE227088	AE227099
Post-Verification	AE227CAA	AE227CAA	AE227CAA	AE227CAA
Depth Return Error (in.)	N/A	N/A	N/A	- 1
Comments	None	Dead Time > 40 %	Fine gain adjustment after file -086	None

Log Run	11	12	13 Repeat	
Date	08/23/07	08/28/07	08/28/07	
Logging Engineer	Pearson	Pearson	Pearson	
Start Depth (ft)	322.0	84.0	108.0	
Finish Depth (ft)	161.0	162.0	84.0	
Count Time (sec)	100	100	100	
Live/Real	R	R	R	
Shield (Y/N)	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	
ft/min	N/A	N/A[3]	N/A	
Pre-Verification	DL021CAB	DL031CAB	DL031CAB	
Start File	DL021000	DL031000	DL031079	
Finish File	DL021161	DL031078	DL031103	
Post-Verification	DL021CAA	DL031CAA	DL031CAA	
Depth Return Error (in.)	- 2.5	N/A	+ 1	
Comments	Fine gain adjustment after files -035, 101, 135, 144	None	None	

High Rate Logging System (HRLS) Log Run Information:

Log Run	5	6			
Date	07/30/07	07/30/07			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	21.0	26.0			
Finish Depth (ft)	36.0	29.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	Y (Internal)			
MSA Interval (ft)	1.0	0.5			
ft/min	N/A	N/A			
Pre-Verification	AC175CAB	AC175CAB			
Start File	AC175000	AC175016			
Finish File	AC175015	AC175022			
Post-Verification	AC175CAA	AC175CAA			
Depth Return Error (in.)	- 0.5	- 0.5			
Comments	No fine gain adjustment	Fine gain adjustment after file -018			

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7	8 Repeat	14	15	16 Repeat
Date	07/31/07	07/31/07	08/28/07	08/28/07	08/28/07
Logging Engineer	Pearson	Pearson	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	25.0	84.0	284.0	305.0
Finish Depth (ft)	85.0	35.0	284.0	313.0	280.0
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	DH622CAB	DH622CAB	DH672CAB	DH672CAB	DH672CAB
Start File	DH622000	DH622341	DH672000	DH682000	DH682117
Finish File	DH622340	DH622381	DH672801	DH682116	DH682217
Post-Verification	DH622CAA	DH622CAA	DH682CAA	DH682CAA	DH682CAA
Depth Return Error (in.)	N/A	0	N/A	N/A	- 1.5
Comments	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	9	10 Repeat			
Date	07/31/07	07/31/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	24.0			
Finish Depth (ft)	85.0	30.0			
Count Time (sec)	60	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	0.25			
ft/min	N/A	N/A			
Pre-Verification	DH632CAB	DH632CAB			
Start File	DH632000	DH632086			
Finish File	DH632085	DH632110			
Post-Verification	DH632CAA	DH632CAA			
Depth Return Error (in.)	N/A	- 1			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

For log runs 1 through 10 (0 to 85 ft), a plastic sleeve was placed over the sondes and cable to prevent internal casing contamination from adhering to the equipment. Logging was conducted with a centralizer on each sonde. Measurements are referenced to ground surface.

Analysis Notes:

Analyst:	P.D. Henwood	**Date:**	09/24/07	**Reference:**	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. Acceptance criteria were met for all systems. A casing correction for 9/16-in.-thick casing was applied to the spectral log data (SGLS and HRLS) from the ground surface to 85 ft. A casing correction for 1/2-in. thick casing was applied to SGLS data acquired below 85 ft.

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 G1EMay07.xls and G4LJuly07.xls for the SGLS and G1CNov06.xls for the HRLS using efficiency functions and

corrections for casing and dead time as determined from annual calibrations. Where dead time is excessive, HRLS data (with and without the internal shield) are substituted for the SGLS data. Moisture data were converted to volumetric moisture using calibrations acquired from 6- and 8-in. casings. Therefore, the data acquired in the 10-in. casing (0 to 85 ft) are not accurate and indicate only relative moisture changes and the data below 85 ft are based on calibrations. There is no calibration for passive neutron data that are reported in counts per second.

Results and Interpretations:

Cs-137 is detected in this borehole at the ground surface and from 18 to 86 ft. The maximum concentration is measured at approximately 2 million pCi/g at 27.5 ft in depth. However, because the contamination appears to lie in a thin interval (probably 0.5 ft or less) this assay could be significantly underestimated. The calibration of the logging system response is based on an infinite, uniform distribution that is not consistent with thin bed responses. Internal casing contamination appears to be reflected in the data. Concentration data below 28 ft most likely is solely due to casing contamination rather than contamination in the formation.

From 21 to 24 ft, and again from 32 to 37 ft, Cs-137 concentrations determined from the SGLS are about an order of magnitude higher than those determined by the HRLS. In these intervals, the values are at or below the low end of the HRLS measurement range and the SGLS values are considered more reliable.

Moisture data reflect some thin intervals of slightly higher moisture content. The data from 282 to 302 ft reflect a relatively large interval of higher moisture that coincides with an interval of high K-40, U-238, and Th-232 concentrations that represent a lithologic change. The relatively high moisture represented at approximately 27.5 ft may not be accurate. The detector is influenced by the extremely high gamma activity at this depth. High moisture is indicated in the data acquired in July near the bottom of the extent of the first casing string at approximately 85 ft. It is believed this moisture is the result of attempts to swab the borehole to remove internal contamination rather than formation moisture. It is not known if the relatively high moisture between 85 and 92 ft is also an artifact of the swabbing.

Passive neutron logging was performed in the borehole. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α,n) reaction and may indicate the presence of transuranic radionuclides. Many transuranic radionuclides decay predominantly by alpha particle emission and the passive neutron system may be useful to identify the existence of these radionuclides where no gamma emissions are available for detection. There is no calibration for this logging system and the data provided are to be used qualitatively.

The passive neutron indicates approximately 100 cps at 27.5 ft. This count rate is believed to be influenced by the high gamma activity at this depth rather than representing the existence of alpha emitting contaminants. The count rate exhibited by the passive neutron logging is subtracted from the moisture count rate data acquired at the same depths to better approximate the true moisture content.

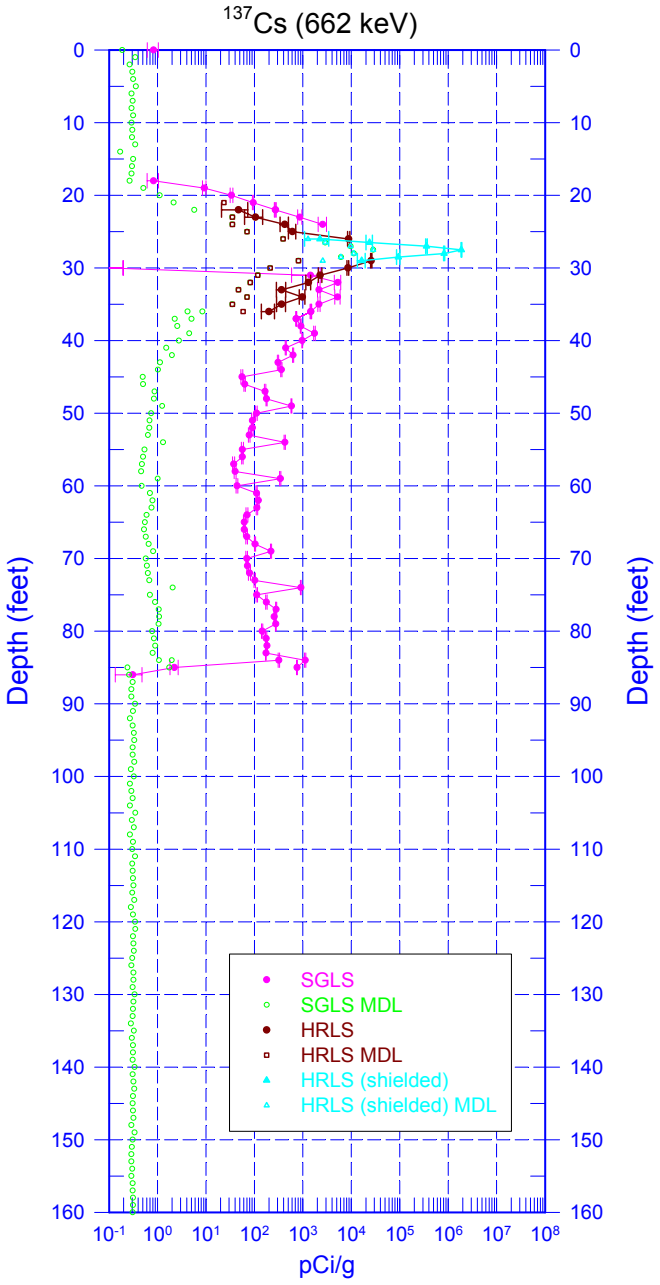
The repeat sections for the SGLS, NMLS, and PNLS indicate good agreement.

