Stoller
Grand Junction Office
established 1959

299-W15-43 (C3955)
Log Data Report

Borehole Information:

Borehole:	299-W15-43 (C3955)		Site:	West of TX Farm	
Coordinates (WA State Plane)		GWL (ft)[1]:	227.0	GWL Date:	11/12/2002
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A[3]	N/A	Oct. 2002	NA	347	Becker

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	0.0	11-3/4	10-3/4	1/2	0.0	30.0
Threaded Steel	3.0	9	8	1/2	+3.0	347.0
Threaded Steel	3.0	6-1/4	6	1/8	+3.0	347.0

The well site geologist was the source for the casing depth and stickup information. The 9-in. inside casing diameter was estimated. All other casing diameters and thicknesses were measured by the logging engineer.

Borehole Notes:

Well construction information is from measurements by Stoller personnel and the well site geologist. The well site geologist also supplied the depth to groundwater. Zero reference is the ground surface. The logging engineer measured the outside and inside casing diameters of the 6-in. and 11-in. casings using a steel tape and calipers. The outside diameter of the 9-in. casing was measured with a caliper and a steel tape. The inside casing diameter of the 9-in. casing was estimated. The Becker drilling system utilizes a special dual-wall casing string. Air passes through the annular space between the inner and outer casings, and drill cuttings are brought up inside the inner casing. For this well, the casing consisted of a 6-in. ID inner casing with 0.125-in. wall thickness inside an 8-in. ID outer casing with 0.5-in. wall thickness. The inner casing is thicker at casing joints, where wall thickness is 0.406 in. Casing joints are approximately 1 ft long overall and occur at 10-ft intervals. No contamination was detected during drilling.

Logging Equipment Information:

Logging System:	Gamma 3E (RLS-1)	Type:	70% HPGe
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-386-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat	3	4	5
Date	11/13/02	11/13/02	11/13/02		
Logging Engineer	Kos	Kos	Kos		
Start Depth (ft)	349.0	135.0	99.0		

Log Run	1	2/Repeat	3	4	5
Finish Depth (ft)	100.0	100.0	0.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	None	None	None		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	n/a[4]	n/a	n/a		
Pre-Verification	CE041CAB	CE041CAB	CE041CAB		
Start File	CE041000	CE041250	CE041286		
Finish File	CE041249	CE041285	CE041385		
Post-Verification	CE041CAA	CE041CAA	CE041CAA		
Depth Return Error (in.)	0.0	NA	0.0		
Comments	No fine gain adjustments.	No fine gain adjustments.	No fine gain adjustments.		

Logging Operation Notes:

Zero reference was the ground surface, and the borehole was logged through drill pipe. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the RLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. During logging run 3, liquid N_2 depleted at 1,800 hrs at a depth of 33.0 ft. The tool was winched to the ground surface, and the dewar was filled. The well was reentered and logging was resumed at a depth of 33.0 ft, file CE041352.

Analysis Notes:

Analyst:	Sobczyk	Date:	12/03/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

RLS pre-run and post-run verification spectra were collected at the beginning and end of the day. File CE041CAB was slightly above the control limit for the 609-keV full-width at half-maximum value. File CE041CAA was slightly above the control limit for the 1461-keV full-width at half-maximum value. 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 stable and between 1 and 2 percent of one another. Examinations of spectra indicate that the detector appears to have functioned normally during all of the logging runs.

Log spectra for the RLS 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: RLS-1Oct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the ground surface. Data were analyzed using a uniform casing correction based on the cumulative wall thickness of 0.625 in. for the dual wall casing. This correction was applied from 30.0 to 349.0 ft. From ground surface to 30.0 ft, the casing correction factor was calculated based on 1.125 in., which represents the cumulative thickness of the dual wall casing and the 10.75-in. ID surface casing. The increase in casing thickness at the joints in the dual wall casing results in an apparent reduction in concentration, because the actual thickness increases to 0.9 in., but the casing correction is not changed. A water correction was applied to the RLS data at and below 227.0 ft. For the 70% HPGe detector, dead time at background count rates varies from 2 to 6 percent, averaging about 4 percent. This variation appears to be due to random fluctuation, as it does not correlate with count rate. The fluctuation is apparently an operational characteristic of the detector. Experiments with the detector in the calibration models indicate that the dead time is a function of count rate and that a dead time correction function similar to that developed for the SGLS can be used. Dead time values less than 10 percent should be ignored. Dead time corrections are required when dead time exceeds 18 percent. As the dead time did not exceed 18 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 (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. 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 exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected by automated data processing at 95.0-ft log depth at an activity near its MDL of approximately 0.2 pCi/g. After examination of the individual spectrum, it was determined that there is no evidence of a photopeak at 662 keV. This isolated occurrence is the result of statistical fluctuation.

Recognizable changes in the KUT and total gamma logs occurred in this borehole. Starting at about 8 ft, decreases in total gamma and KUT concentrations occur every 10.0 ft at the casing joints in the dual wall casing. These concentration changes are due to an increase in gamma attenuation associated with the increase in casing thickness at the joints, rather than an actual change in activity. They are most apparent on the total gamma and ^{40}K (1461 keV) logs. At 61 ft, there is a 5-pCi/g increase in ^{40}K concentration and a 0.4-pCi/g increase in ^{232}Th concentration. These increases in apparent ^{40}K and ^{232}Th concentrations may correspond to the contact with the Hanford H2. At 87 ft, there is an 8-pCi/g decrease in ^{40}K concentration and a 0.4-pCi/g decrease in ^{232}Th concentration. These decreases in apparent ^{40}K and ^{232}Th concentrations may correspond to the contact with the Hanford H3. Between 111 and 117 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is shown by an increase in total gamma (100 cps) and ^{232}Th (1.0 pCi/g). A 10-pCi/g decrease in ^{40}K and a 1.0-pCi/g decrease in ^{232}Th concentration occur at 117 ft. On the basis of low ^{40}K and ^{232}Th concentrations, the carbonate-rich paleosols of the Cold Creek Unit are interpreted as being between 117 and 130 ft.

The plots of the repeat logs demonstrate good repeatability of the RLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV.

