



03-3040.30
September 25, 2007

Mr. David Horton, Project Manager
U.S. Army Joint Munitions Command
1 Rock Island Arsenal
Rock Island IL 61299-6000

RE: Final Status Survey of Site 18 Stockpiled Soils

Dear Mr. Horton;

This letter presents the results of the Naval Station Great Lakes (NSGL) Site 18 stockpiled soil surveys and sampling performed to determine if any of this soil was below the recently developed derived concentration guideline level (DCGL) of 4 picocuries per gram (pCi/g) above background for thorium-232 (^{232}Th). The objective of this effort was to determine if any of this stockpiled soil could be further segregated for possible disposition at the NSGL without regard for the radioactive content, thus reducing the overall volume of soil requiring offsite disposal.

History

As the result of prior soil remediation at Site 18 during Phase IV, approximately 875 cubic yards (yd^3) was stockpiled at the NSGL awaiting disposition at a later date. During this time period, the DCGL for ^{232}Th , approved by the NSGL and applied during remediation, was 1.0 pCi/g above background. Removal of this soil from Site 18 was necessary since soil sample analytical results indicated the ^{232}Th concentrations in soil, above background, exceeded this DCGL.

In 2007, the NSGL developed a site-specific DCGL based on the most probable future land use scenario, a resident gardener. Using conservative input parameters for development of the resident gardener exposure model, the DCGL for ^{232}Th was determined to be 4 pCi/g, above background.

Following development of the site-specific DCGL, the NSGL suspected that some of the previously stockpiled soil at Site 18 may not exceed the newly developed site-specific DCGL and thus, may not require offsite disposal. This development could lead to a reduction in the overall cost of remediation as well as the unnecessary use of disposal space at the offsite facility.



Survey Approach and Soil Stockpile Preparation

To determine if soil within this stockpile could be segregated and disposed without regard to radioactivity content (onsite use of soil as excavation backfill, etc.), a survey and sampling approach was designed in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* for Class 1 final status surveys (FSS). This required collection of systematic soil samples on a specified grid, performance of a 100% gamma walkover survey (GWS), and collection of biased soil samples, as required, based on the results of the GWS. It was determined these surveys would be performed over a maximum soil depth of 1 foot. To accomplish this, it was necessary to spread the existing soil stockpile to provide a consistently even surface for survey and sampling performance. This resulted in a “leveled” soil depth of approximately 2 feet across the entire footprint. To meet the 1 foot depth criterion, it was necessary to perform the surveys and soil sampling in two separate evolutions (lifts), with the footprint of each lift constituting a single Class 1 survey unit (SU). The Class 1 survey units for the two lifts were designated SU 17 and SU 18.

The top 1-foot layer of the flattened stockpile was considered SU 17. These soils were evaluated in their entirety prior to their removal (and/or segregation) based on direct comparison to the 4 pCi/g DCGL. Following removal of soil from this first lift, the remaining soils (lift 2) were evaluated using the same approach and techniques as SU 18. Segregation and removal of the soil in the second lift completed the evaluation of the soil stockpile.

Biased soil samples were collected at locations where the GWS count rates were shown to exceed a Z-Score of 3, meaning that the count rate exceeded the mean count rate in that SU by more than 3 standard deviations. These samples were collected to test for the presence of small pockets of contamination within the systematic sampling grid.

Results

A total of 14 systematic soil samples were collected from each of the stockpiled soil Class 1 survey units (lifts). Systematic sample locations were determined in accordance with MARSSIM guidance using a random start point and triangular grid layout. The GWS covered 100 percent of each Class 1 survey unit, with biased samples collected at locations of elevated GWS count rate. The results of the GWS and the systematic and biased sample locations for each of the two Class 1 soil stockpile survey units (SU 17 and SU 18) are shown in Figures 1 and 2, attached.

Soil samples were processed (dried and weighed) and analyzed in CABRERA’s onsite gamma spectroscopy laboratory. Sample count times were sufficient to assure a minimum detectable concentration (MDC) not greater than 10 percent of the DCGL, or 0.4 pCi/g for actinium-228 (²²⁸Ac), the surrogate radionuclide used to determine concentration of ²³²Th in site soils. The actual analysis MDC for all soil samples had an average of 0.25 pCi/g. The raw results of the Onsite Lab counts are attached.



None of the systematic soil sample analytical results for both survey units (SU 17 and SU 18) exceeded the DCGL (4 pCi/g). Therefore, statistical analysis of the sample sets from each survey unit was not necessary. Sample analysis results summaries for both survey units are attached, with summary statistics provided in Table 1.