List of Plots:

Manmade Radionuclides (2 pages)
Natural Gamma Logs (2 pages)
Combination Plot (3 pages)
Combination Plot (0-325 ft) (1 page)
Total Gamma, Moisture, & Passive Neutron (2 pages)
Total Gamma & Dead Time (2 pages)
Repeat of Manmade Radionuclides (1 page)
Repeat Section of Natural Gamma Logs (1 page)
Repeat of Moisture & Passive Neutron (1 page)

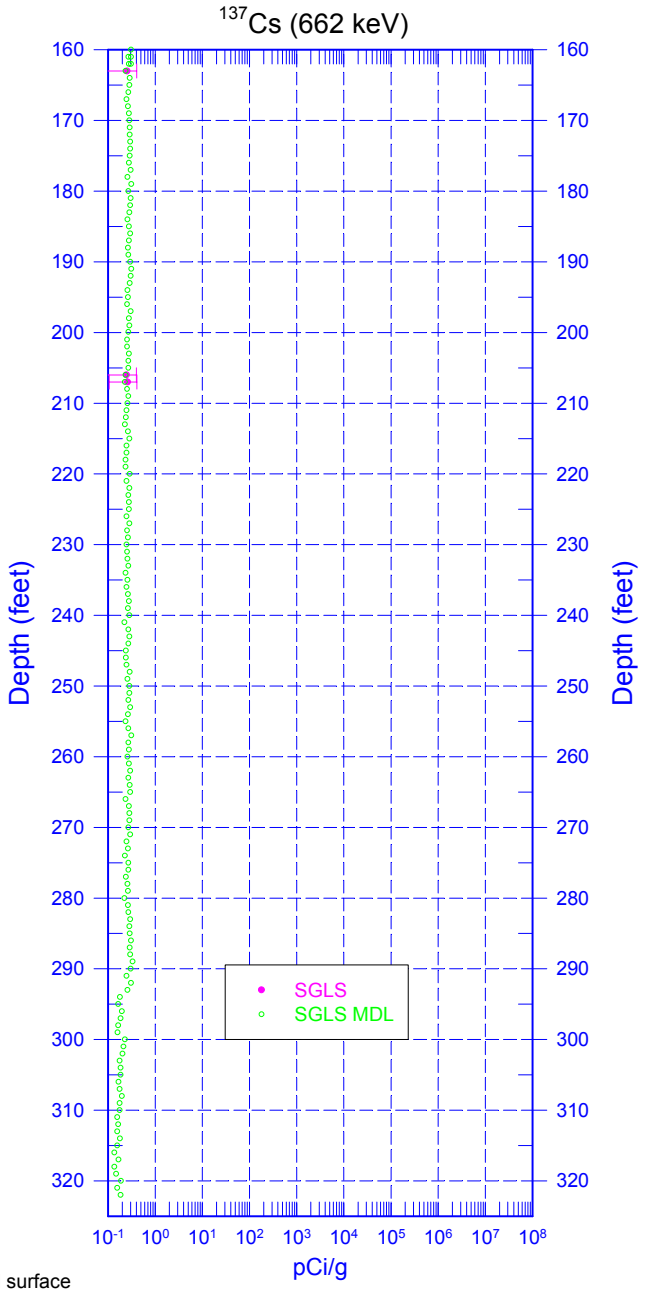
[1] GWL – groundwater level

C5515
Manmade Radionuclides



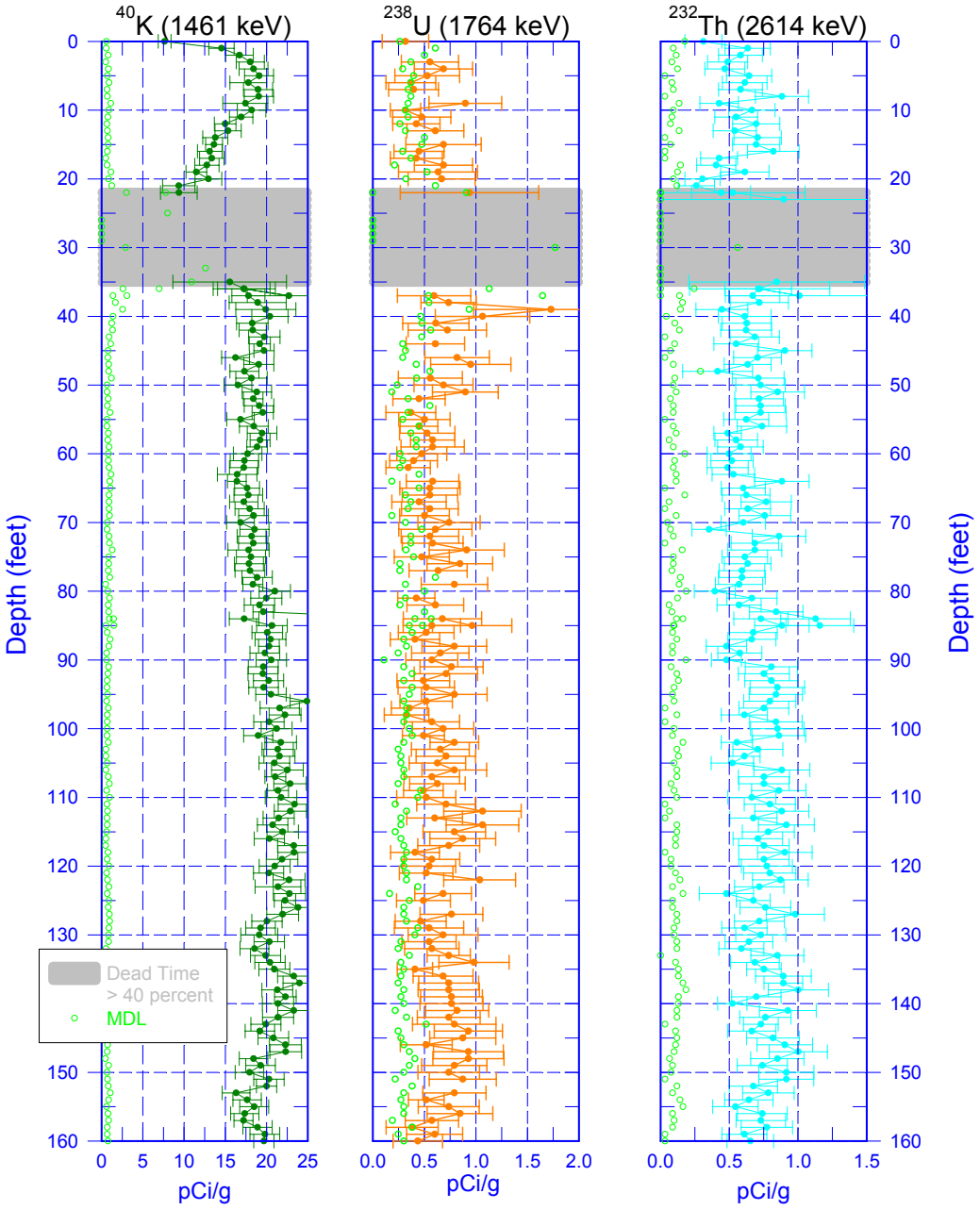
Zero Reference = Ground surface