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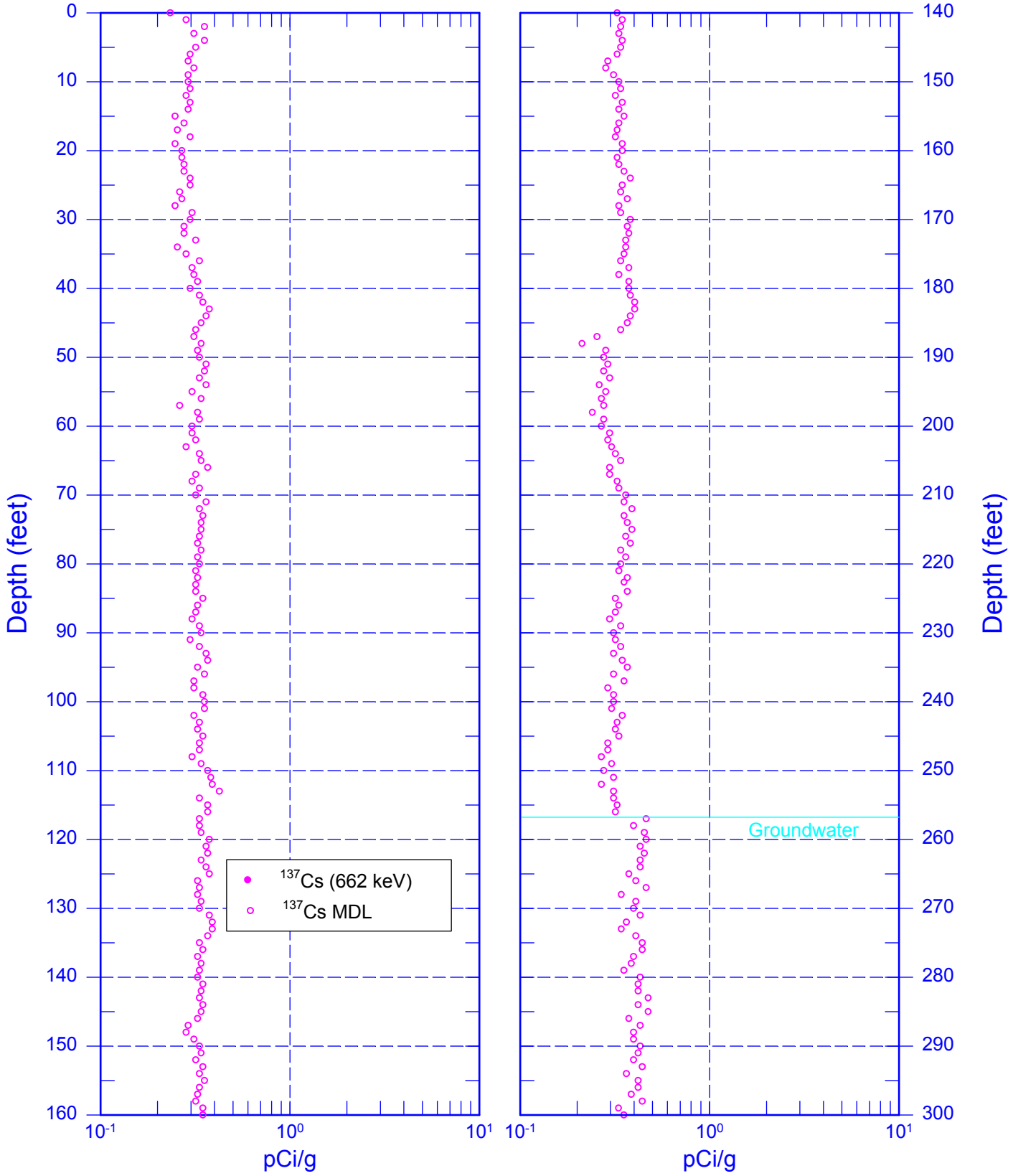
[1] GWL – groundwater depth
[2] TOC – top of casing
[3] N/A – not available
[4] n/a – not applicable

299-W19-46 (C3958)

Man-Made Radionuclides

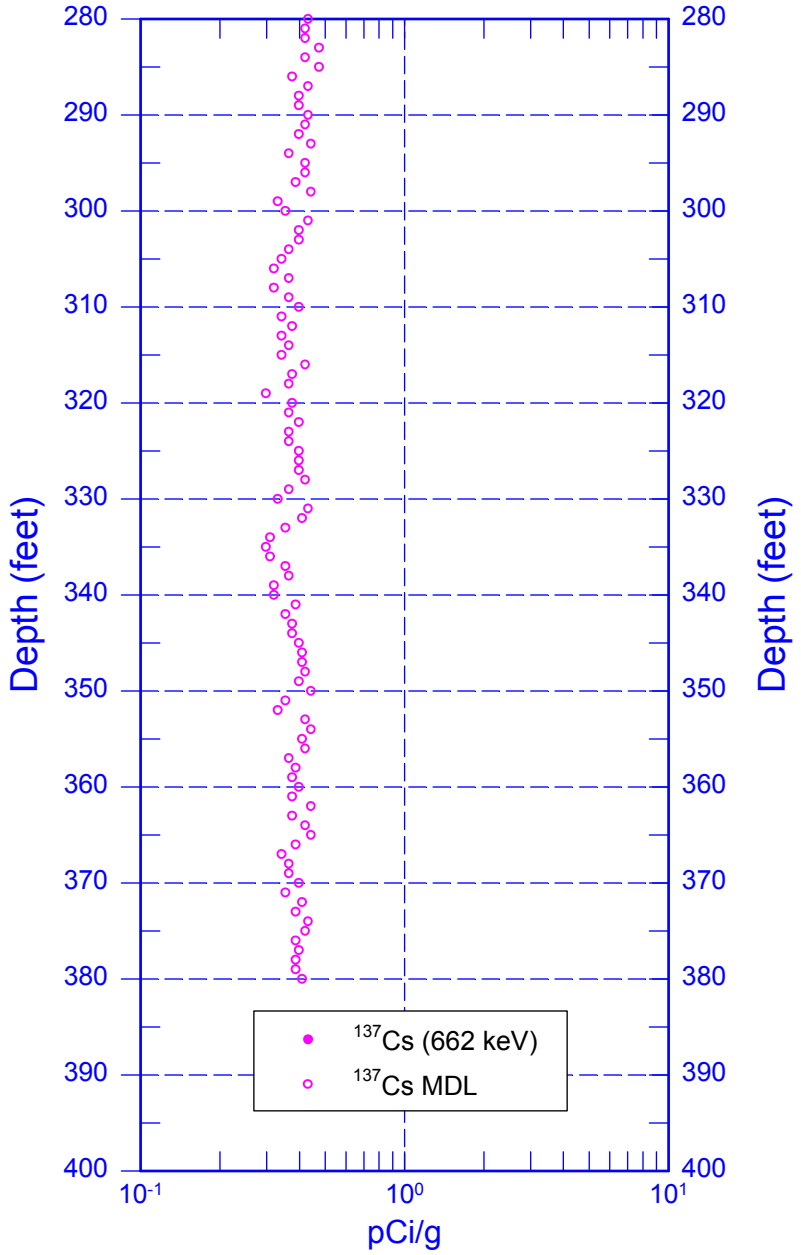


Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)

