

299-W15-81 (A7382) Log Data Report

Borehole Information:

Borehole: 299-W15-81 (A7382)		Site: 216-T-22 Trench			
Coordinates (WA State Plane)		GWL (ft)¹: Not deep enough		GWL Date: 12/17/2002	
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
136,152.46 m	566,501.60 m	Oct. 1953	207.978 m	117	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	3.7	8 11/16	8	11/32	+3.7	113
The logging engineer measured the casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS³, and Chamness and Merz (1993). The logging engineer measured the depth-to-bottom reported above. Zero reference is the top of the 8-in. casing. Top of casing is cut evenly. A reference point survey "X" is located on top of the casing stickup.

On 12/17/02, the borehole was swabbed and indicated probable presence of radon gas. Elevated activity was detected on the swab, but after two days the activity dropped to background level. Starting on 12/30/02 and for three days before logging began, the borehole cap was left off the casing to vent radon gas.

Logging Equipment Information:

Logging System: Gamma 2A	Type: SGLS (35%)
Calibration Date: 10/2002	Calibration Reference: GJO-2002-383-TAC
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4/Repeat	
Date	12/30/02	12/31/02	01/02/03	01/02/03	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	12.0	117.0	21.0	40.0	
Finish Depth (ft)	4.0	20.0	11.0	28.0	
Count Time (sec)	200	200	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	

Log Run	1	2	3	4/Repeat	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A ⁴	N/A	N/A	N/A	
Pre-Verification	BA185CAB	BA187CAB	BA188CAB	BA188CAB	
Start File	BA186000	BA187000	BA188000	BA188011	
Finish File	BA186008	BA187097	BA188010	BA188023	
Post-Verification	BA186CAA	BA187CAA	BA188CAA	BA188CAA	
Depth Return Error (in.)	0	-0.5	0	0	
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	

Logging Operation Notes:

Zero reference was top of the 8-in. casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 082. During SGLS logging, fine-gain adjustments were not needed to maintain the 1460-keV (⁴⁰K) photopeak at a pre-described channel. On 12/31/02, before logging began, the sonde was run up and down the borehole one time to displace any radon gas if present.

Analysis Notes:

Analyst:	Sobczyk	Date:	01/13/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits that were established on 12/05/2002. 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 generally lower and between 1 and 6 percent of each other.

Log spectra for the SGLS 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: G2AOct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 8-in. casing. On the basis of Chamness and Merz (1993) and the gross gamma response, the casing configuration was assumed to be one string of 8-in. casing to 113 ft and open hole from 113 ft total depth (117 ft). The casing correction factor was calculated assuming a casing thickness of 11/32 (0.344) in. This casing thickness is based upon the field measurement. A water correction was not needed or applied to the data. Dead time corrections are required when dead time exceeds 10.5 percent. As the dead time did not exceed 10.5 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 (⁴⁰K, ²³⁸U, and ²³²Th), 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 ²¹⁴Bi peak at 1764 keV was used to determine the naturally occurring ²³⁸U concentrations on the combination plot rather than the ²¹⁴Bi peak at 609 keV because it is less affected by the presence of radon gas inside the casing.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected in the borehole near the ground surface with a concentration of 0.5 pCi/g at a log depth of 5 ft.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi , under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn . When radon is present, ^{214}Bi will tend to “plate” onto the casing wall and will quickly reach equilibrium with ^{222}Rn . Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609-keV photopeak relative to the 1764-keV photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) This effect is observed in log run 2 (117 to 20 ft). The effects of radon appear to be minimal in log runs 1 (12 to 4 ft) and 3 (21 to 11 ft). The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb . This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609-keV photopeak between run 2 and the repeat section (run 4).

The presence of radon is not an indication of man-made contamination: it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

In the repeat log, the SGLS showed good repeatability except for the 609-keV photopeak. The repeat log run (log run 4) was run two days after the original log run (log run 2). The ^{238}U values based on 609 keV are at least a 1/4 pCi/g lower on the repeat log than on the original log run. This variation is attributed to the effects of radon. The ^{40}K , ^{232}Th , and ^{238}U (1764 keV) concentrations agree well.