C5515
Manmade Radionuclides



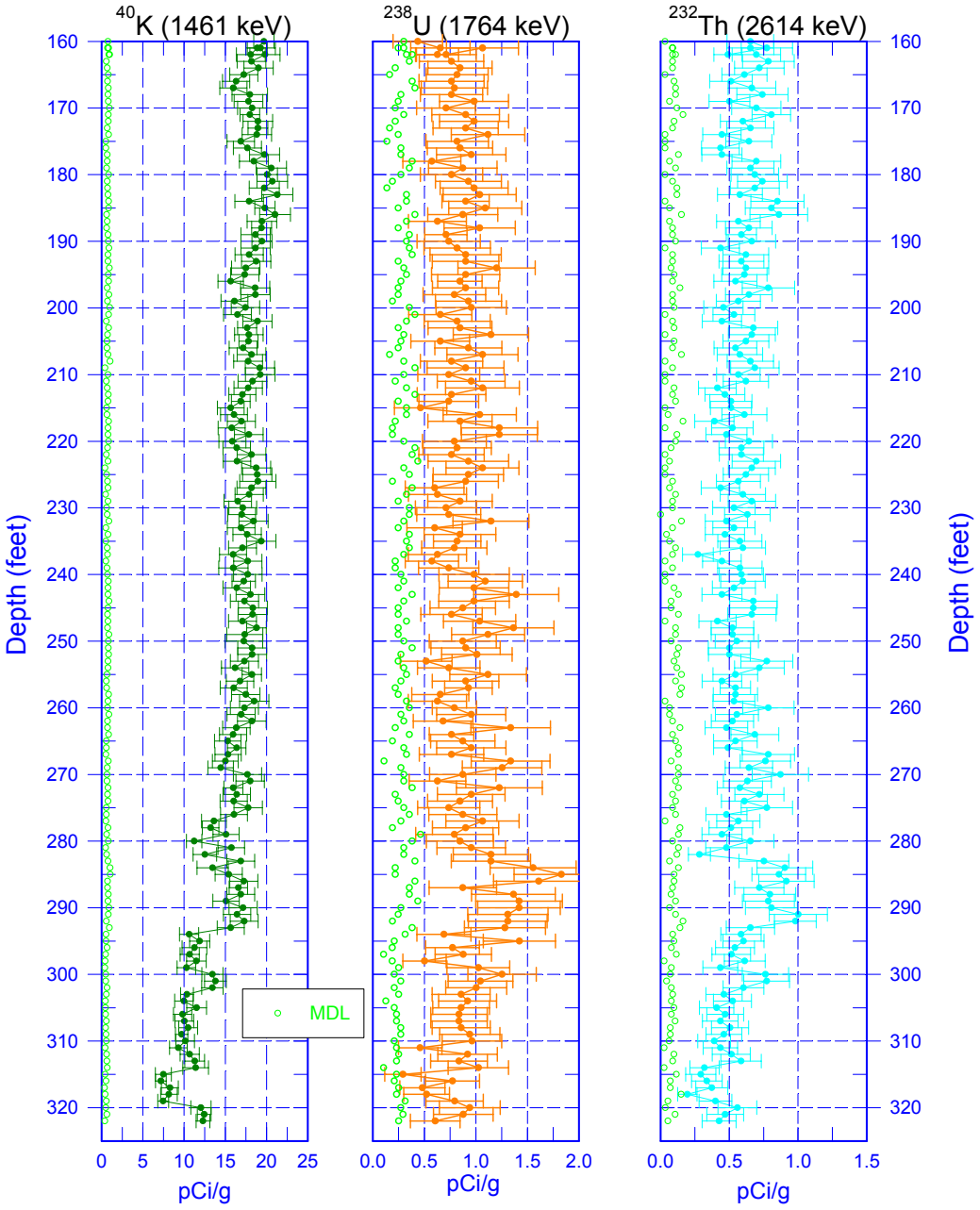
Zero Reference = Ground surface

C5515
Natural Gamma Logs



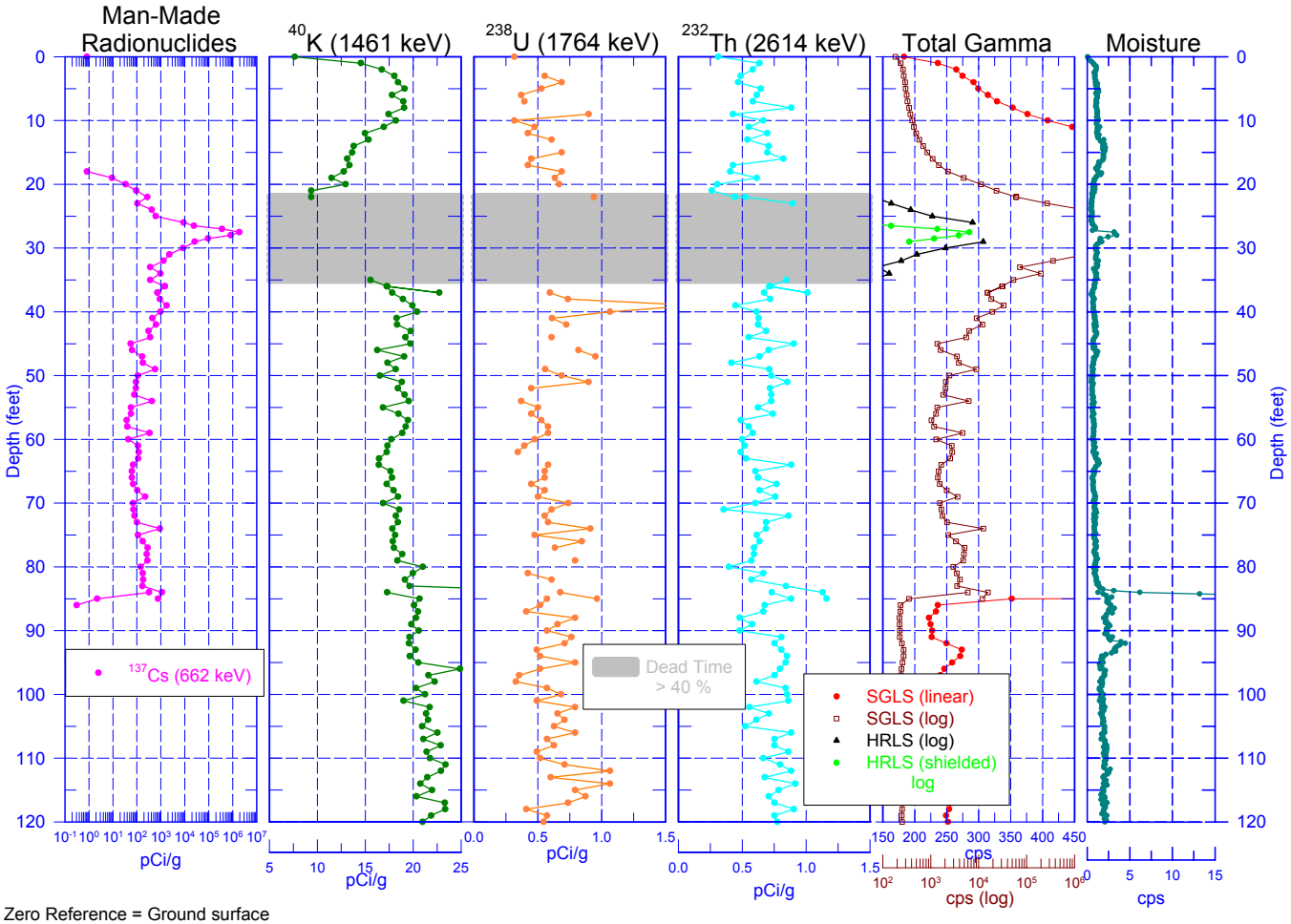
Zero Reference = Ground surface

C5515
Natural Gamma Logs



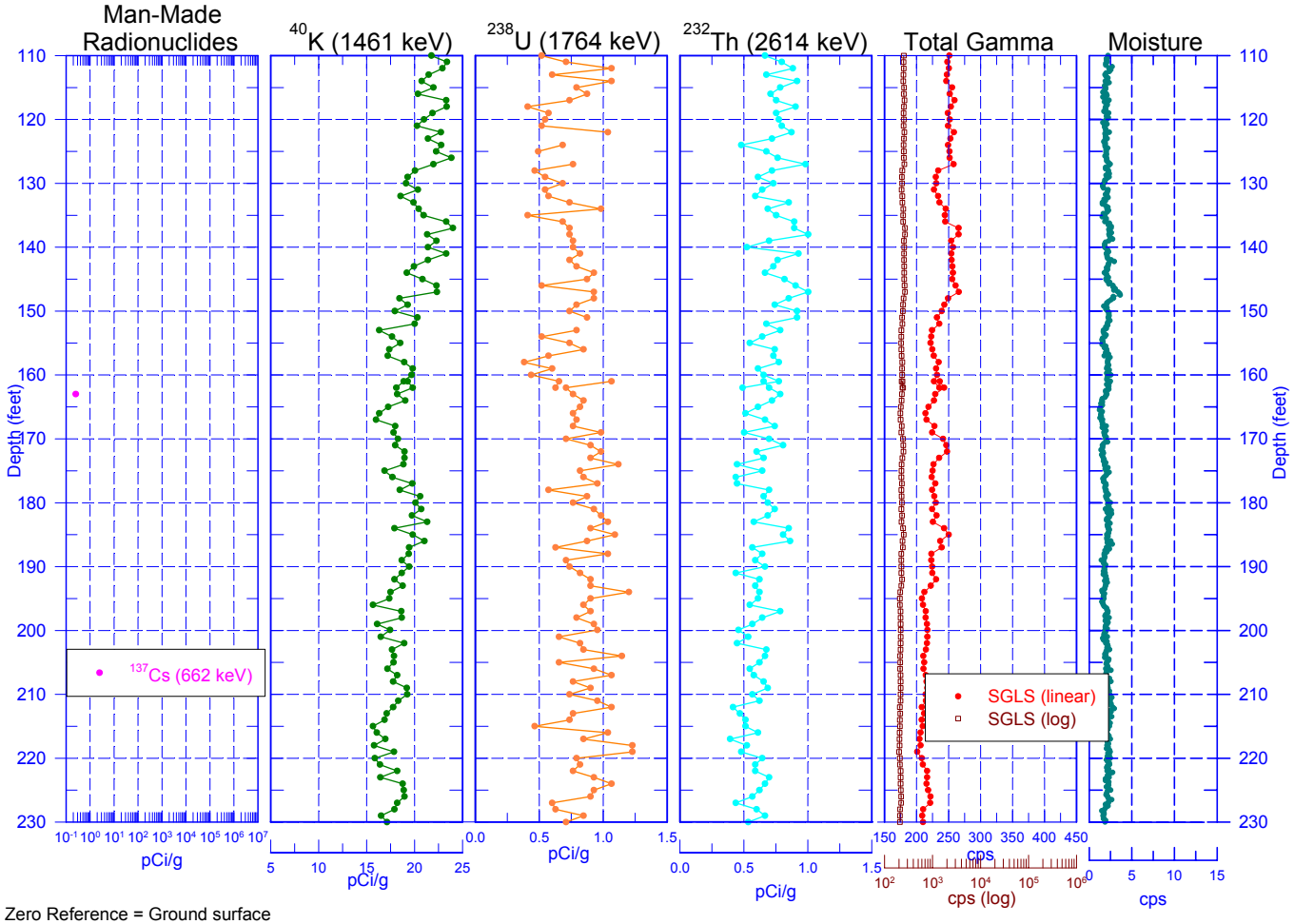