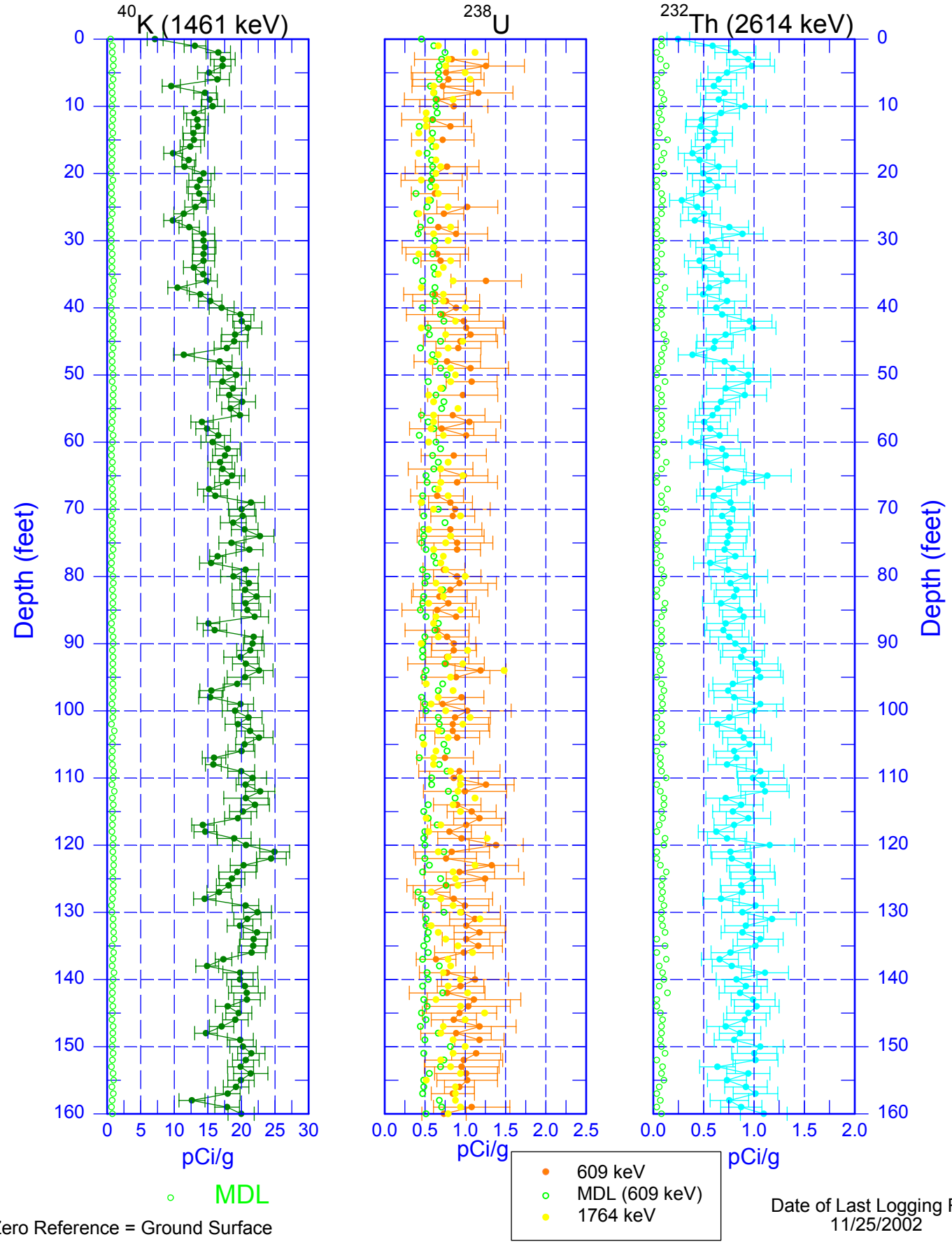
Man-Made Radionuclides



Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)
Natural Gamma Logs



Zero Reference = Ground Surface

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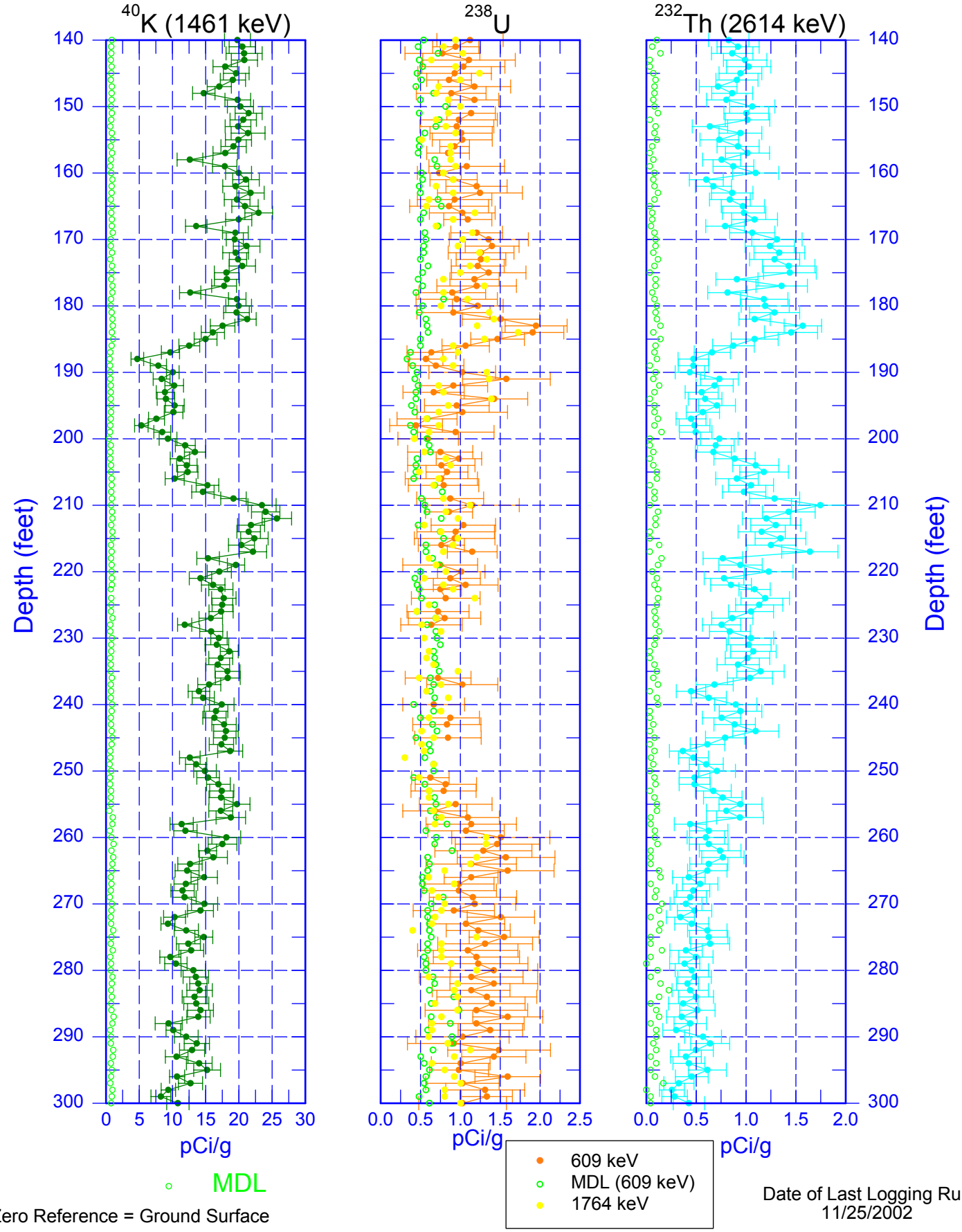
11/25/2002

