



C3341

Log Data Report

Borehole Information:

| | | | | | |
|----------------------------------|--------------------|----------------------------------|---|-------------------------------|---------------------|
| Borehole: C3341 | | Site: 216-B-38 | | | |
| Coordinates | | GWL (ft)¹: N/A | | GWL Date: | |
| North N/A ³ | East N/A | Drill Date June 2001 | TOC² Elevation N/A | Total Depth (ft) 60 | Type push |

Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|----------------|--------------|----------------------|-----------------------|-----------------|----------|-------------|
| steel threaded | 0.5 | 6.625 | 5.625 | 0.5 | 0 | 59.5 |

Borehole Notes:

This temporary borehole was pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface. The zero reference point for the log data is the ground surface.

Logging Equipment Information:

| | |
|--|--|
| Logging System: Gamma 2B | Type: SGLS (35%) |
| Calibration Date: 09/00 | Calibration Reference: GJO-2001-245-TAR |
| Logging Procedure: MAC-HGLP 1.6.5 | |

| | |
|--|--|
| Logging System: RLS1 | Type: NMLS (Moisture) |
| Calibration Date: 05/01 | Calibration Reference: GJO-2001-247-TAR |
| Logging Procedure: MAC-HGLP 1.6.5 | |

| | |
|--|--|
| Logging System: Gamma 1C | Type: HRLS |
| Calibration Date: 09/00 | Calibration Reference: GJO-2001-244-TAR |
| Logging Procedure: MAC-HGLP 1.6.5 | |

Spectral Gamma Logging System (SGLS) Log Run Information:

| | | | | | |
|-------------------|------------------|----------|----------|----------|----------|
| Log Run | 1 | 2 | 3 | 4 | 5 |
| Date | 7/10/01 | 7/10/01 | 7/10/01 | 7/10/01 | 7/10/01 |
| Logging Engineer | Spatz | Spatz | Spatz | Spatz | Spatz |
| Start Depth | 59.5 | 33.0 | 30.5 | 20.0 | 19.0 |
| Finish Depth | 32.0 | 29.5 | 19.0 | 18.0 | 13.0 |
| Count Time (sec) | 180 | 180 | 180 | 180 | 30 |
| Live/Real | L | R | L | R | R |
| Shield (Y/N) | N | N | N | N | N |
| MSA Interval (ft) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ft/min | n/a ⁴ | n/a | n/a | n/a | n/a |
| Pre-Verification | B0016CAB | B0016CAB | B0016CAB | B0016CAB | B0016CAB |
| Start File | B0016000 | B0016056 | B0016064 | B0016088 | B0016093 |
| Finish File | B0016055 | B0016063 | B0016087 | B0016092 | B0016105 |
| Post-Verification | B0016CAA | B0016CAA | B0016CAA | B0016CAA | B0016CAA |

| | | | | | |
|-------------------|----------|--------------|--------------|--|--|
| Log Run | 6 | 7 | 8 (repeat) | | |
| Date | 7/10/01 | 7/11/01 | 7/11/01 | | |
| Logging Engineer | Spatz | Musial/Spatz | Musial/Spatz | | |
| Start Depth | 14.0 | 8.0 | 14.0 | | |
| Finish Depth | 7.0 | 1.0 | 8.0 | | |
| Count Time (sec) | 180 | 180 | 180 | | |
| Live/Real | L | L | L | | |
| Shield (Y/N) | N | N | N | | |
| MSA Interval (ft) | 0.5 | 0.5 | 0.5 | | |
| ft/min | n/a | n/a | n/a | | |
| Pre-Verification | B0016CAB | B0017CAB | B0017CAB | | |
| Start File | B0016106 | B0017000 | B0017015 | | |
| Finish File | B0016120 | B0017014 | B0017027 | | |
| Post-Verification | B0016CAA | B0017CAA | B0017CAA | | |

