Stoller
Grand Junction Office established 1959

GJO-2004-575-TAC

C4201
Log Data Report

Borehole Information:

Borehole: C4201			**Site:** 216-U-1 and U-2 Cribs		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:**	02/03/2004
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not Available	Not Available	Feb. 2004	Not Available	50	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0.2	6 5/8	5 1/2	9/16	0.2	50

Borehole Notes:

Zero reference is the ground surface. The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Casing diameter was measured using a caliper and a steel tape. Measurements were rounded to the nearest 1/16 in.

Logging Equipment Information:

Logging System:	Gamma 1E		**Type:**	SGLS (70%) 34TP40587A
Calibration Date:	01/2004	**Calibration Reference:**	GJO-2004-568-TAR	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 / Repeat		
Date	02/03/04	02/03/04	02/03/04		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	48.87	48.5	34.5		
Finish Depth (ft)	48.87	0.5	29.5		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	N/A[3]	1.0	1.0		
ft/min	N/A	N/A	N/A		
Pre-Verification	AE075CAB	AE075CAB	AE075CAB		
Start File	AE076000	AE076001	AE076050		
Finish File	AE076000	AE076049	AE076055		
Post-Verification	AE076CAA	AE076CAA	AE076CAA		
Depth Return Error (in.)	N/A	0	0		

Log Run	1	2	3 / Repeat		
Comments		No fine-gain adjustment.	Repeat section.		

Logging Operation Notes:

Zero reference was ground surface. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. As instructed by Rick McCain, file AE760000 is from total depth with the logging cable under tension and the sonde tip touching the bottom plug. File AE076000 was collected at the maximum depth reached by the sonde measured from the ground surface to the crystal's center or 0.77 ft from the tip. After collecting one spectrum, the sonde was moved to the nearest 0.5-ft interval and logging continued as prescribed in the logging procedure.

Analysis Notes:

Analyst:	Sobczyk	Date:	2/04/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

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 1.0 percent lower and 8.0 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. 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: G1EJan04.xls). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 9/16 in. to 48.87 ft (total logging depth). Dead time and water corrections were not required.

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, ^{238}U, and ^{235}U were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in the interval between 1.5 and 6.5 ft with concentrations ranging from the MDL (0.3 pCi/g) to 21 pCi/g. ^{137}Cs was detected in the interval between 30.5 and 40.5 ft with concentrations ranging from the 0.4 to 60 pCi/g, which was measured at 31.5 ft. ^{137}Cs was also detected at 19.5 ft at a concentration near the MDL. Examination of the gamma energy spectra indicates that the occurrence of ^{137}Cs at 19.5 ft is probably a statistical fluke, since a well-defined 662-keV photopeak is not evident. ^{238}U, based on the 1001-keV photopeak, was detected in the interval between 35.5 and 44.5 ft with concentrations ranging from 22 to

155 pCi/g. The maximum concentration was measured at 43.5 ft. The MDL for processed ^{238}U is approximately 15 pCi/g. ^{235}U, based on the 186-keV photopeak, was detected at 43.5 ft with a concentration of 6.9 pCi/g. The MDL for ^{235}U was approximately 1.5 pCi/g.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV and for ^{137}Cs at 662 keV.

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[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