299-W19-46 (C3958)
Natural Gamma Logs



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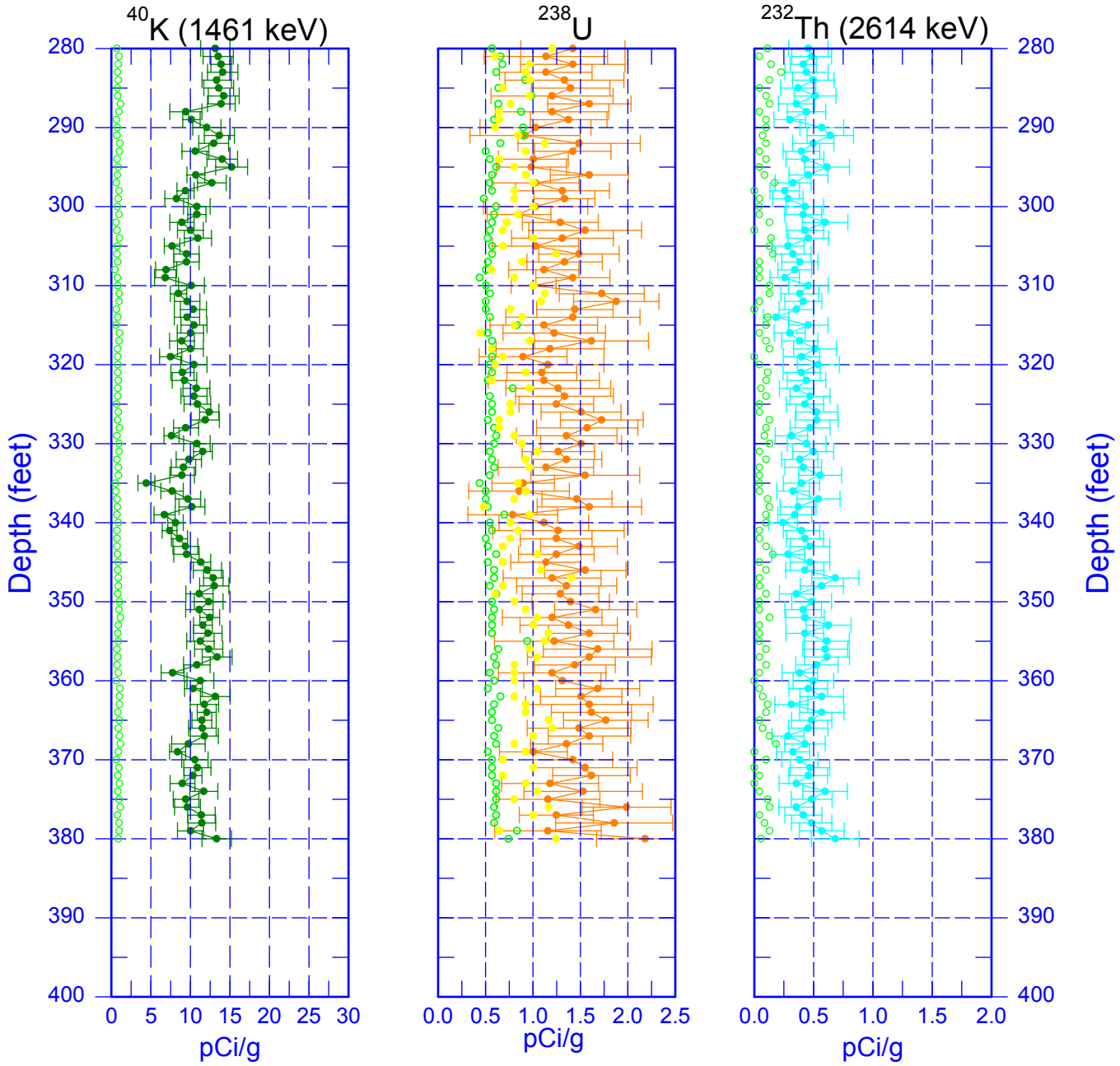
11/25/2002

