RUST GEOTECH INC.

Spectral Gamma-Ray Borehole
Log Data Report

Borehole 51-06-08

Log Event A

Borehole Information

Farm : TX	**Tank :** TX-106	**Site Number :** 299-W15-175
N-Coord : 41,730	**W-Coord :** 75,892	**TOC Elevation :** 673.77
Water Level, ft :	**Date Drilled :** 4/30/1974	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:

This borehole was completed to a depth of 100 ft in April 1974. Though not mentioned specifically in the drilling log, 6-in. casing was apparently installed from the ground surface to the bottom of the borehole. There is no indication that the casing was perforated. The drilling log does not indicate that any interval of the borehole was grouted. Total logging depth achieved by the SGLS was 98 ft.

The casing thickness is presumed to be 0.280 in., on the basis of published thickness for schedule-40, 6-in. steel tubing.

The zero reference for the SGLS logs is the top of the borehole casing. The top of the casing is flush with the ground surface.

Equipment Information

Logging System : 1	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 11/1995	**Calibration Reference :** GJPO-HAN-3	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	1/25/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	98.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	46.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	1/26/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	47.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	0.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	3	**Log Run Date :**	1/26/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	60.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	40.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : P-GJPO-1787 Analysis Date : 12/4/1996

Analysis Notes :

This borehole was logged by the SGLS in two logging runs. A third log run was a repeat of a segment of the log conducted as an additional quality assurance check.

The pre-survey field verification spectra for all three logging runs failed to meet the acceptance criteria established for the peak shape and system efficiency. A nonconformance report issued in August 1996 (N-96-05) identified the cause of this failure as a power supply malfunction that resulted in a low detector bias voltage being supplied to the logging tool. This malfunction occurred in the mornings because of inadequate system warm-up time. The nonconformance report also documents that radionuclide concentrations calculated from data collected in the first 2 hours of logging could be systematically understated by about 10 percent. Data from logging run one are probably unaffected but data from log run two may show a repeatability problem if the borehole is re-logged in the future.

The post-survey field verification spectra for log runs one and two met the acceptance criteria established for the peak shape and system efficiency, indicating that the logging system was operating properly after an initial warm-up period. The energy calibration and peak-shape calibration from accepted field verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during logging. There was negligible gain drift during logging; it was not necessary to adjust the energy calibration to maintain proper peak identification while processing the data from the logging spectra.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

A depth overlap, where data were collected by separate runs at the same depth, occurred in this borehole between depths of 46 and 47 ft. The KUT concentrations were calculated using the separate data sets at the overlapping depth points. The calculated concentrations of K-40 and U-238 using the separate data sets were generally within two standard deviations of each of the measured gamma-ray energy count rates used in the calculations (two-sigma or 95-percent confidence interval), indicating acceptable repeatability of results from the logging system. The Th-232 concentration in the overlapping region of the logs was close to the MDL and it was not possible to compare all overlapping points.

As an additional check of the repeatability of the logging system, the segment of the log between 60 and 40 ft was repeated and the concentrations of the KUT radionuclides were calculated with the two separate data sets. The concentrations of almost all these radionuclides were within two standard deviations (the two-sigma or 95-percent confidence interval), confirming the good repeatability of the gamma-ray energy measurements used to determine the radionuclide assays. There were no occurrences of man-made radionuclides in the relogged segment of this borehole.

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The man-made gamma-ray-emitting radionuclides Cs-137, Eu-154, and Co-60 were encountered in this borehole. Cs-137 contamination was detected continuously from the ground surface to a depth of 17 ft and from 20 to 32 ft. A zone of relatively higher Cs-137 contamination, about 3 pCi/g, was detected between 2 and 5 ft. The maximum concentration of Cs-137 detected was 30 pCi/g at 6 ft. Eu-154 and Co-60 were also detected in this region of the borehole. Eu-154 was detected between 5 and 6 ft at concentrations ranging from 0.6 to 1 pCi/g. One occurrence of Co-60 was detected at a depth of 5.5 ft at a concentration of 0.15 pCi/g. The historical gross gamma-ray logs of this borehole show that anomalous gamma-ray activity was first detected in this region of the borehole in June 1975.

Detectable quantities of Cs-137 were also encountered intermittently between 33.5 and 38.5 ft and at depths of 43.5, 83.5, 96.5 ft, and at the bottom of the borehole. The Cs-137 concentrations below 32 ft were equal to or slightly above the MDL and ranged from 0.1 to 0.4 pCi/g.

The logs of the naturally occurring radionuclides show a pronounced increase in the K-40 concentrations and a slight increase in the Th-232 concentrations at a depth of about 48 ft.

The SGLS total count rate is reflective of the man-made radionuclides where present, and the naturally occurring radionuclides elsewhere. There is a pronounced increase in the SGLS total count rate below a depth of about 47 ft. There is a noticeable decrease in the count rate between depths of 82 and 93 ft with a slight peak in activity occurring at a depth of about 88 ft.

Details regarding the interpretation of the data for this borehole are presented in the Tank Summary Data Report for tank TX-106.

Log Plot Notes:

Separate log plots show the man-made (Cs-137, Eu-154, and Co-60) and the naturally occurring (KUT) 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 statistical 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, in addition to the total gamma derived from the spectral data and the Tank Farm 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 plot of representative historical gross gamma-ray logs acquired between May 1975 and June 1993 is included. These historical gamma-ray logs can be used to identify the approximate time period in which anomalous gamma-ray activity was recognized in the borehole.

A separate plot shows the concentrations of the naturally occurring radionuclides calculated using both the original log data and the set provided by the rerun segment. There were no occurrences of man-made radionuclides in the repeated segment of the borehole.