Zero Reference = Ground surface

C5515 Combination Plot



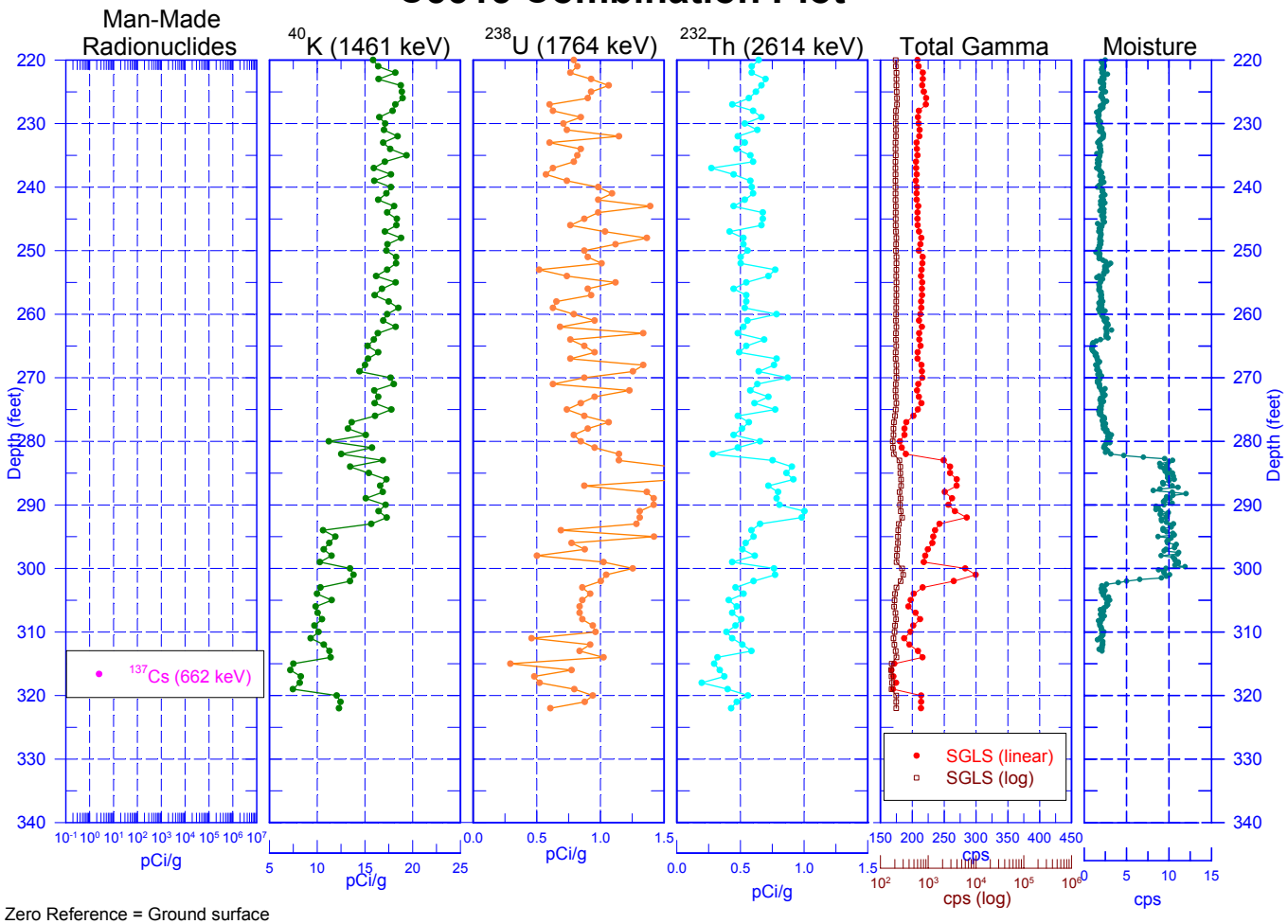
Zero Reference = Ground surface

C5515 Combination Plot



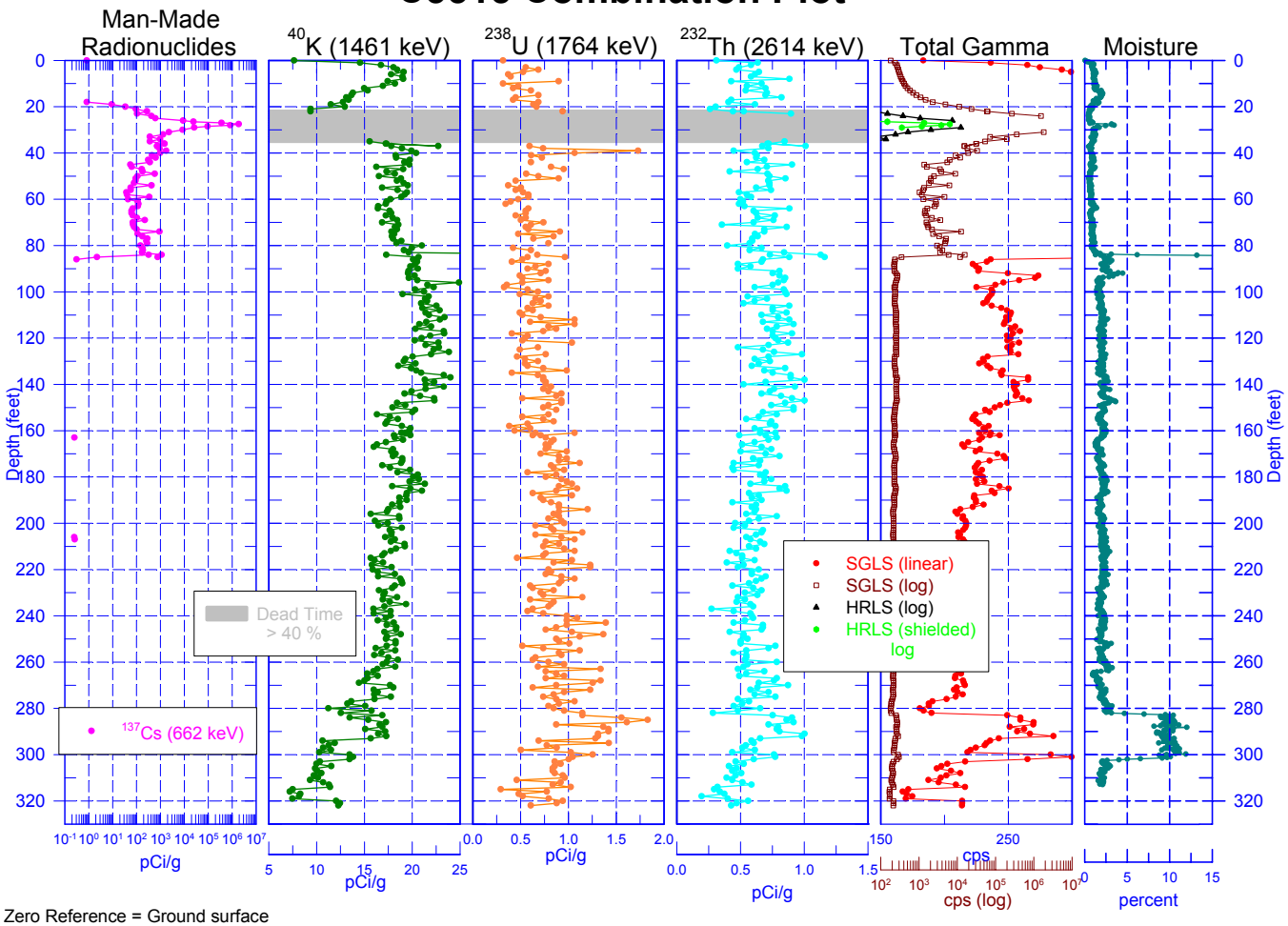
Zero Reference = Ground surface

C5515 Combination Plot