References:

Chamness, M.A. and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

¹ GWL – groundwater level

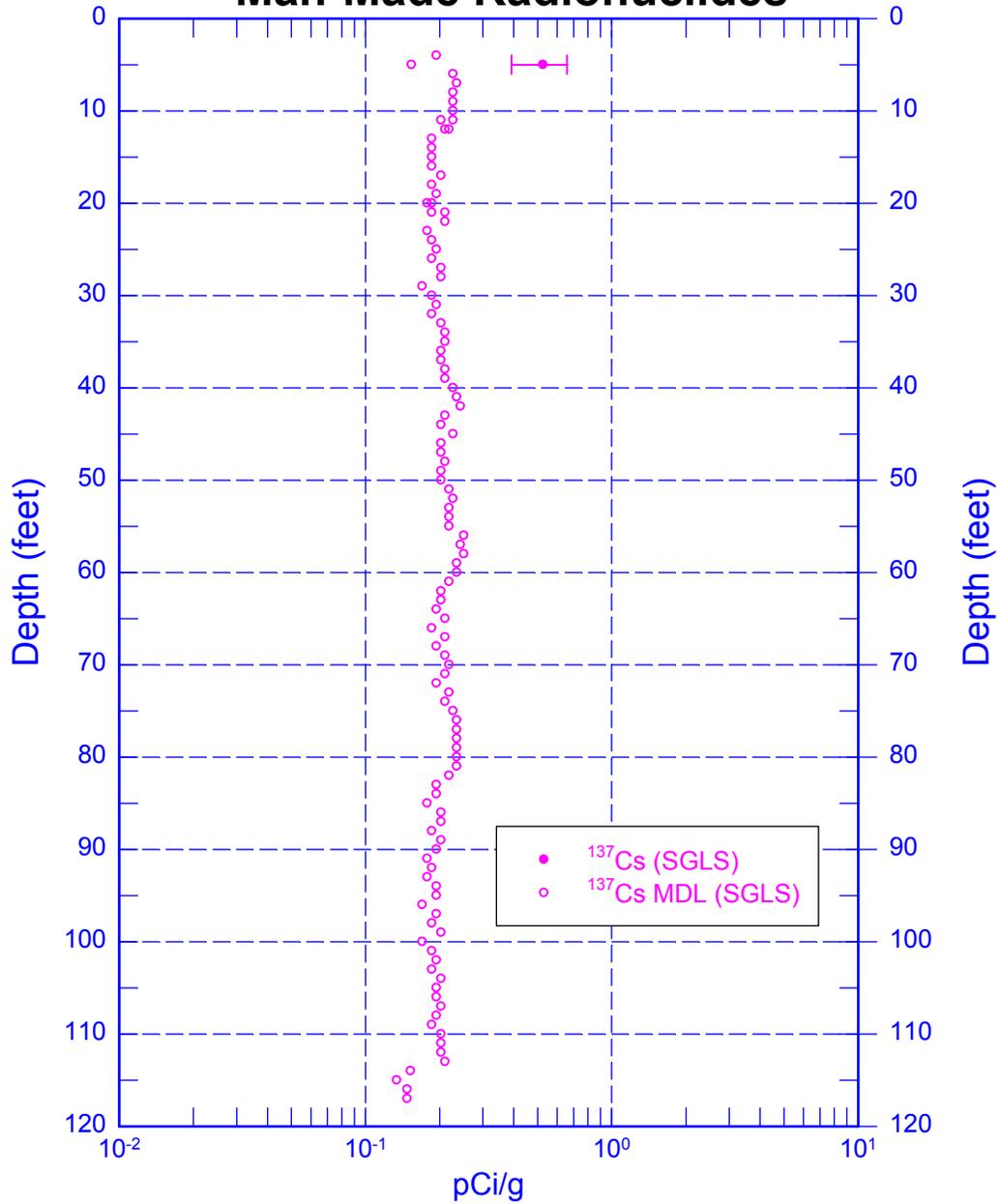
² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

299-W15-81 (A7382)