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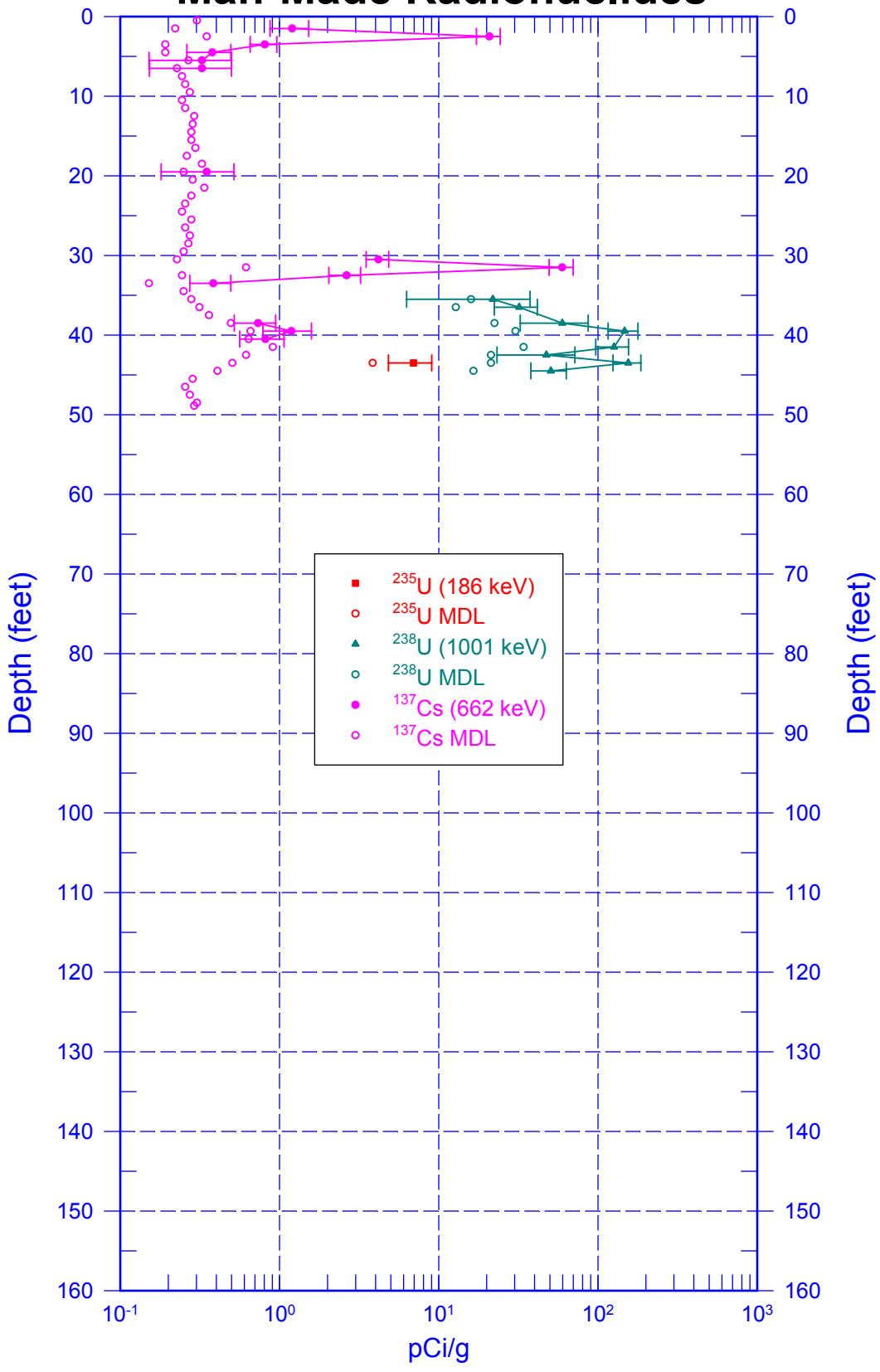