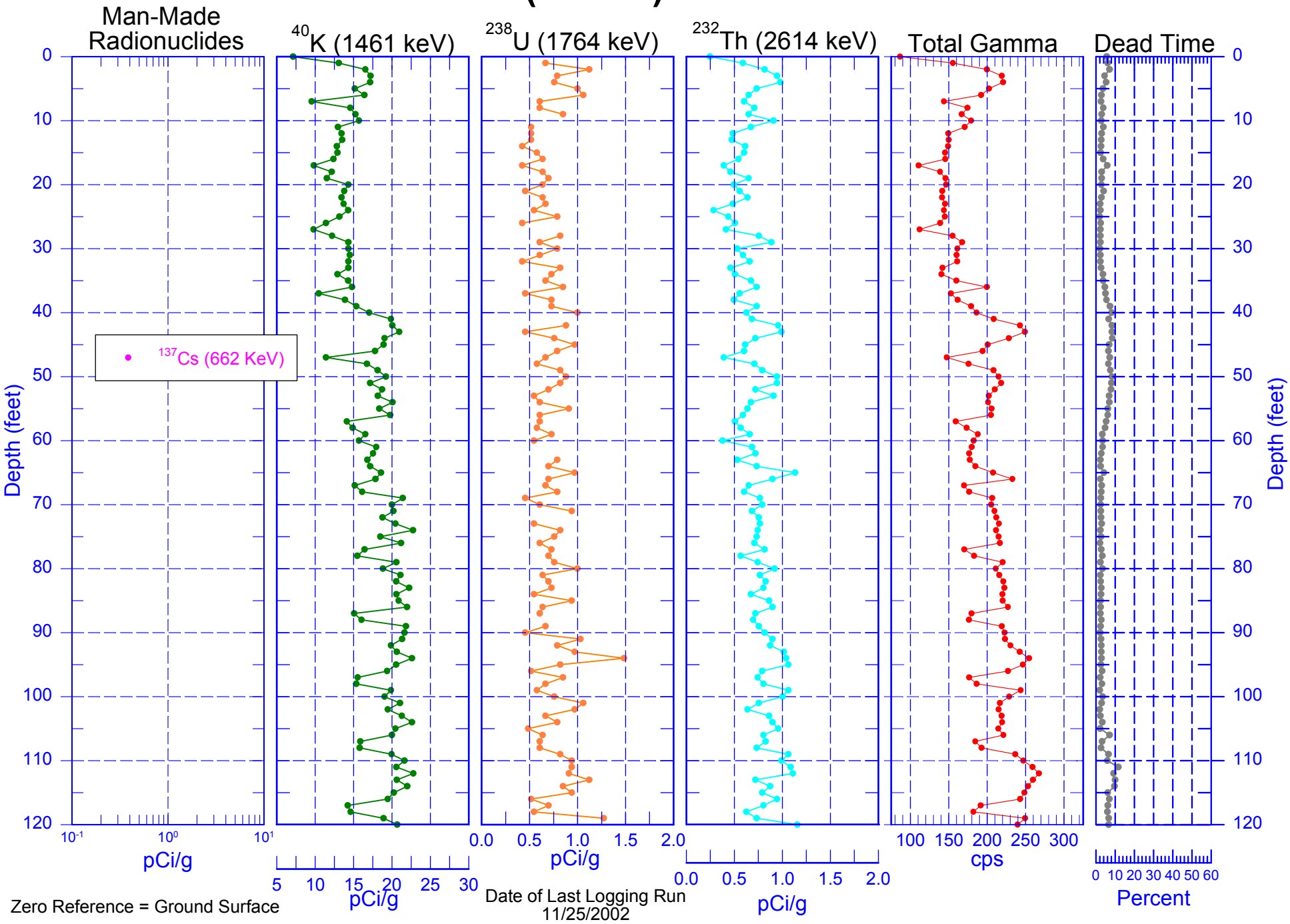
299-W19-46 (C3958)
Natural Gamma Logs



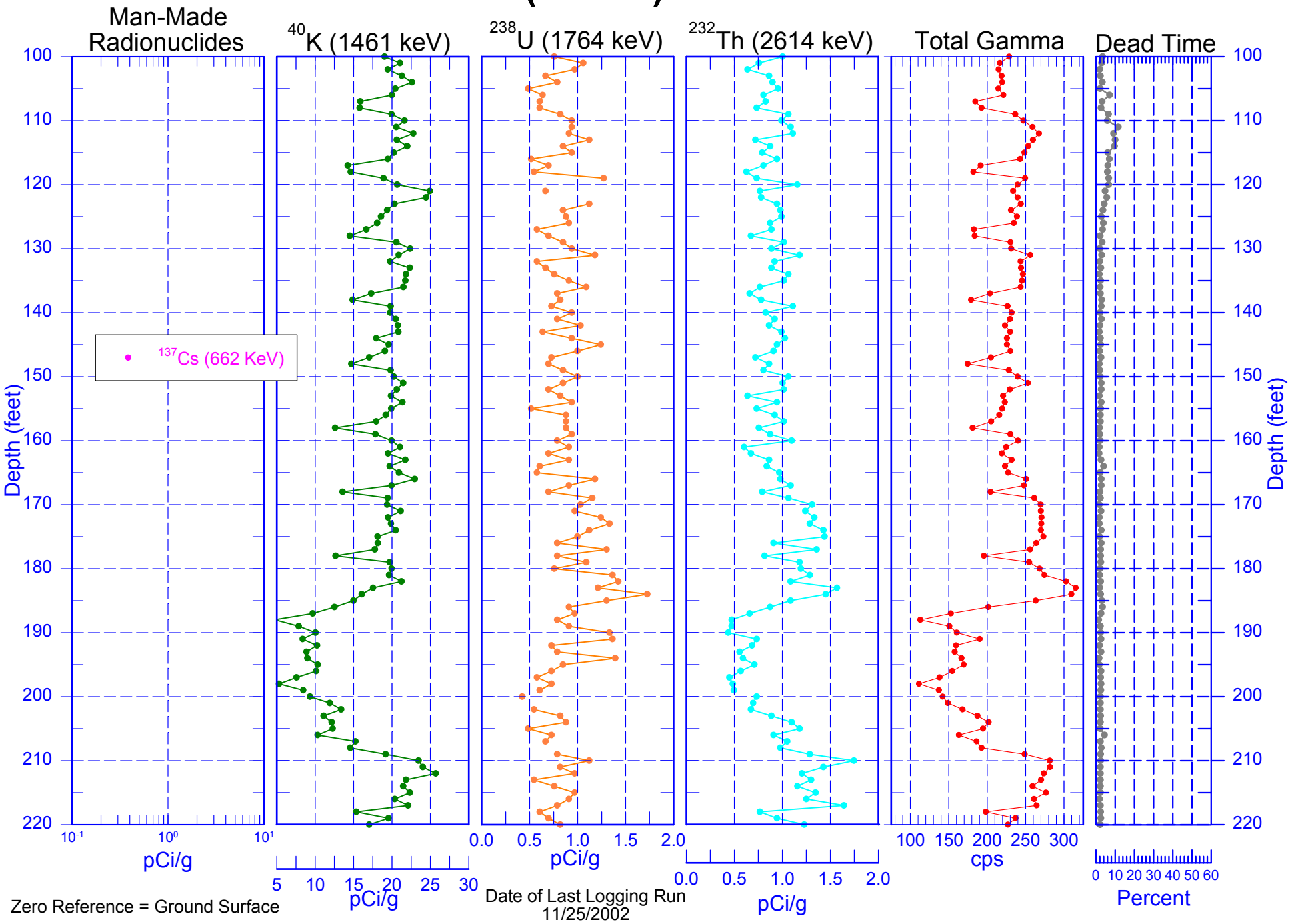
Date of Last Logging Run
11/25/2002

Zero Reference = Ground Surface