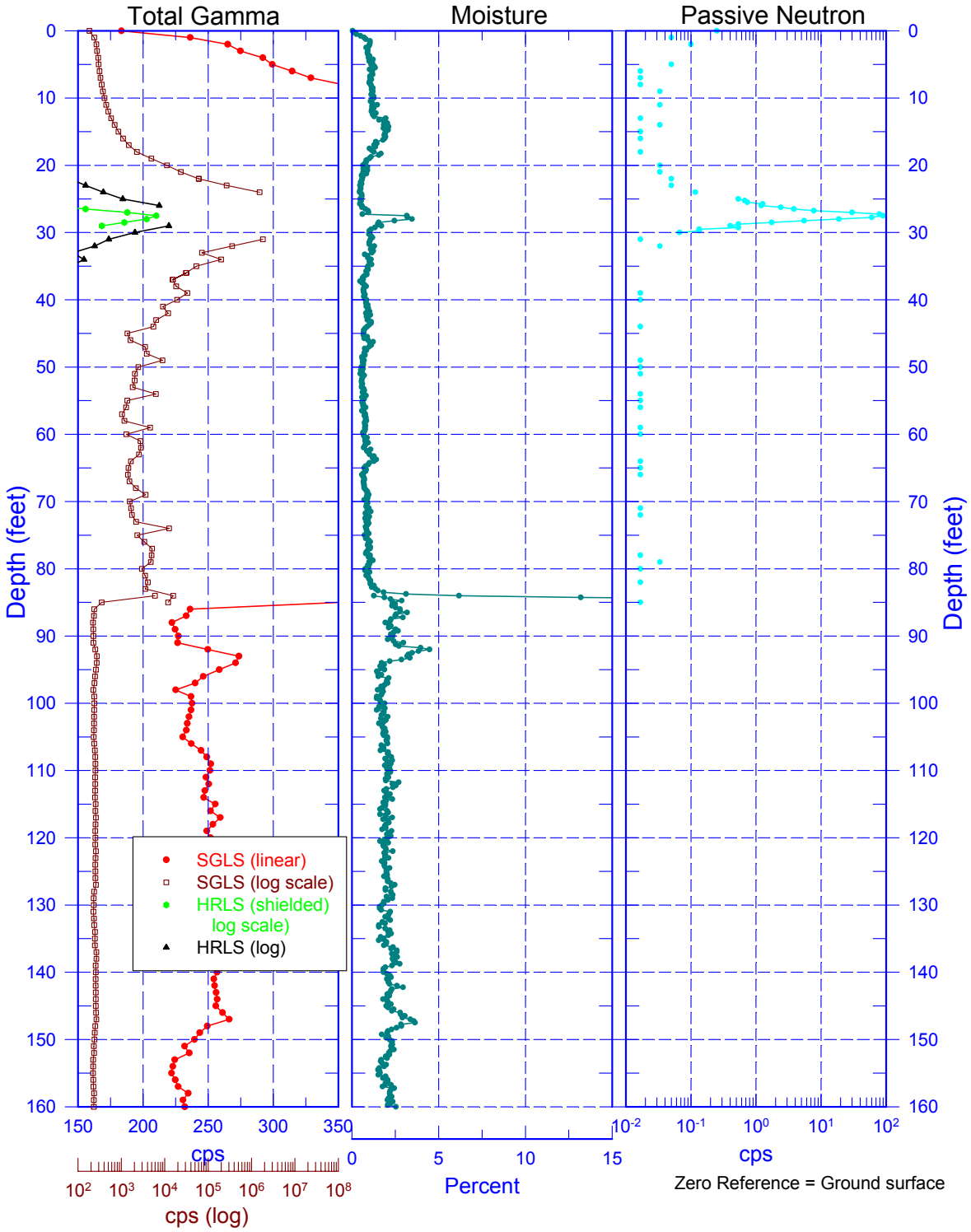
Zero Reference = Ground surface

C5515 Combination Plot

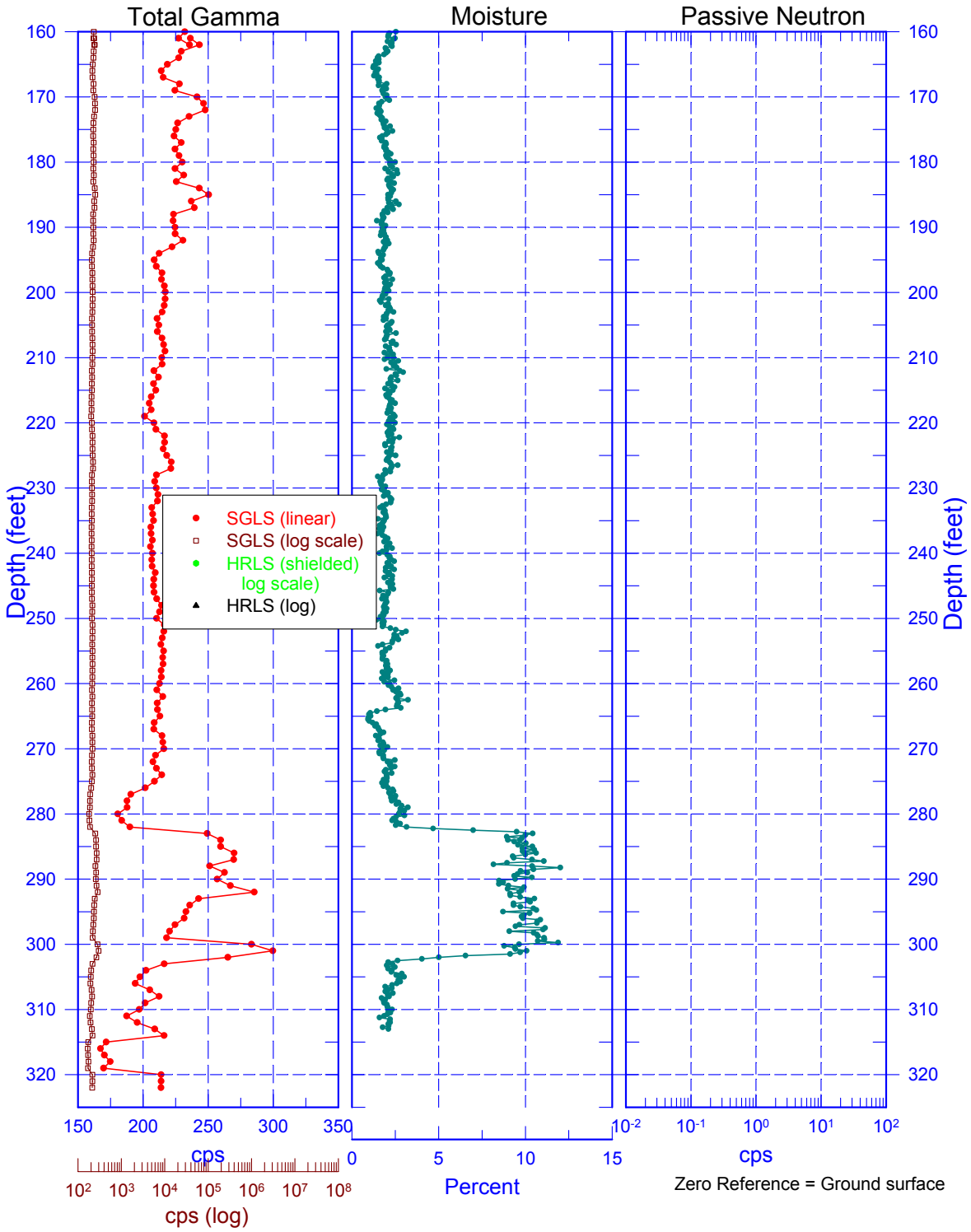


Zero Reference = Ground surface

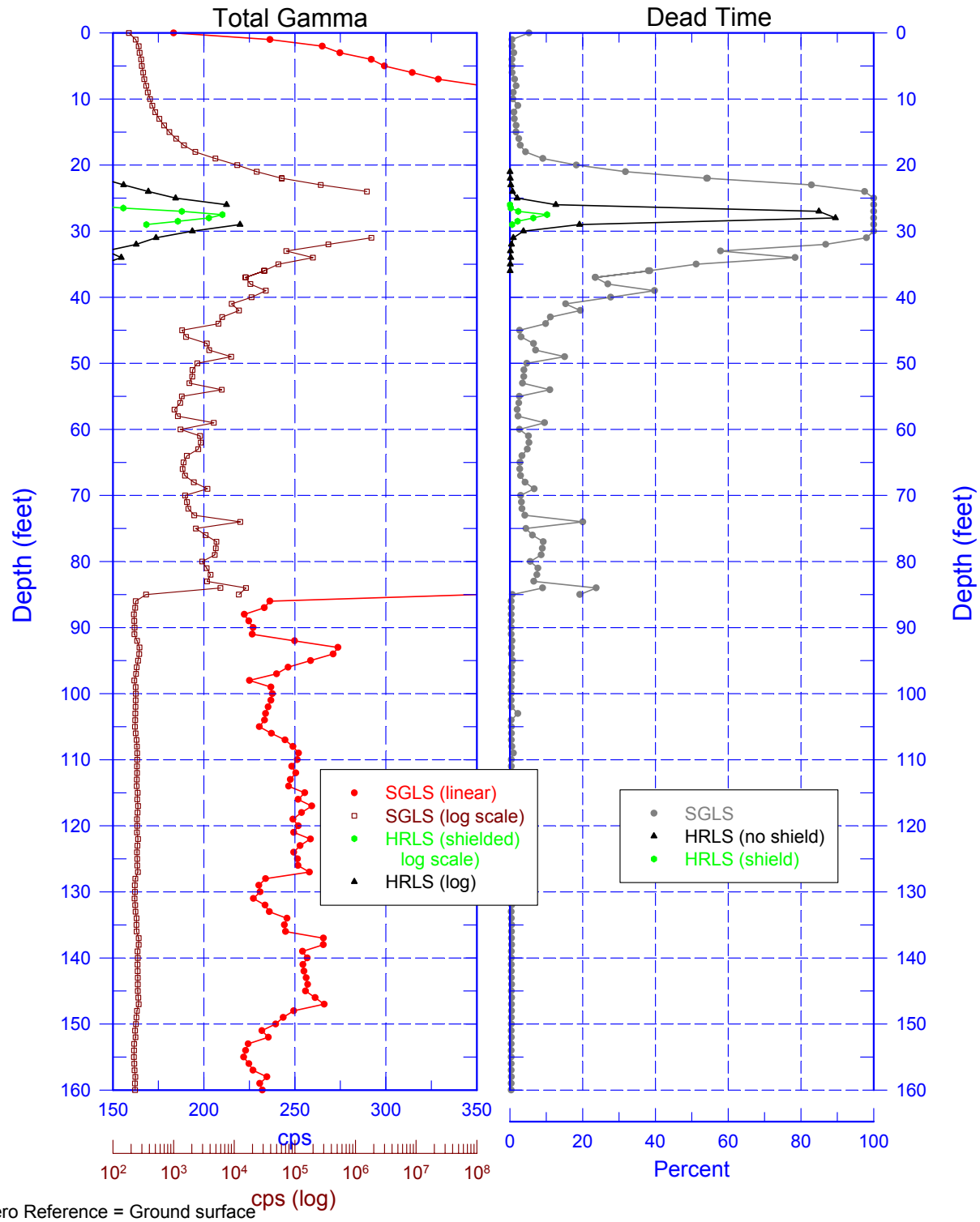
C5515
Total Gamma, Moisture, & Passive Neutron