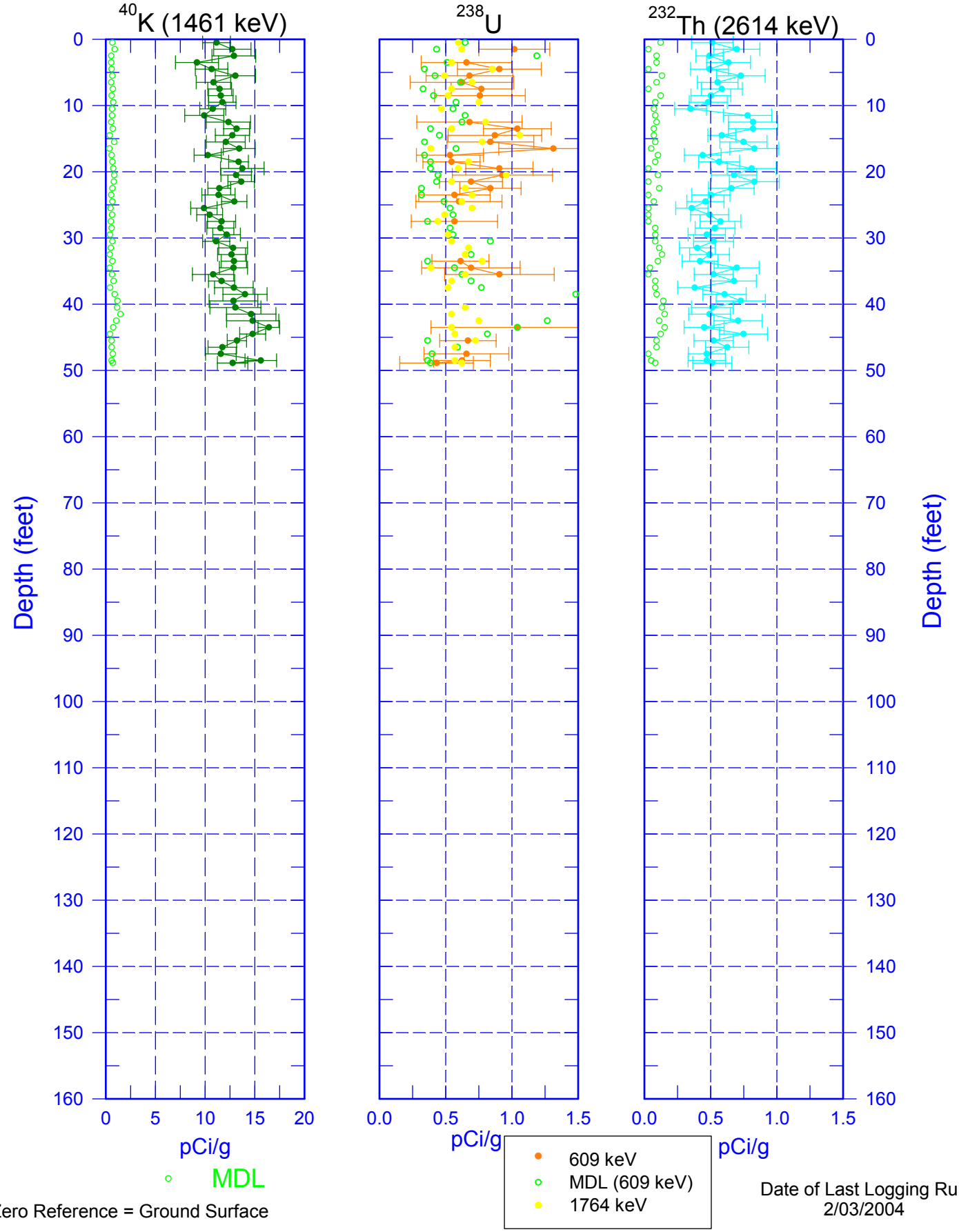
Man-Made Radionuclides