Table 1. Systematic Sample Summary Statistics for SUs 17 and 18.
(All values in pCi/g)

Survey Unit	Mean	Median	Max	Standard Deviation
SU 17	1.36	1.38	1.61	0.17
SU 18	1.25	1.16	1.93	0.25

The GWS identified three areas of elevated activity in the first lift (SU 17). However, analysis of biased samples obtained from each of these locations did not identify ²³²Th activity above 4 pCi/g. Therefore, it was concluded that none of the soil from the first lift (SU 17) required segregation for packaging and offsite disposal. The GWS in the second lift (SU 18) identified a single area of elevated activity. The biased soil sample obtained from this location did identify ²³²Th activity above the DCGL of 4 pCi/g. A total of 10 yd³ of soil from the second lift (SU 18) was removed and packaged for offsite disposal, with the remainder acceptable for onsite disposition. A summary of the biased sample results is provided in

Table 2. Results of SU 17 and 18 Biased Samples

Sample ID	²³² Th (pCi/g)	2-σ Uncertainty (pCi/g)	Comments
SU17-B29	1.25	0.15	Concentration below DCGL.
SU17-B30	2.18	0.17	Concentration below DCGL.
SU17-B31	1.42	0.16	Concentration below DCGL.
SU18-B32	32.17	0.69	Collected at GWS hot spot. 10 yd ³ of soil removed.
SU18-B33	1.53	0.16	Taken beneath excavated soil area. Concentration below DCGL.

Summary and Conclusion

FSS activities were conducted on the Site 18 soil stockpile from the Phase 4 remediation activities. GWS as well as systematic and biased soil samples were collected as part of the FSS to evaluate these soils versus a newly developed ²³²Th DCGL of 4 pCi/g above background. This evaluation resulted in the removal of 10 yd³ of soil above the site-specific DCGL for ²³²Th, requiring packaging and offsite disposal. As a result, approximately 865 yd³ of previously stockpiled soil was determined acceptable for onsite disposition.



Should you have questions or comments, please contact me at 314.703.6784

Sincerely,

John Eberlin, PMP
Project Manager
Cabrera Services, Inc.