C5515
Total Gamma, Moisture, & Passive Neutron

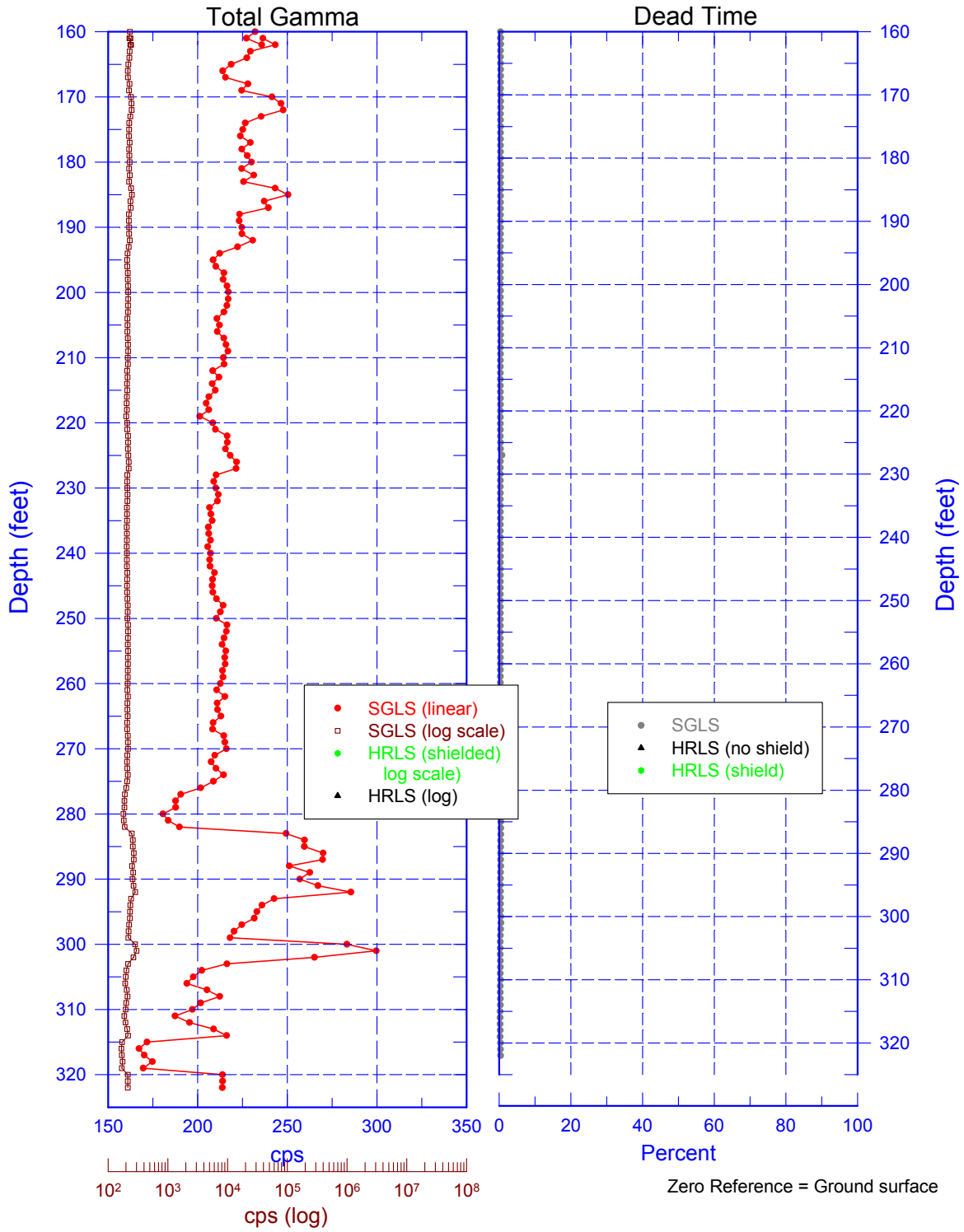


C5515
Total Gamma & Dead Time

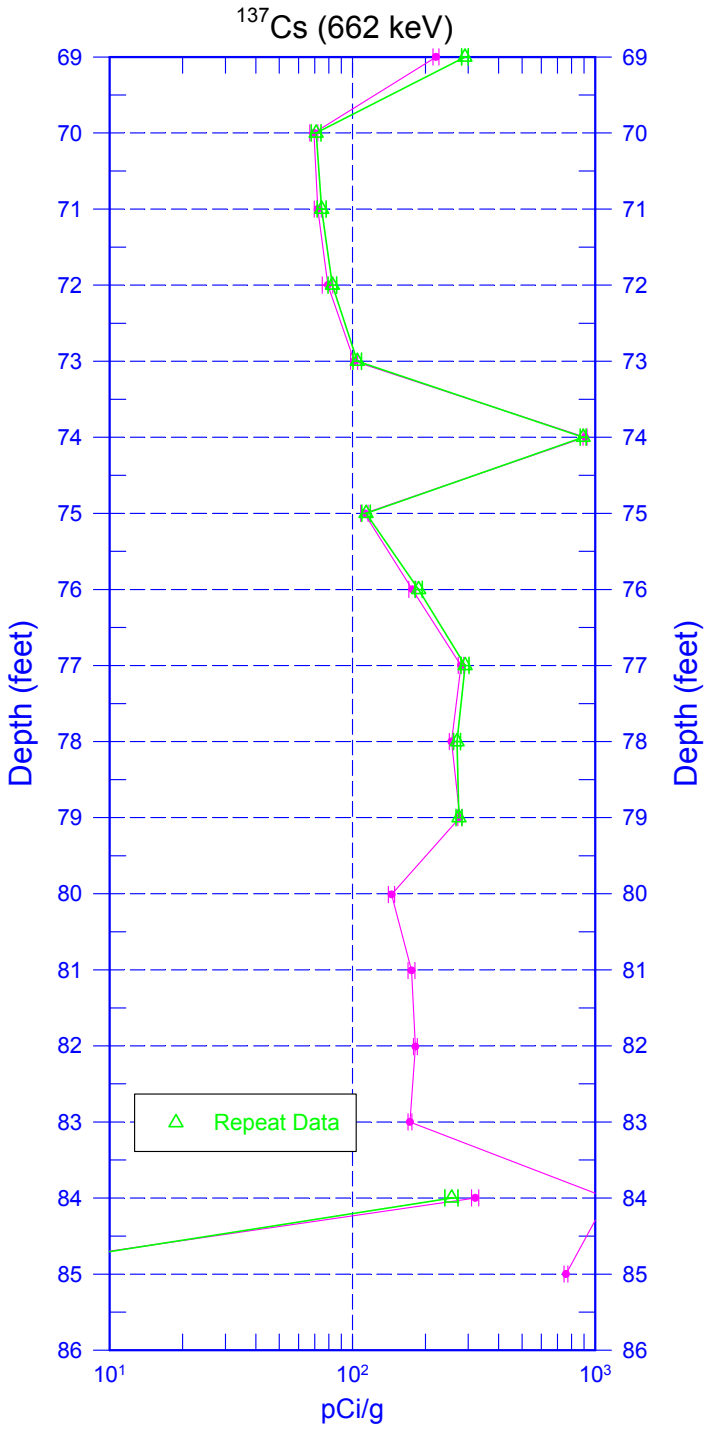


Zero Reference = Ground surface

C5515
Total Gamma & Dead Time