High Rate Logging System (HRLS) Log Run Information:

| | | | | | |
|-------------------|--------------------|--------------------|--|--|--|
| Log Run | 9 | 10 | | | |
| Date | 7/20/01 | 7/20/01 | | | |
| Logging Engineer | Pearson /Musial | Pearson /Musial | | | |
| Start Depth | 13.5 | 29.0 | | | |
| Finish Depth | 24.0 | 34.0 | | | |
| Count Time (sec) | 300 | 300 | | | |
| Live/Real | R | R | | | |
| Shield (Y/N) | N | N | | | |
| MSA Interval (ft) | 0.5 | 0.5 | | | |
| ft/min | n/a | n/a | | | |
| Pre-Verification | D0000CAB | D0000CAB | | | |
| Start File | D0001000 | D0001022 | | | |
| Finish File | D0001021 | D0001032 | | | |
| Post-Verification | D0002CAA | D0002CAA | | | |

Neutron Moisture Logging System (NMLS) Log Run Information:

| | | | | |
|-------------------|-----------|-------------|--|--|
| Log Run | 11 | 12 (repeat) | | |
| Date | 7/24/01 | 7/24/01 | | |
| Logging Engineer | Kos/Spatz | Kos/Spatz | | |
| Start Depth | 0.0 | 42.0 | | |
| Finish Depth | 59.5 | 35.75 | | |
| Count Time (sec) | n/a | n/a | | |
| Live/Real | n/a | n/a | | |
| Shield (Y/N) | N | N | | |
| MSA Interval (ft) | 0.25 | 0.25 | | |
| ft/min | 1.0 | 1.0 | | |
| Pre-Verification | C0042CAB | C0042CAB | | |
| Start File | C0062000 | C0062239 | | |
| Finish File | C0062238 | C0062264 | | |
| Post-Verification | C0062CAA | C0062CAA | | |

Logging Operation Notes:

Log depths are relative to ground surface. Multiple SGLS log runs were made to adjust count times in response to high dead time intervals. Measurement mode was switched from live time to real time in intervals with high count rates to expedite logging operations. In areas of excessive dead time, the count time was reduced to 30 seconds to provide a log record where spectra are not anticipated to contain reliable full energy peaks. No fine-gain adjustments were made. The post-run verification spectrum B0017CAA was collected over a 500-second count time instead of 1,000 seconds.

The HRLS data are relative to top of casing. To account for the 0.5-ft stickup, depths for the HRLS should be reduced by 0.5 ft.

Analysis Notes:

| | | | | | |
|-----------------|--------|--------------|----------|-------------------|------------------------|
| Analyst: | McCain | Date: | 07/27/01 | Reference: | MAC-VZCP 1.7.9, Rev. 2 |
|-----------------|--------|--------------|----------|-------------------|------------------------|

Pre-run and post run verification spectra were evaluated and found to be within acceptance criteria. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness and dead time. Water correction was not required. Because of high dead time and detector saturation, maximum gross count rates and ¹³⁷Cs concentrations are not considered reliable, and are probably significantly higher than reported values. Where dead time exceeds about 40 percent, pulse pileup and peak spreading effects may result in underestimation of peak count rates. The ²¹⁴Bi peak at 1764 keV was used to determine ²³⁸U concentrations instead of the ²¹⁴Bi peak at 609 keV to avoid interference from the ¹³⁷Cs peak at 662 keV.

The high rate data were processed for ¹³⁷Cs count rate at 662-keV energy level using APTEC supervisor. Concentrations were calculated in EXCEL. A casing correction factor of 1.37 was applied to the high rate data to account for the increased attenuation in the 0.5-inch steel casing, relative to 0.28-inch casing, for which the system was calibrated. No shield corrections were required.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of

the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , and decay progeny of ^{232}Th and ^{238}U), man-made radionuclides, and moisture content. 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 and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. Intervals where SGLS dead time exceeds 40% are shaded. The total gamma log is plotted at both logarithmic and linear scales. The logarithmic scale shows the full range of variation, while the linear scale shows subtle variation in low count intervals.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs. This demonstrates good repeatability in both depth and radionuclide measurement.

Results and Interpretations :

^{137}Cs and ^{60}Co were detected. The highest ^{137}Cs concentrations occur between 12.5 and 28 ft. High dead times and detector saturation occurs between 14.5 and 19 ft. The maximum measured ^{137}Cs concentration is about 56,186 pCi/g at 17 ft. A second interval of ^{137}Cs occurs between 29.5 and 33 ft, with concentrations as high as 6356 pCi/g at 31.5 ft. Minor ^{137}Cs also occurs between 4.0 and 5.5 ft, with a maximum concentration of 2.57 pCi/g.