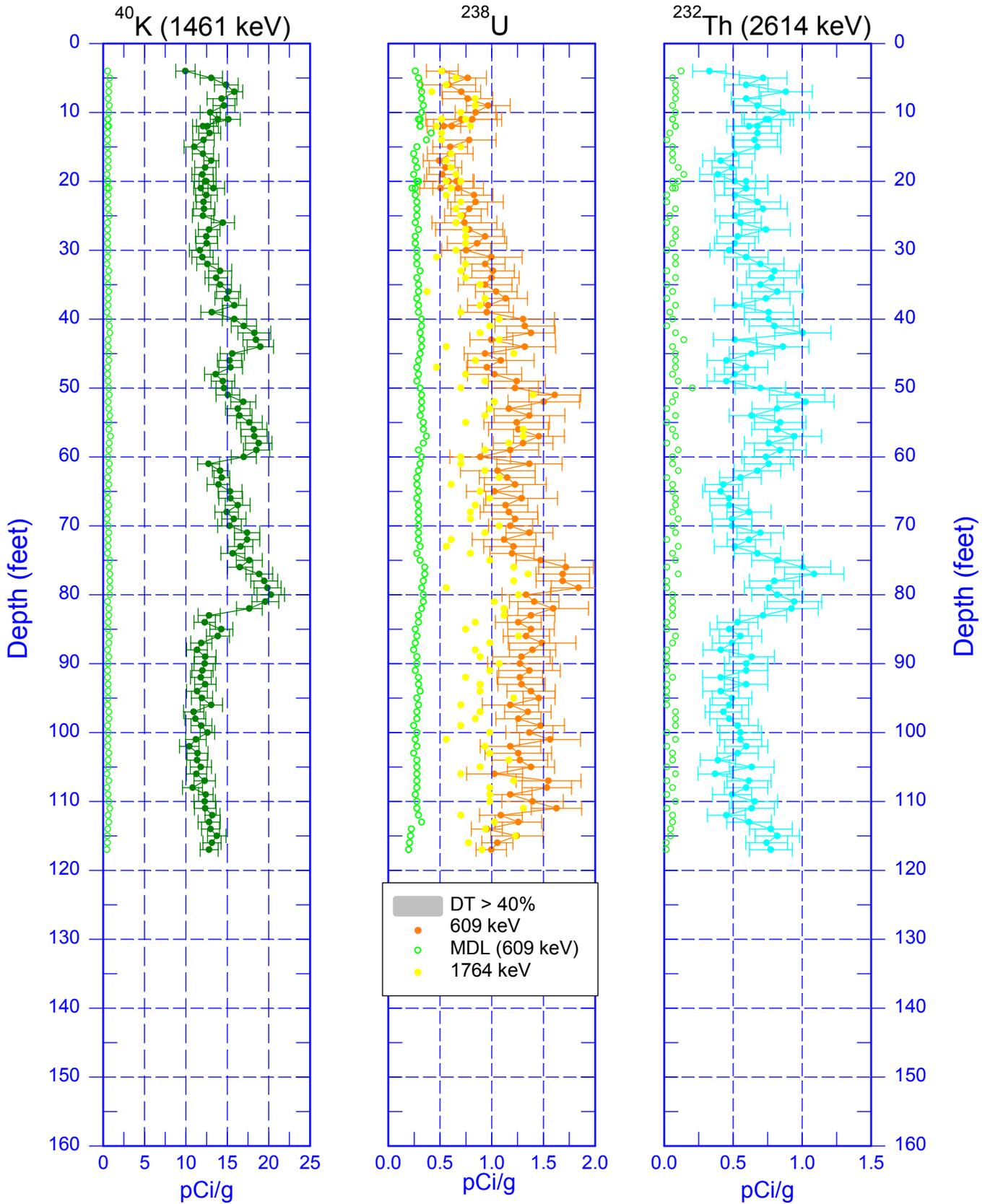
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
1/02/2003

