MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 50-06-03

Borehole Information

Farm :	T	**Tank :**	T-106	**Site Number :**	299-W10-107
N-Coord :	43,535	**W-Coord :**	75,792	**TOC Elevation :**	671.51
Water Level, ft :	106.0	**Date Drilled :**	7/31/1973		

Casing Record

Type :	Steel-welded	Thickness, in. :	0.237	ID, in. :	4
Top Depth, ft. :	0	Bottom Depth, ft. :	122		
Type :	Steel-welded	Thickness, in. :	0.280	ID, in. :	6
Top Depth, ft. :	0	Bottom Depth, ft. :	122		

Cement Bottom, ft. : 122 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 50-06-03 was drilled in July 1973 to a depth of 100 ft with 6-in. casing. Data from the drilling log and Chamness and Merz (1993) were used to provide borehole construction information. In March 1977, the borehole was deepened and the 6-in. casing was extended to a depth of 122 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 or perforations was provided in the drilling log or Chamness and Merz (1993), it is assumed that portions of the 6-in. casing were perforated and the entire annulus between the 4-in. and 6-in. casings was filled with grout because casing perforation and annular grouting were 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 :**	03/04/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	10.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Event A

Borehole # 50-06-03

Log Run Number :	2	**Log Run Date :**	03/05/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	9.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	44.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	3	**Log Run Date :**	03/05/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	43.5	**Counting Time, sec.:**	200	**L/R :** R	**Shield :** N
Finish Depth, ft. :	49.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	4	**Log Run Date :**	03/05/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	48.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	64.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	5	**Log Run Date :**	03/06/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	118.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	63.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged by the SGLS in five 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 118.0 ft.

High dead time (greater than 50 percent) was encountered during log run two at a depth of 44 ft. As a result, log run three was logged in real time from 43.5 to 49 ft. Log runs four and five (48 to 118 ft) were logged in live time after the dead time dropped below 50 percent.

A water level of 106.0 ft was recorded at the time of logging, indicating that approximately 12.5 ft of standing water was present inside the borehole.

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.

Approximately 12.5 ft of water has collected inside the bottom of this borehole. The appropriate water correction factor was not available, so no compensation was applied to the water-filled interval. This resulted in lower reported man-made and natural radionuclide concentration values between 105.5 and 118 ft.

A zone of high dead time (greater than 50 percent) occurred from 44 to 49 ft. Although the accuracy of the radioassays collected within the high dead time interval may be limited, these data were still included on the log plot.

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.

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, and Sn-126 were detected by the SGLS. The Cs-137 contamination was detected continuously from the ground surface to a depth of 10 ft. Small zones of continuous Cs-137 contamination were detected from 19.5 to 22 ft and 33 to 40.5 ft. Intermittent occurrences of Cs-137 were detected from 11.5 to 16.5 ft and 27 to 27.5 ft. The Co-60 contamination was measured continuously from 34.5 to 41.5 ft and from 43 ft to the bottom of the logged interval (118 ft). The Eu-154 contamination was detected continuously from 34.5 to 41.5 ft, 42.5 to 97.5 ft, and from 98.5 ft to the bottom of the logged interval. A small zone of Eu-154 contamination was detected from 20 to 21 ft. The Eu-152 contamination was measured continuously from 43.5 to 54.5 ft and nearly continuously from 75.5 to 87.5 ft. Small zones of Eu-152 were detected from 35 to 36.5 ft, 56.5 to 70 ft, and 105.5 to 107 ft. A small zone of Sn-126 was detected from 44.5 to 45.5 ft.

The K-40 concentrations are absent from 45 to 46.5 ft; the Th-232 concentrations are absent from 45.5 to 46.5 ft. Most of the U-238 concentrations are absent between 44 and 50 ft and along a few intervals between 50 ft and the bottom of the logged interval.

Log Event A

Borehole 50-06-03

The K-40 concentration values increase from 37.5 to 39.5 ft. Elevated K-40 concentrations were detected from 39 to 50 ft. Increased Th-232 concentrations occur from 81 to 91 ft. Sharply decreased K-40 and Th-232 concentration values occur from 90 to 94 ft and 100 to 105 ft. The K-40 and Th-232 concentrations increase between 105 and 108 ft and generally 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.