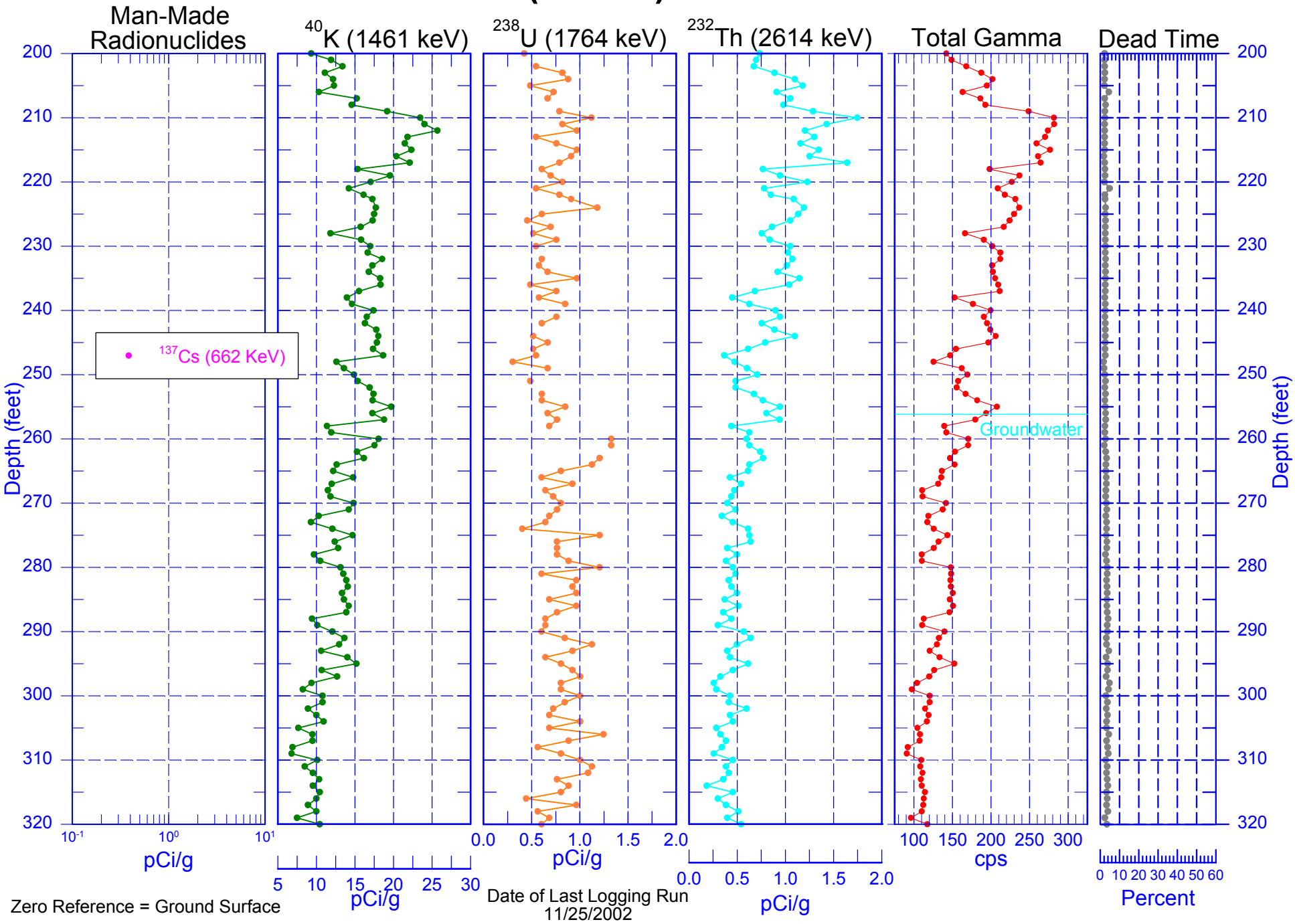
299-W19-46 (C3958) Combination Plot



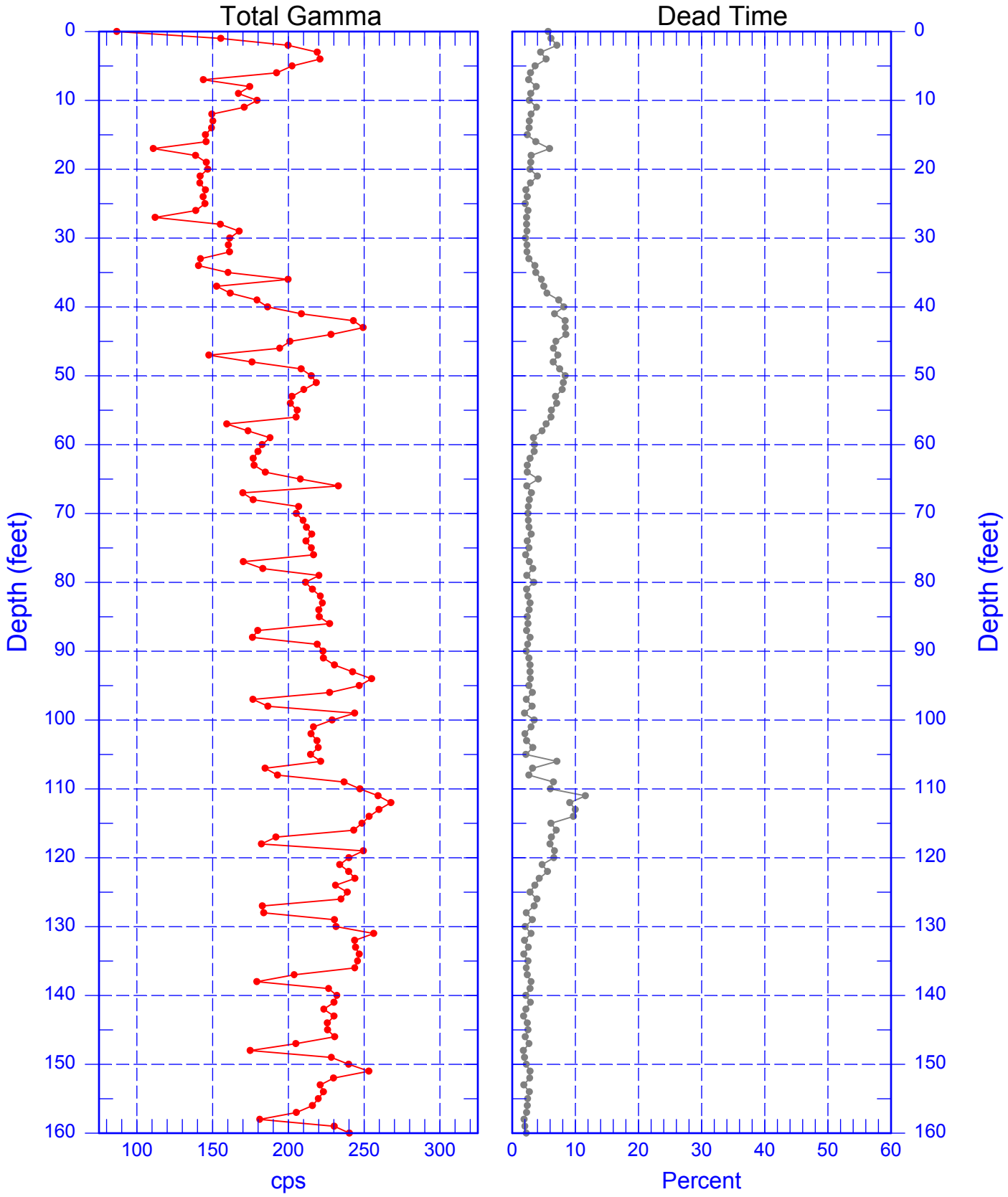
299-W19-46 (C3958) Combination Plot



299-W19-46 (C3958) Combination Plot



299-W19-46 (C3958)