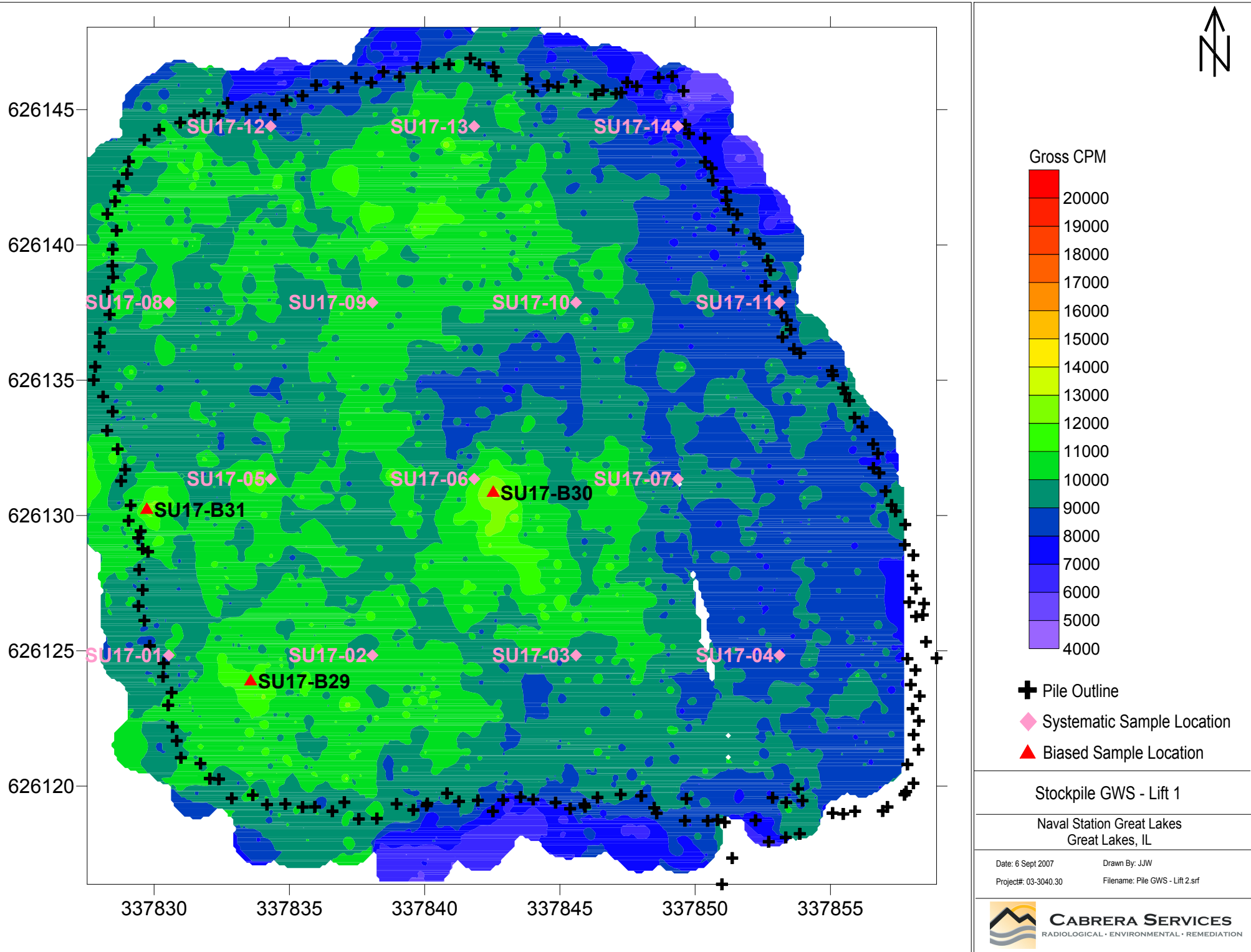
Attachment
cc: Project File

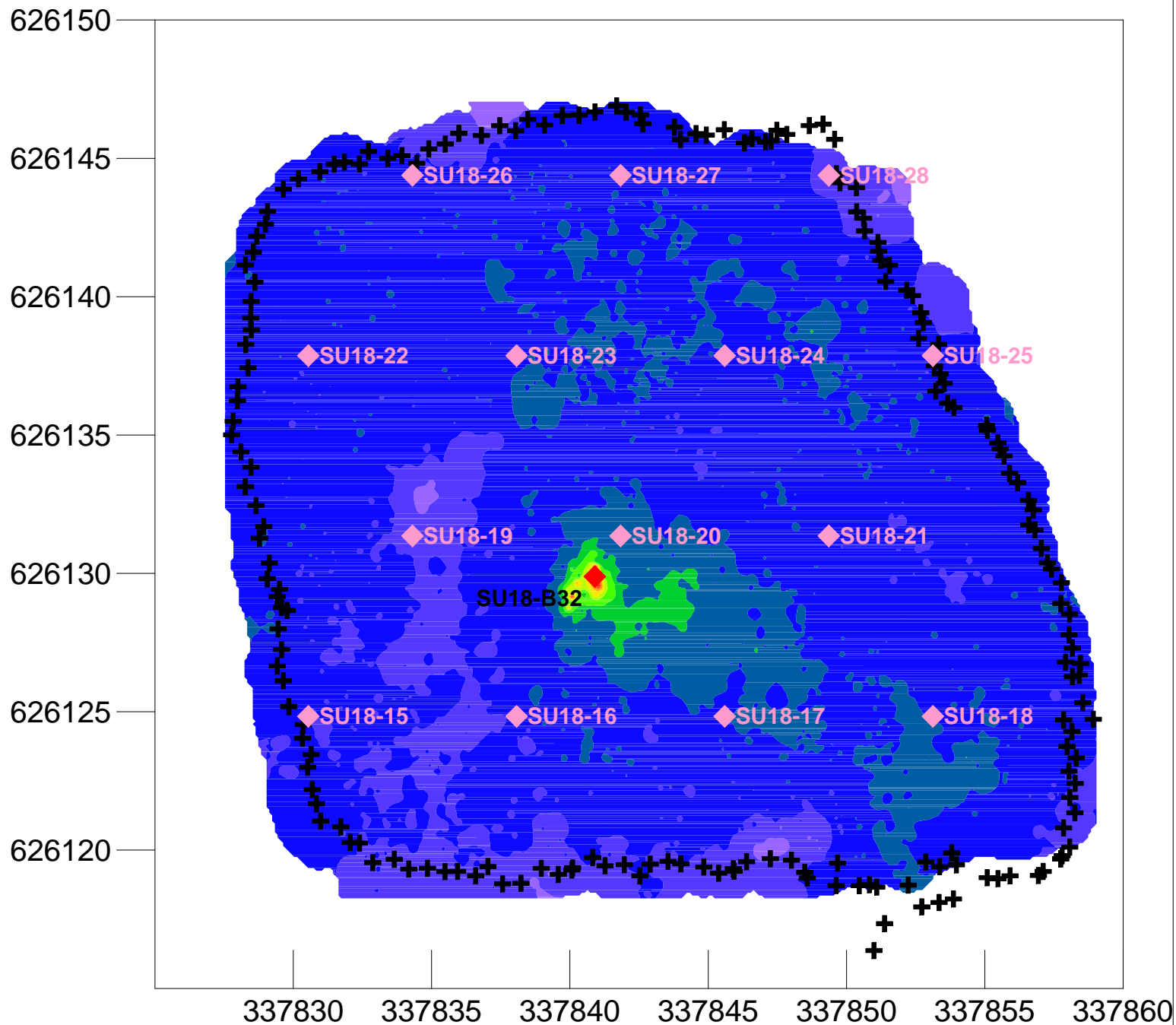


ATTCHMENTS

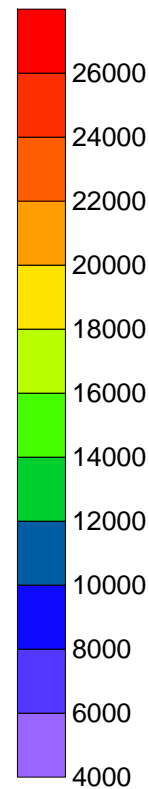
Gamma Walkover Survey Results Maps for SU 17 and SU 18