^{60}Co was detected intermittently between 33 and 57 ft, with a maximum concentration of 0.16 pCi/g at 33 ft.

^{40}K concentrations increase gradually from about 10 pCi/g at 19 ft to about 20 pCi/g at 33 ft. This increase may indicate a gradational change, with increasing fines in the material below 32.5 ft.

Moisture content appears to increase slightly between about 15 and 35 ft. This corresponds to the interval of high ^{137}Cs concentration, but it is not clear if the neutron log is responding to an increased moisture content or to interference from the high gamma flux in this interval.

¹ GWL – groundwater level

² TOC – top of casing

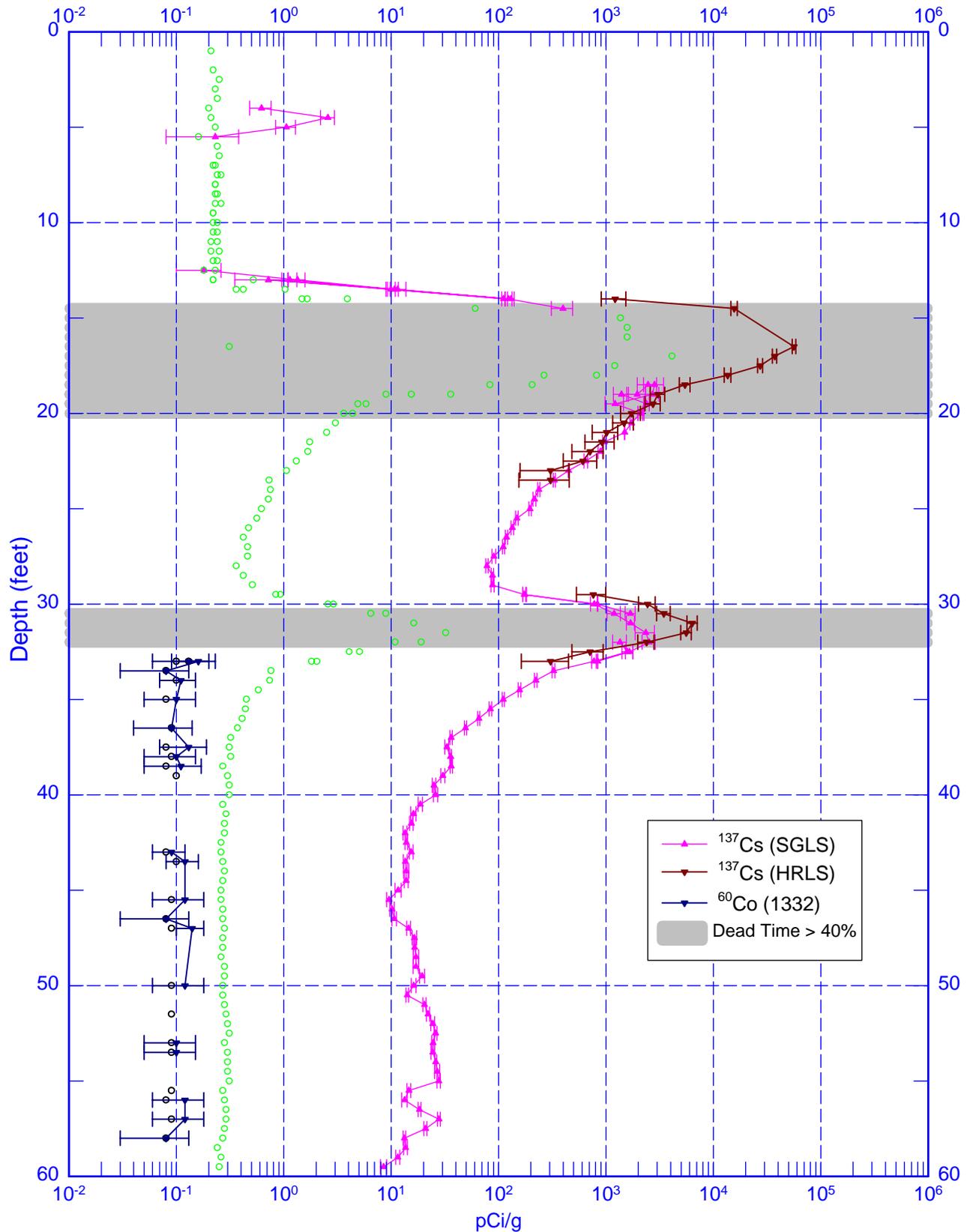
³ N/A – not available

⁴ n/a – not applicable

C3341

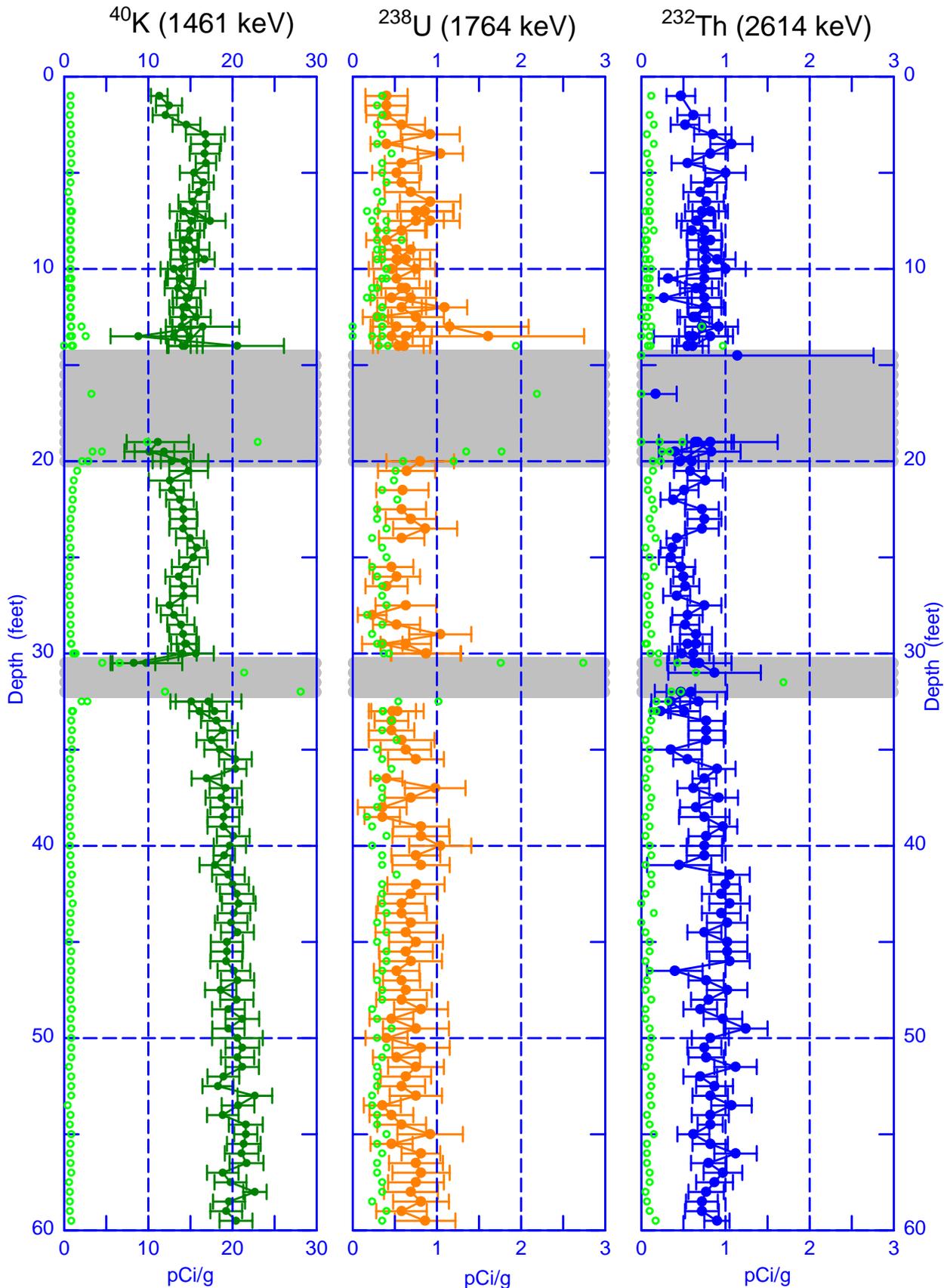
Man-Made Radionuclides

^{137}Cs (662 keV)