Total Gamma & Dead Time



Zero Reference = Ground Surface

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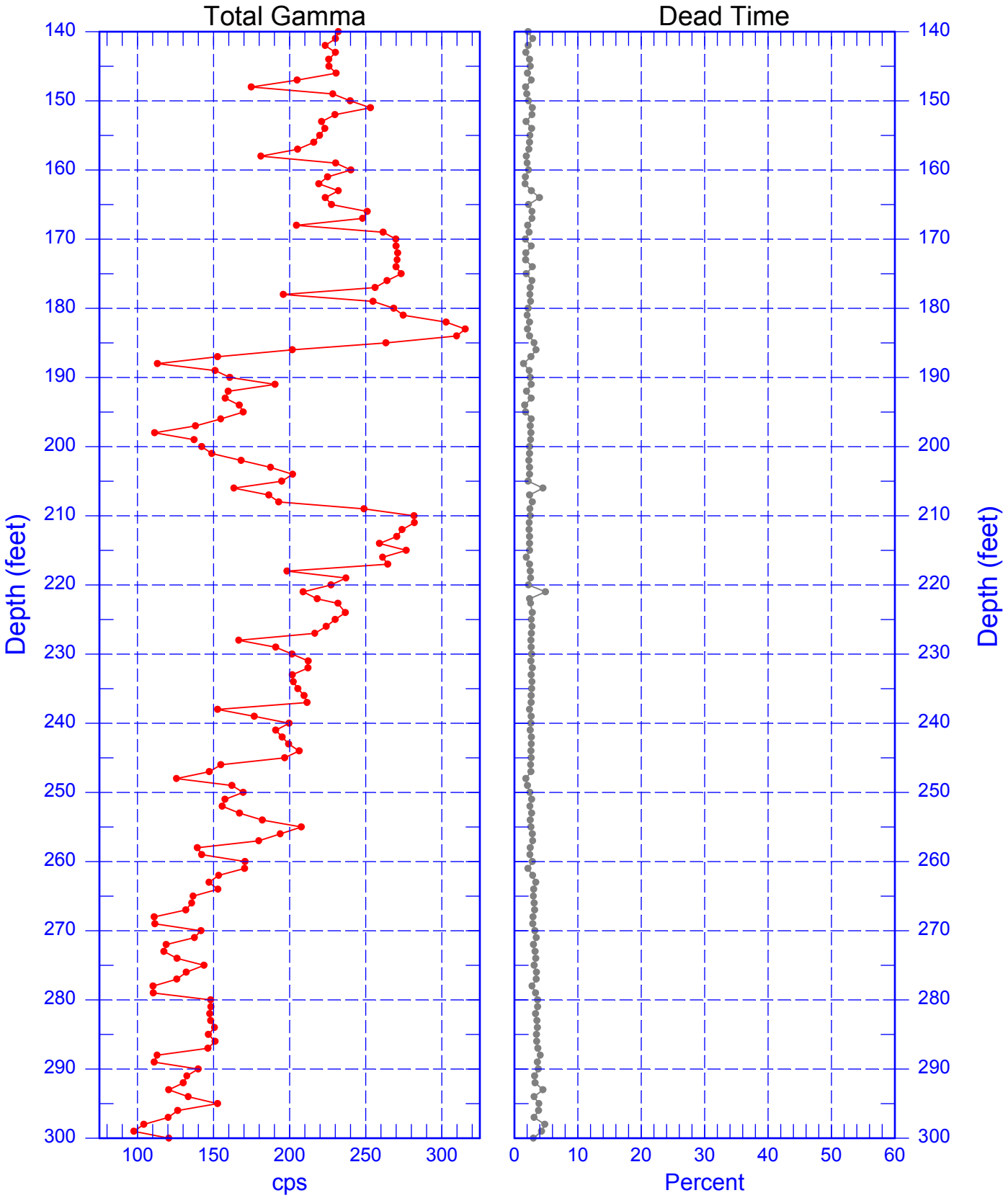
299-W19-46 (C3958)
Total Gamma & Dead Time