FSS Systematic Sample Data Summary Sheets





Gross CPM



- + Pile Outline
- ◆ Systematic Sample Location
- ◆ Biased Sample Location

Stockpile GWS - Lift 2

Naval Station Great Lakes
Great Lakes, IL

Date: 6 Sept 2007

Drawn By: JJW

Project#: 03-3040.30

Filename: Pile GWS - Lift 2.srf



CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

Survey Date: 8/29/07
Survey Unit #: SU-17
FSS SU Classification: 1
SU DCGLw (pCi/g): 4.0
SU Description: Stockpile Lift #1

GWS Ratemeter / Probe	Ratemeter S/N	Probe S/N	Cal Due Date
2221 / 44-10	218600	PR-166864	7/3/2008

1	2	3	4	5	6
Sample ID	Sample Type	Th-232 Result (pCi/g)	Th-232 Uncertainty (pCi/g)	Th-232 MDC (pCi/g)	Sign Test Parameter
SU17-01	SYS	1.44	0.15	0.17	-1
SU17-02	SYS	1.39	0.13	0.25	-1
SU17-03	SYS	1.27	0.16	0.23	-1
SU17-04	SYS	1.38	0.14	0.25	-1
SU17-05	SYS	1.18	0.13	0.24	-1
SU17-06	SYS	1.40	0.13	0.24	-1
SU17-07	SYS	1.58	0.18	0.25	-1
SU17-08	SYS	1.34	0.16	0.26	-1
SU17-09	SYS	1.25	0.13	0.28	-1
SU17-10	SYS	1.61	0.18	0.27	-1
SU17-11	SYS	1.20	0.15	0.23	-1
SU17-12	SYS	1.60	0.18	0.28	-1
SU17-13	SYS	1.41	0.17	0.33	-1
SU17-14	SYS	1.01	0.13	0.20	-1
Mean		1.36	MARSSIM SIGN TEST EVALUATION		
Median		1.38	Sum of Positive Signs		0
Std Dev (1 σ)		0.17	Sign Test Critical Value (n=14)		10
Range		0.60	Null Hypothesis Evaluation		PASS

NOTES:

- Sample Type: SYS = Systematic Location B = Biased Location
- MARSSIM Sign Test parameter. If Result > DCGLw, Sign = -1, otherwise 1.

Survey Date:	9/5/2007	GWS Ratemeter / Probe	2221 / 44-10	Ratemeter S/N	218600	Probe S/N	PR-166864	Cal Due Date	7/3/2008
Survey Unit #:	SU-18								
FSS SU Classification:	1								
SU DCGLw (pCi/g):	4.0								
SU Description:	Stockpile Lift #2								

1	2	3	4	5	6
Sample ID	Sample Type	Th-232 Result (pCi/g)	Th-232 Uncertainty (pCi/g)	Th-232 MDC (pCi/g)	Sign Test Parameter
SU18-15	SYS	1.39	0.15	0.25	-1
SU18-16	SYS	1.17	0.15	0.23	-1
SU18-17	SYS	1.14	0.15	0.29	-1
SU18-18	SYS	1.59	0.17	0.25	-1
SU18-19	SYS	1.26	0.15	0.23	-1
SU18-20	SYS	1.93	0.16	0.27	-1
SU18-21	SYS	1.07	0.16	0.22	-1
SU18-22	SYS	1.37	0.15	0.29	-1
SU18-23	SYS	1.15	0.15	0.26	-1
SU18-24	SYS	1.02	0.14	0.23	-1
SU18-25	SYS	1.01	0.15	0.25	-1
SU18-26	SYS	1.10	0.15	0.23	-1
SU18-27	SYS	1.14	0.15	0.23	-1
SU18-28	SYS	1.17	0.15	0.23	-1
Mean		1.25	MARSSIM SIGN TEST EVALUATION		
Median		1.16	Sum of Positive Signs		0
Std Dev (1 σ)		0.25	Sign Test Critical Value (n=14)		10
Range		0.92	Null Hypothesis Evaluation		PASS

NOTES:

- 1 Sample Type: SYS = Systematic Location B = Biased Location
- 2 MARSSIM Sign Test parameter. If Result > DCGLw, Sign = 1, otherwise -1.