Zero Reference = Ground Surface

Date of Last Logging Run
2/03/2004

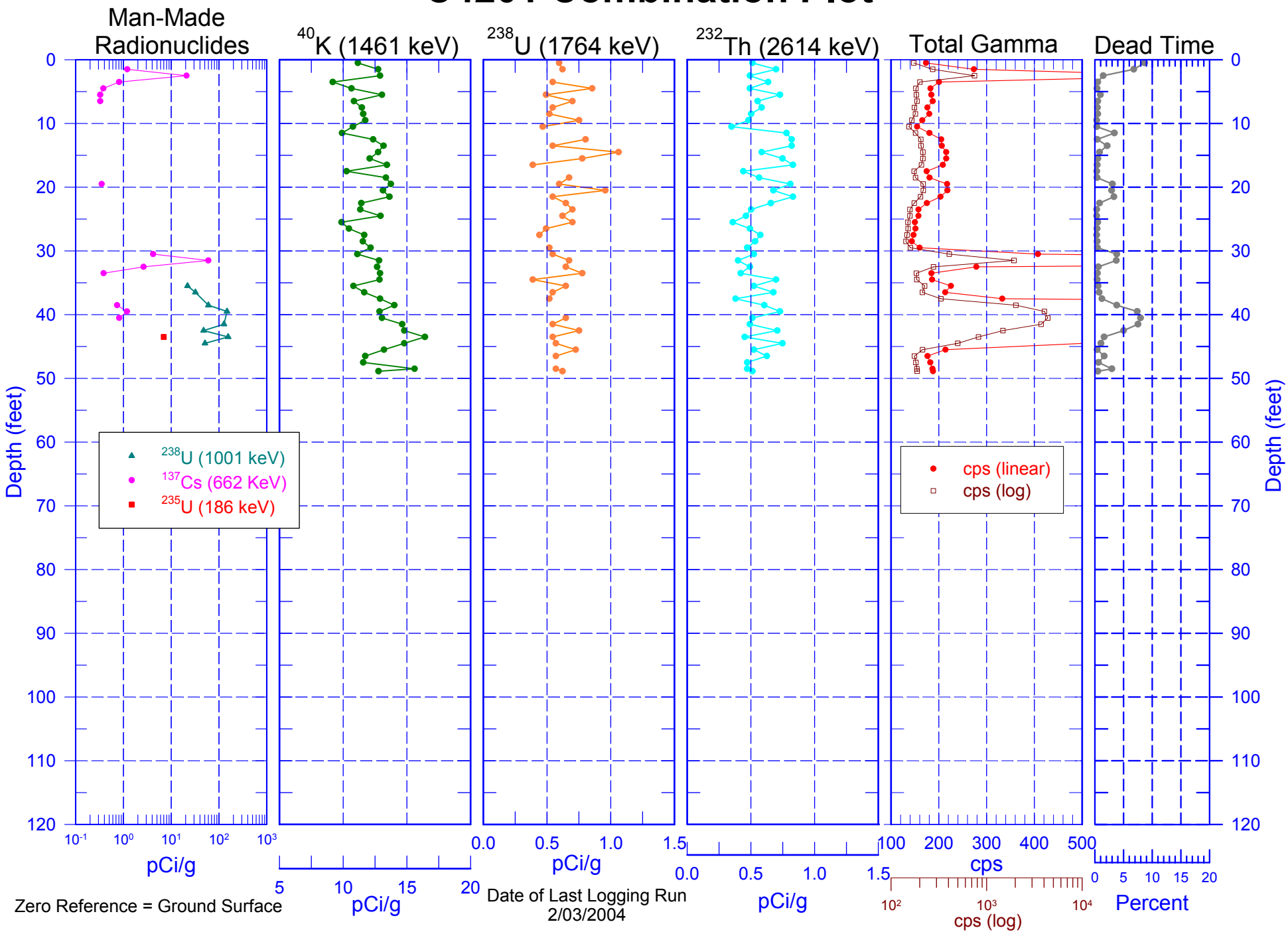
C4201
Natural Gamma Logs

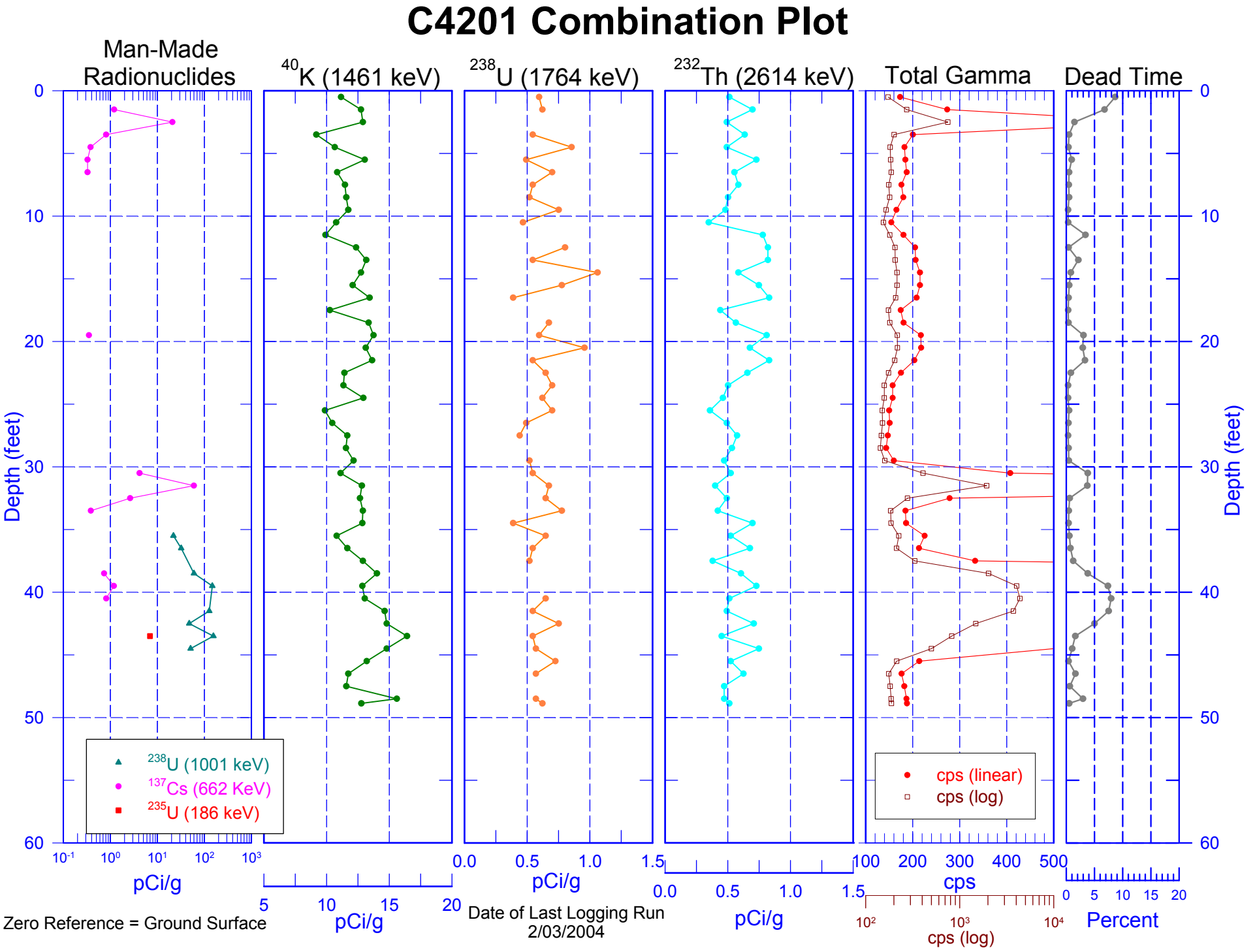


