MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 50-06-02

Borehole Information

Farm : T	**Tank :** T-106	**Site Number :** 299-W10-108
N-Coord : 43,580	**W-Coord :** 75,805	**TOC Elevation :** 671.84
Water Level, ft :	**Date Drilled :** 7/31/1973	

Casing Record

Type :	Steel-welded	Thickness, in. :	0.237	ID, in. :	4
Top Depth, ft. :	0	Bottom Depth, ft. :	125		
Type :	Steel-welded	Thickness, in. :	0.280	ID, in. :	6
Top Depth, ft. :	0	Bottom Depth, ft. :	125		

Cement Bottom, ft. : 125 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 50-06-02 was drilled in July 1973 to a depth of 92 ft with 6-in. casing. Data from the drilling log and Chamness and Merz (1993) were used to provide borehole construction information. In May 1977, the borehole was deepened and the 6-in. casing was extended to a depth of 125 ft. The 6-in. casing was perforated from 0 to 20 ft, 82 to 110 ft, and 115 to 125 ft. A 4-in. casing liner with a metal cap welded on the bottom was positioned inside the 6-in. casing. Although no information concerning grouting was provided in the drilling log or Chamness and Merz (1993), it is assumed the entire annulus between the 4-in. and 6-in. casings was filled with grout because annular grouting was part of the procedure used during the 1977 campaign to deepen selected T Tank Farm boreholes. In addition, the logging engineer reported that grout was visible between the casings at the ground surface. The thicknesses of the 4-in. and 6-in. casings are presumed to be 0.237 in. and 0.280 in., respectively, on the basis of the published thickness for schedule-40, 4-in. and 6-in. steel tubing.

Equipment Information

Logging System : 2B	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 11/1997	**Calibration Reference :** GJO-HAN-20	**Logging Procedure :** MAC-VZCP 1.7.10-1

Logging Information

Log Run Number : 1	**Log Run Date :** 03/09/1998	**Logging Engineer:** Alan Pearson
Start Depth, ft.: 0.0	**Counting Time, sec.:** 200	**L/R :** L **Shield :** N
Finish Depth, ft. : 32.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Log Event A

Log Run Number :	2	**Log Run Date :**	03/10/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	31.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	84.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	03/11/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	122.5	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	83.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged by the SGLS in three log runs using a 200-s counting time. The top of the borehole casing, which is the zero reference for the SGLS, is approximately flush with the ground surface. The total logging depth achieved was 122.5 ft.

Analysis Information

Analyst : E. Larsen

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 07/06/1998

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

This borehole was completed with 4-in.- and 6-in.-diameter casings along the entire logged interval. A casing correction factor for a 0.50-in.-thick steel casing was applied to the concentration data because it most closely matched the 0.517-in. total combined thickness of the 4-in. and 6-in. casings. The entire annulus between the 4-in. and 6-in. casings is filled with grout, making calculation of accurate radionuclide concentrations impossible. However, man-made and natural radionuclides were identified and apparent concentrations are reported.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the estimated uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Log Event A

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A time-sequence plot of the historical gross gamma log data from 1975 to 1994 is presented with the SGLS log plots.

Results/Interpretations:

The radionuclide concentrations identified in this section are reported as only apparent concentrations and are underestimated.

The man-made radionuclides Cs-137, Co-60, Eu-154, Eu-152, U-238, and U-235 were detected by the SGLS. The Cs-137 contamination was detected continuously from the ground surface to 12 ft and nearly continuously from 15.5 to 18.5 ft. A few isolated occurrences of Cs-137 contamination were detected at 25.5 and 29 ft, from 117.5 to 118 ft, and at the bottom of the logged interval (122 to 122.5 ft). The Co-60 contamination was measured continuously from 44.5 ft to the bottom of the logged interval. The Eu-154 contamination was detected continuously from 44.5 to 91 ft. Small zones of continuous and nearly continuous Eu-154 contamination were detected between 94 ft and the bottom of the logged interval. The Eu-152 contamination was measured continuously from 48 to 72.5 ft. A few occurrences of Eu-152 were detected between 75.5 and 77.5 ft. Generally isolated occurrences of U-238 contamination were detected between 76.5 and 91 ft. A single occurrence of U-235 was detected at 91.5 ft.

The naturally occurring U-238 concentrations are absent between 47 and 101 ft.

The K-40 concentration values increase from 37.5 to 39 ft and remain elevated to 48 ft. Increased Th-232 concentrations were detected at about 40 ft and from 81 to 90.5 ft. Sharply decreased K-40 and Th-232 concentration values occur from 91 to 94 ft and 100 to 105 ft. The K-40 and Th-232 concentrations increase at about 107 ft and remain elevated to the bottom of the logged interval.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank T-106.