299-W15-81 (A7382) Natural Gamma Logs



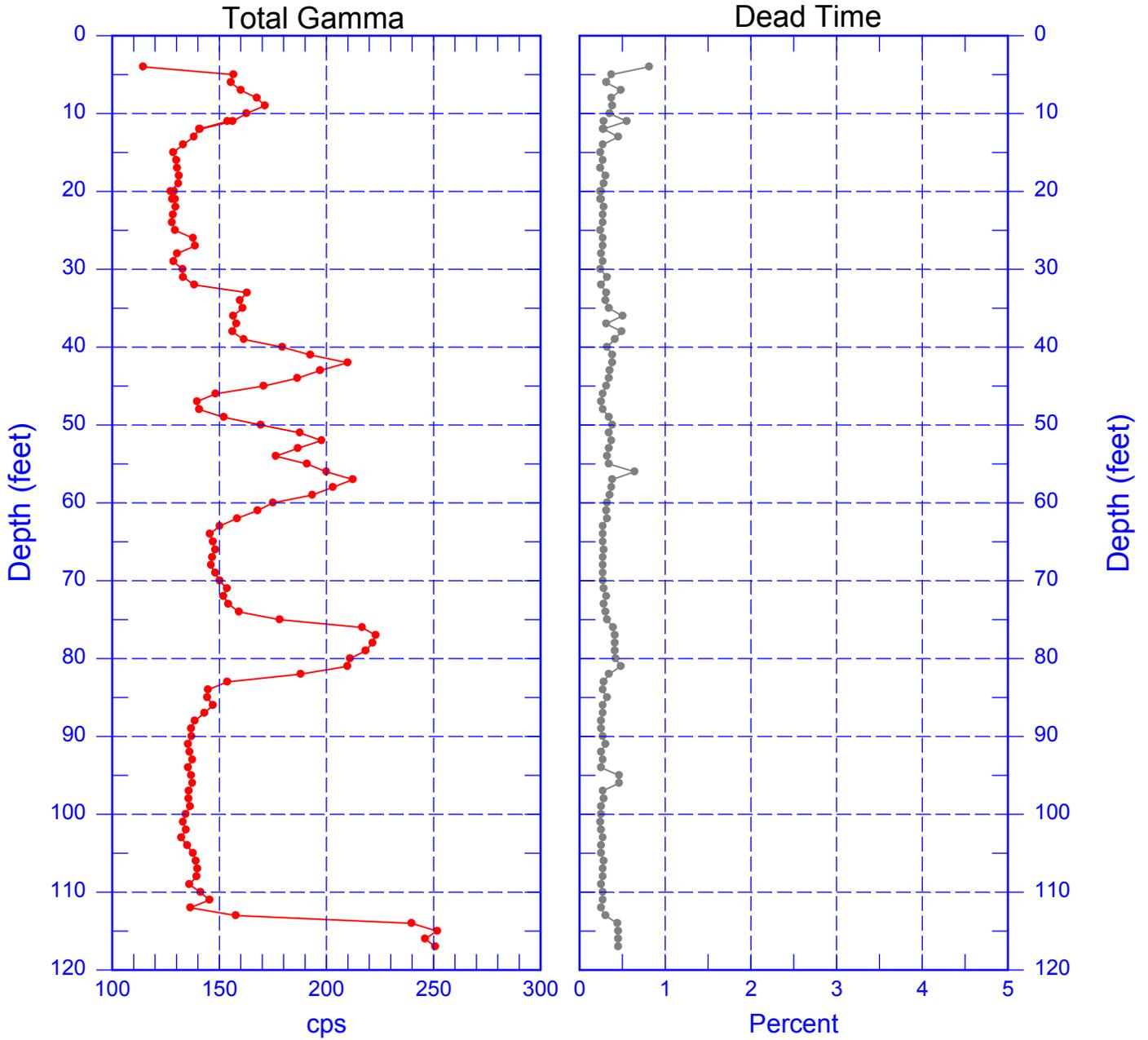
○ MDL

Zero Reference = Top of Casing

Date of Last Logging Run
01/02/2003

299-W15-81 (A7382)

Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
1/02/2003

299-W15-81 (A7382)

Rerun of Natural Gamma Logs (40.0 to 28.0 ft)