Zero Reference = Ground Surface

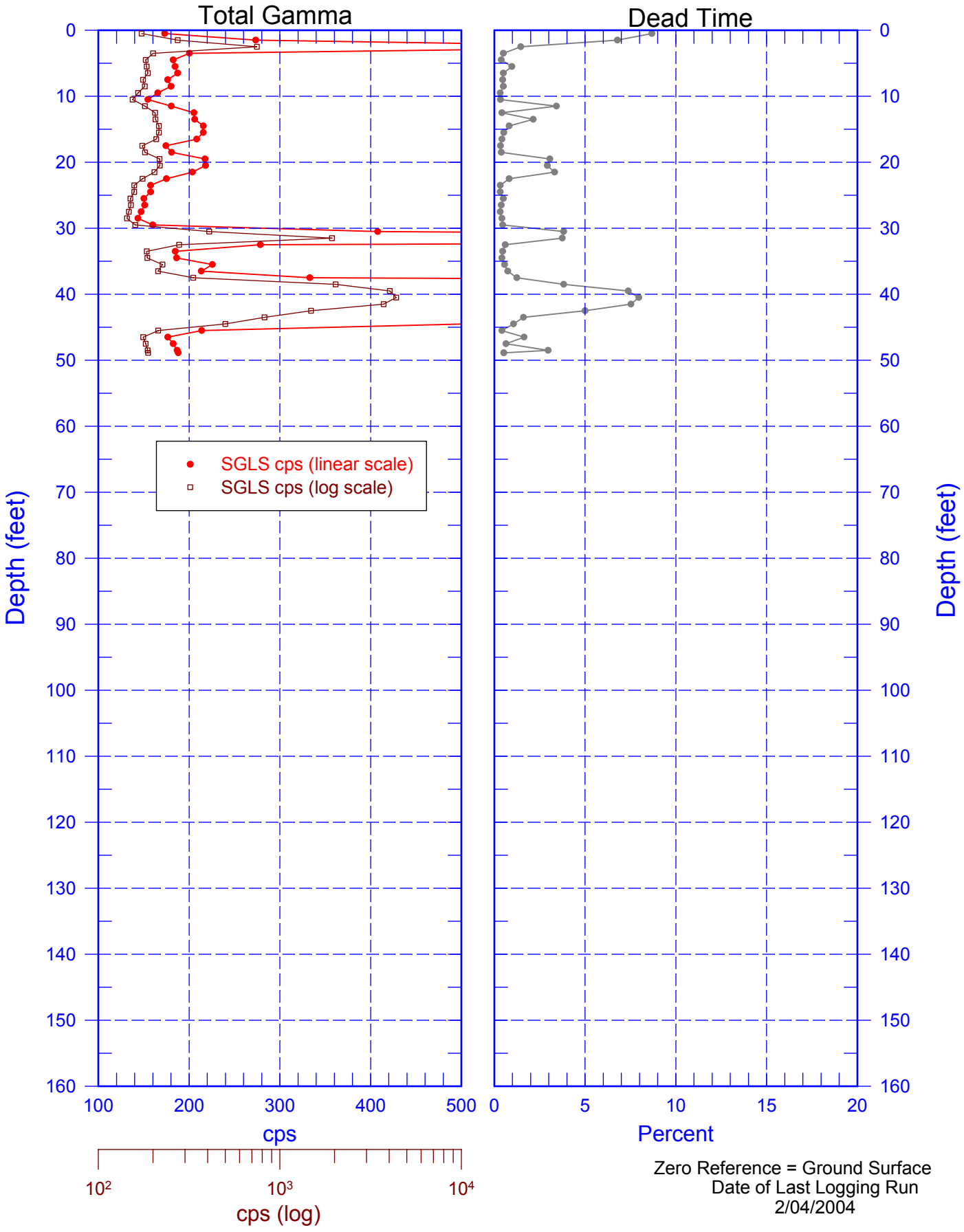
Date of Last Logging Run
2/03/2004

C4201 Combination Plot




C4201 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
238U (1001 keV)
137Cs (662 KeV)
235U (186 keV)
cps (linear)
cps (log)
pCi/g
cps
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
2/03/2004