Zero Reference = Ground Surface

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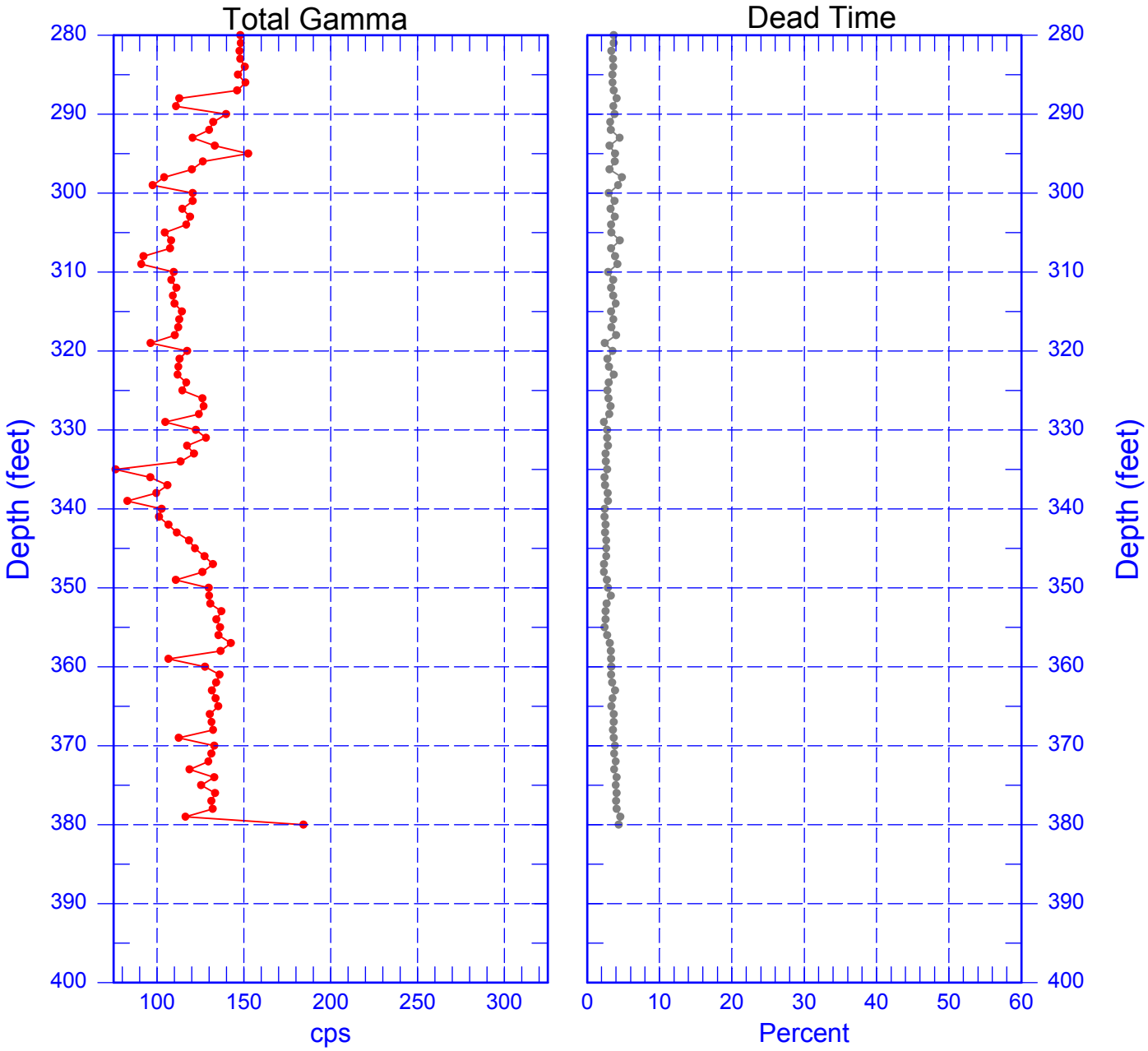
11/25/2002

299-W19-46 (C3958)
Total Gamma & Dead Time



Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

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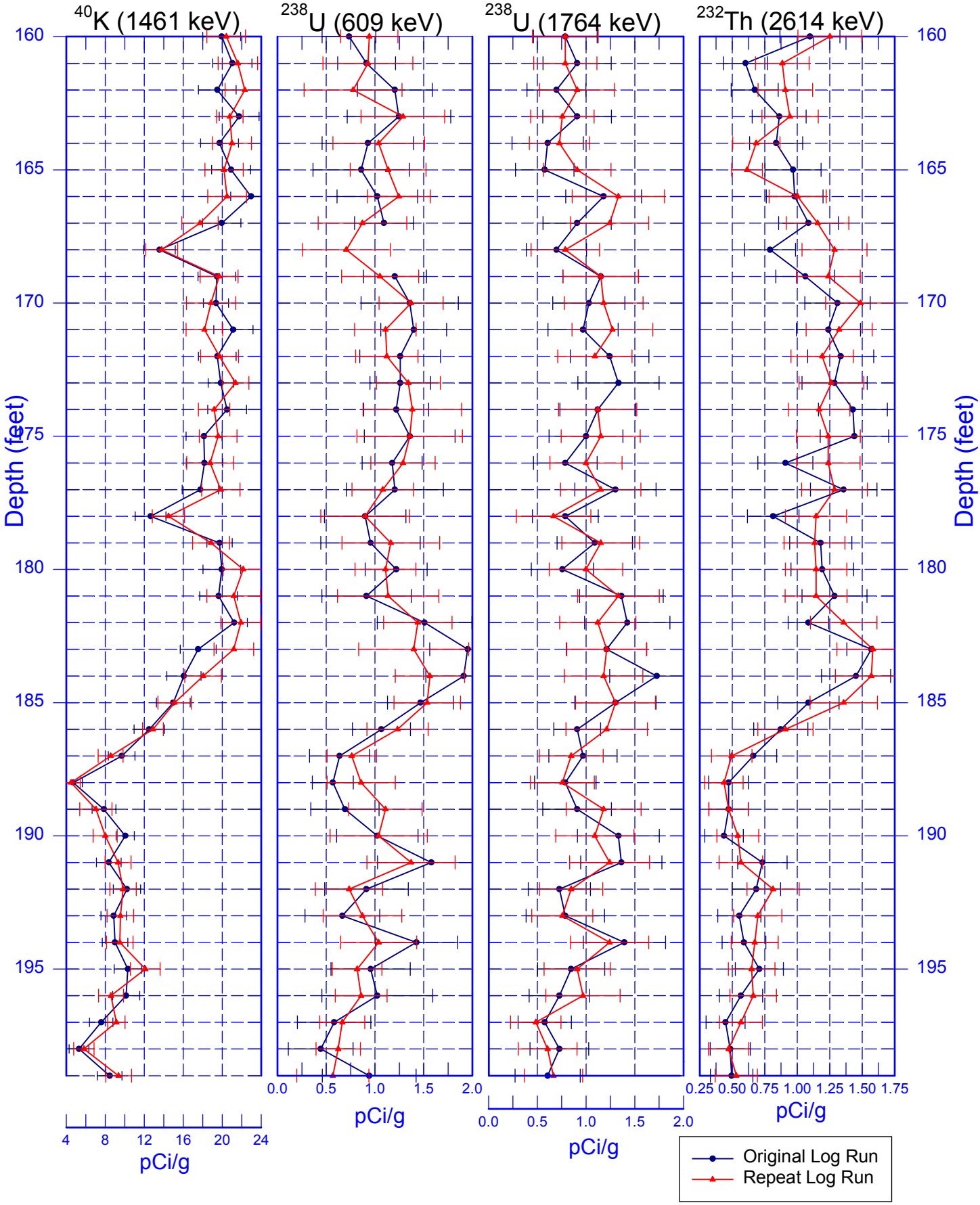
Rerun of Natural Gamma Logs (160.0 to 199.0 ft)