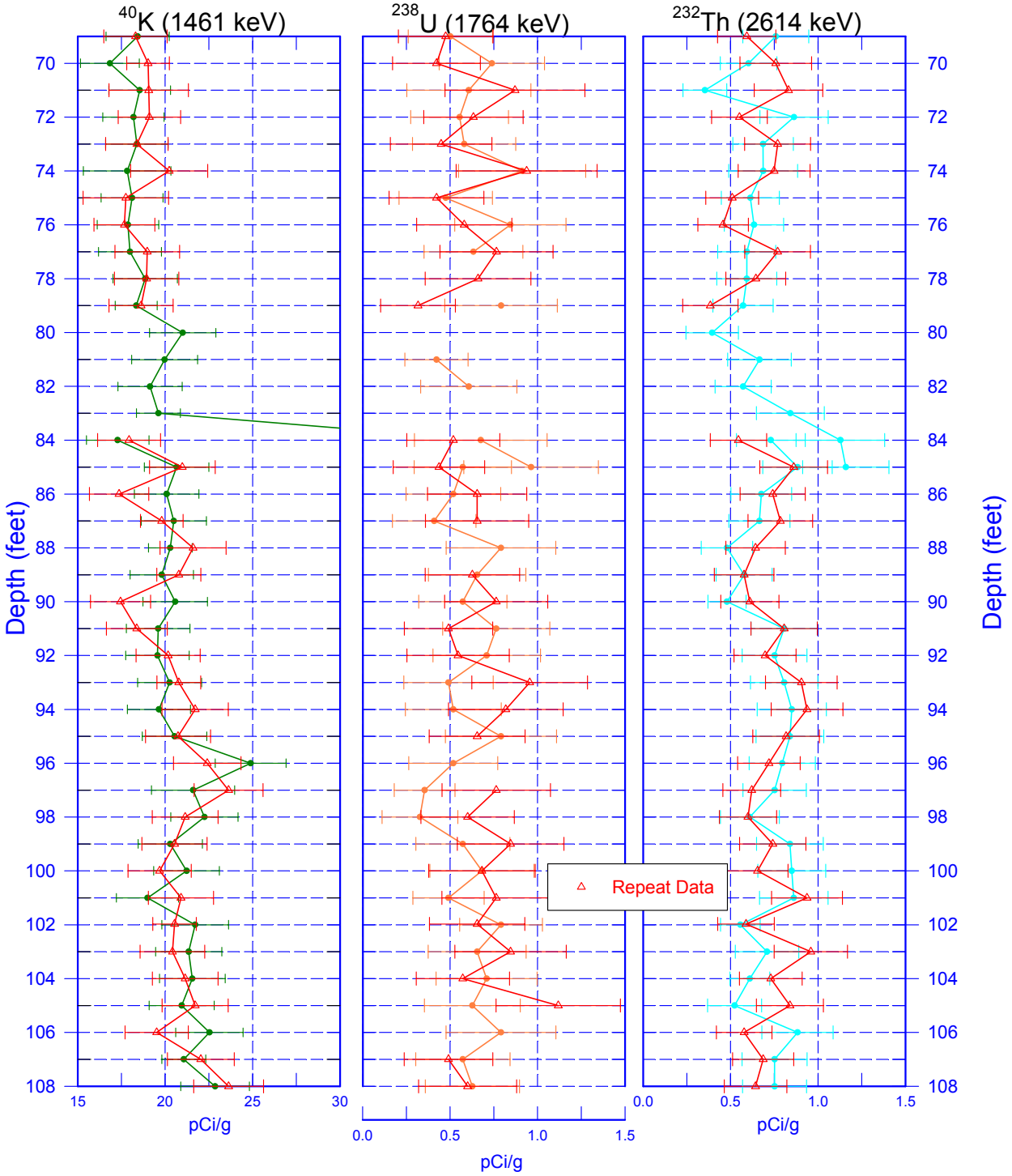
C5515
Repeat of Manmade Radionuclides

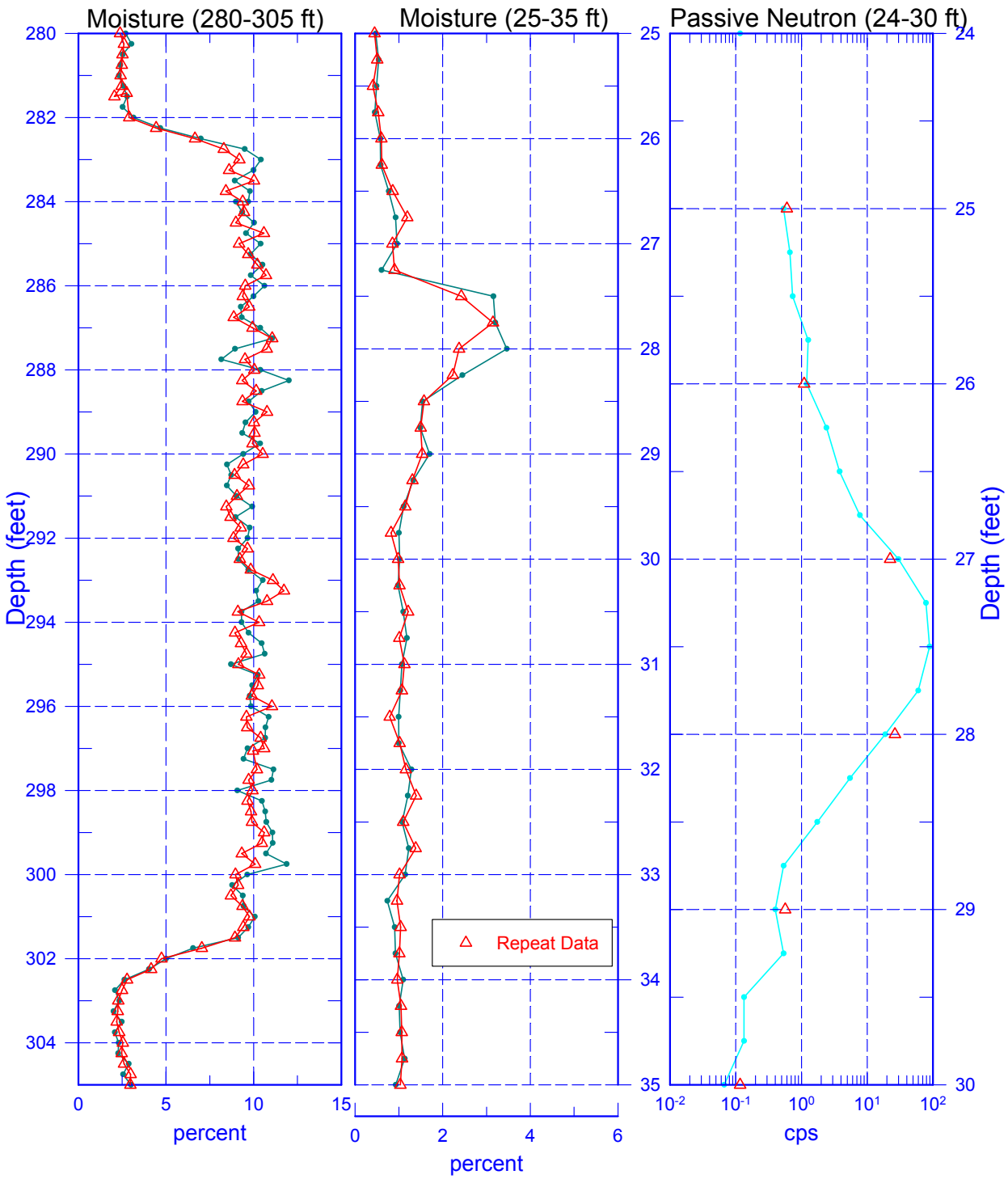


Zero Reference = Ground surface

C5515

Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

C5515
Repeat of Moisture & Passive Neutron