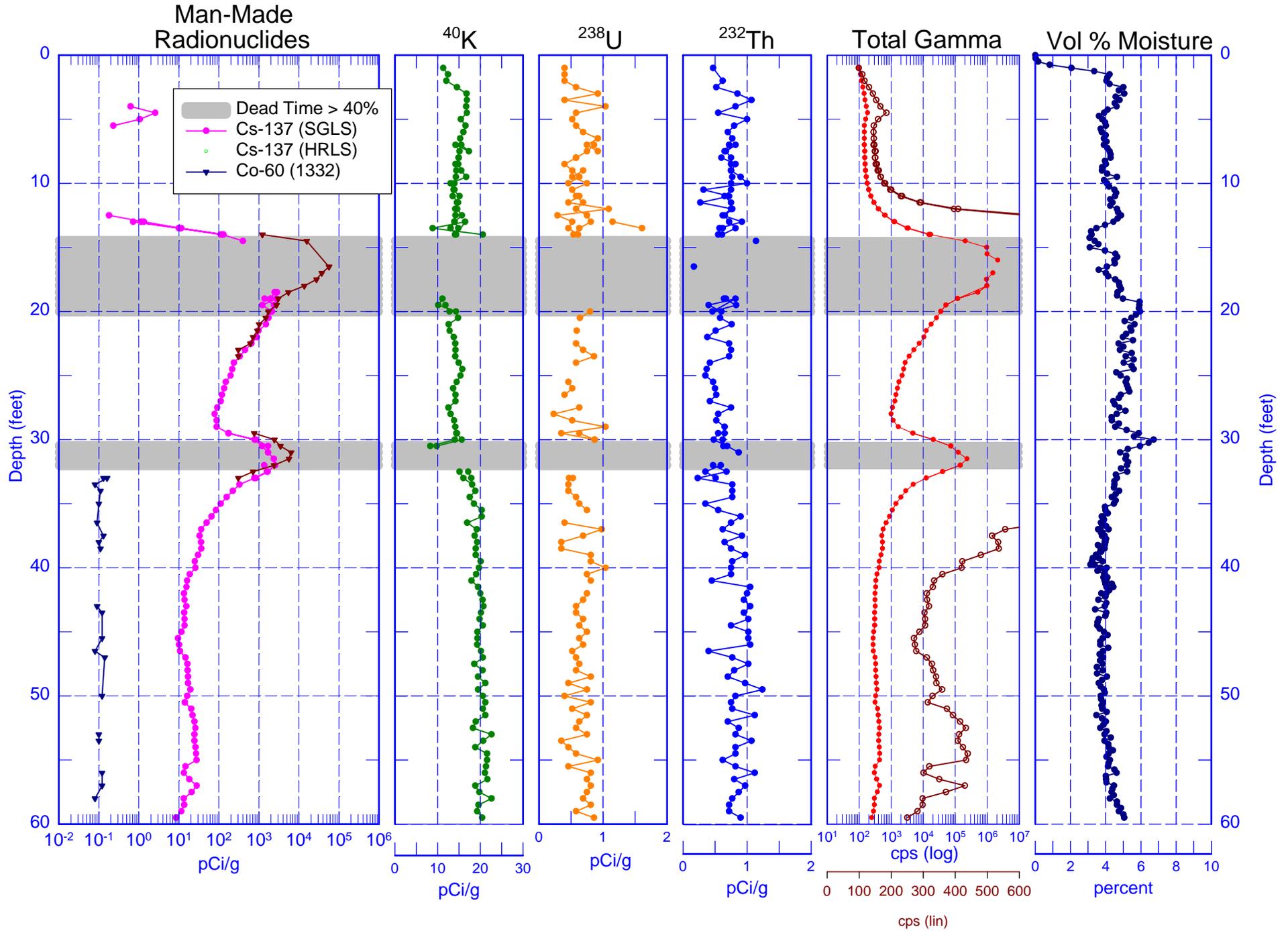
C3341

Natural Gamma (KUT) Logs

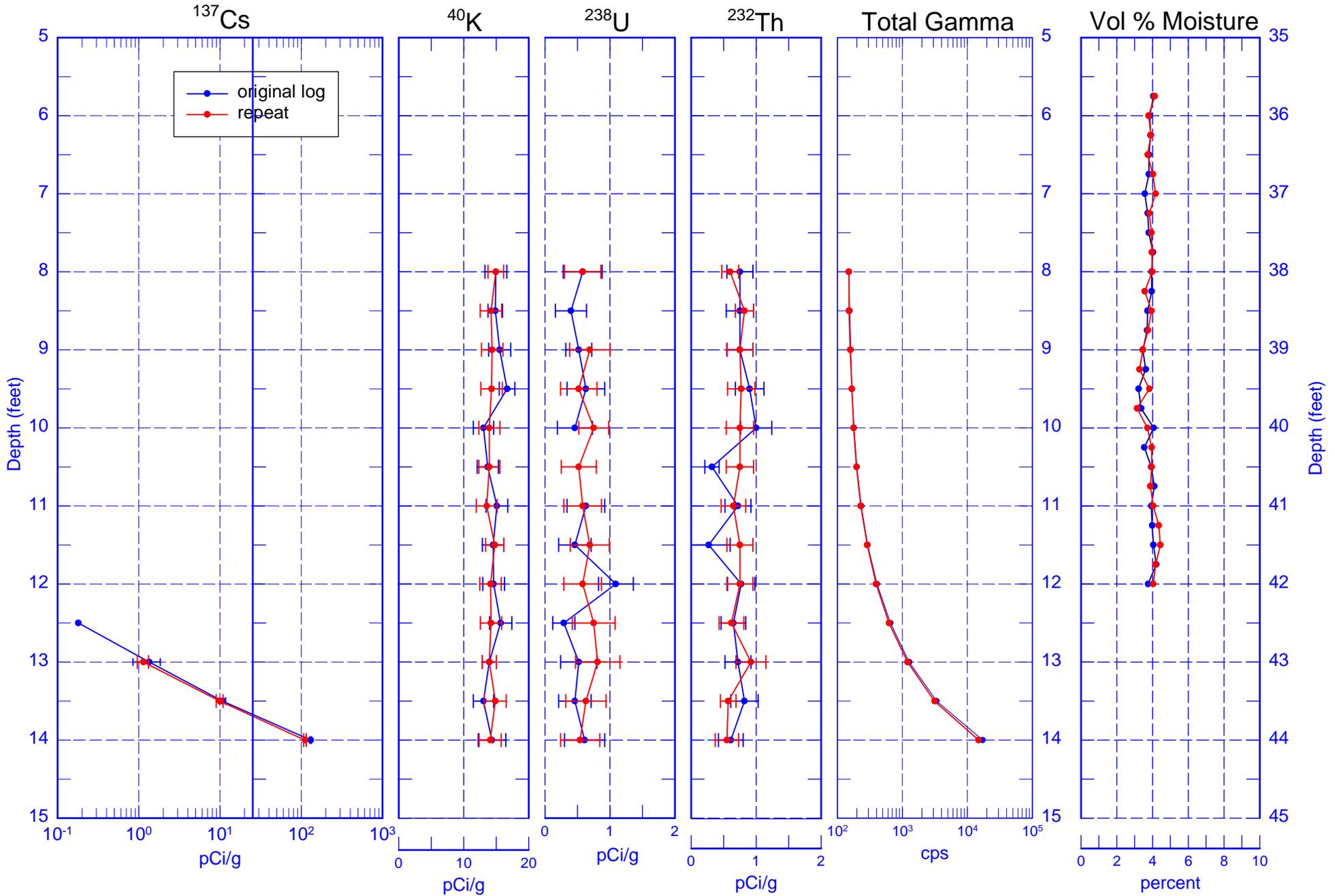


MDL

C3341 Combination Plots



C3341 Repeat Plots



C3341

Total Gamma & Dead Time