C4201
Total Gamma & Dead Time



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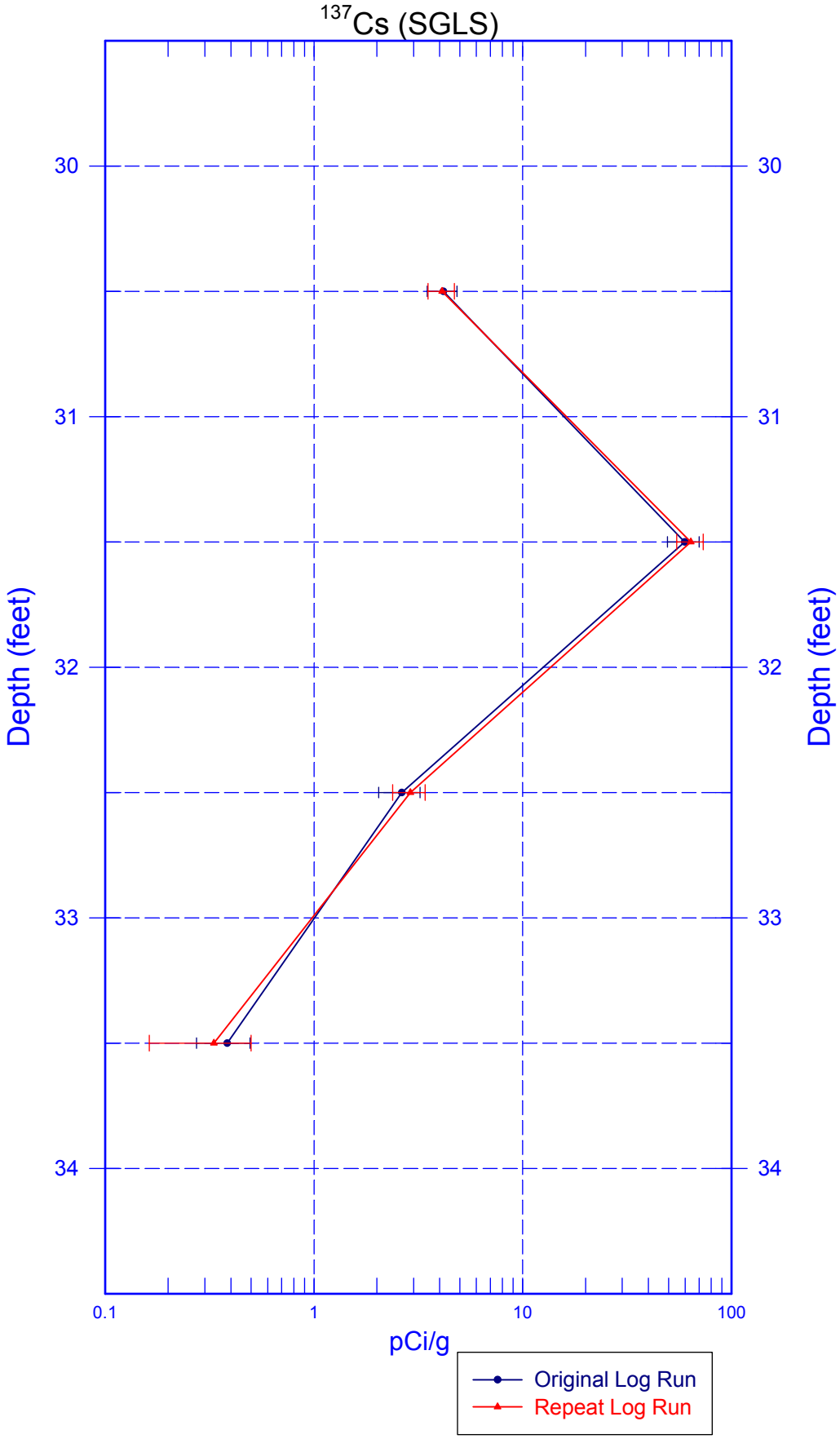
Rerun of Man-Made Radionuclides



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Rerun of Natural Gamma Logs (29.5 to 34.5 ft)