

FINAL STATUS SURVEY REPORT

SURFACE SOIL CHARACTERIZATION

**NUCLEAR FUEL SERVICES NORTH SITE
Erwin, Tennessee**

SURVEY UNIT 1 AND 2

PREPARED FOR:

NUCLEAR FUEL SERVICES, INC.



PREPARED BY:

**MACTEC DEVELOPMENT CORPORATION
MACTEC PROJECT No. 9120101303**

**REVISION 1
JULY 2011**

WORK PERFORMED UNDER DOE CONTRACT No. DE-AC12-04SN39427



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SURVEY UNIT 1 AND 2

NUCLEAR FUEL SERVICES NORTH SITE

Erwin, Tennessee

US NRC SNM License Number 124

Docket Number 70-143

Prepared for:

**Nuclear Fuel Services, Inc.
1205 Banner Hill Road
Erwin, Tennessee 37650**

Prepared by:



**751 Horizon Court, Suite 104
Grand Junction, Colorado 81506**

Contract No. POO7O3070423

Project No. 9120101303

**Revision 1
July 2011**

INTRODUCTION

This report provides a summary of the surface soil investigations performed in Survey Units (SU) 1 and 2 at Nuclear Fuel Service's (NFS) North Site. Both survey units' subsurface soils were previously characterized as part of the Subsurface Soil Characterization and Final Status Survey (FSS) Project. Both survey units' subsurface soils passed the requirements for free release. However, the Nuclear Regulatory Commission (NRC) requested that a surface soil survey be conducted on SU 1 because it would not be excavated or backfilled in the future. NFS elected to conduct a surface soil survey in SU 2 as it was not excavated and not planned to be backfilled in the future.

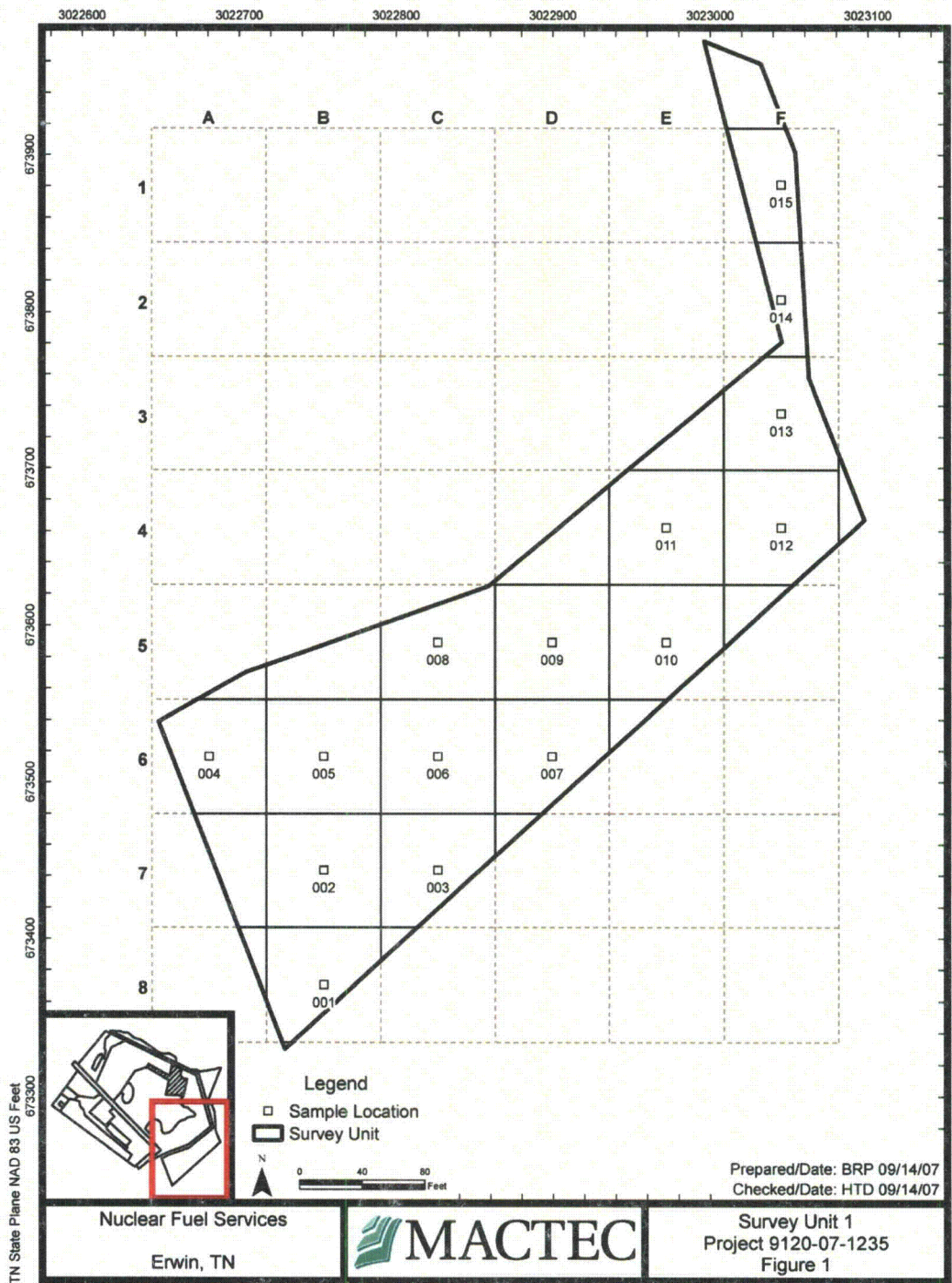
The surface soil survey was designed to evaluate the radiological condition of the survey units in a manner that would be comparable to the methodology utilized and data generated in the Subsurface Soil Characterization project. The design included three types of measurements for the survey units.

- 1- In-Situ static gamma spectroscopy measurements performed at each of the core hole locations established during the subsurface soil investigation.
- 2- Surface soil samples collected from the top 6" of surface soil at each of the core hole locations established during the subsurface soil investigation.
- 3- Scanning gamma spectroscopy measurements performed across the accessible areas of the survey units.

The survey was performed during October and November of 2010.

IN-SITU MEASUREMENT RESULTS

In-situ static measurements were taken at each core hole that was established as part of the subsurface characterization at the north site (Mactec Project# 9120071235). The measurements were performed with a 3"x 3" sodium iodide detector coupled to an ORTEC digibase. At each core hole location shown below, a 20 minute gamma spectra was collected with ORTEC's multi-channel analyzer (MCA) software. Subsequently, the spectra were processed in order to calculate the gross counts in a number of regions of interest (ROI) and net photo peak counts were then derived for each ROI. Finally, the net count rate for a photo peak was converted to a soil concentration for Uranium-238, Thorium-232, and Potassium-40. The net photo peak count rate was calculated for Am-241 and U-235 however the concentration was not calculated or estimated for these isotopes. Rather, the net photo peak count rate was collected to confirm that the concentrations for these isotopes did not change across the survey units.



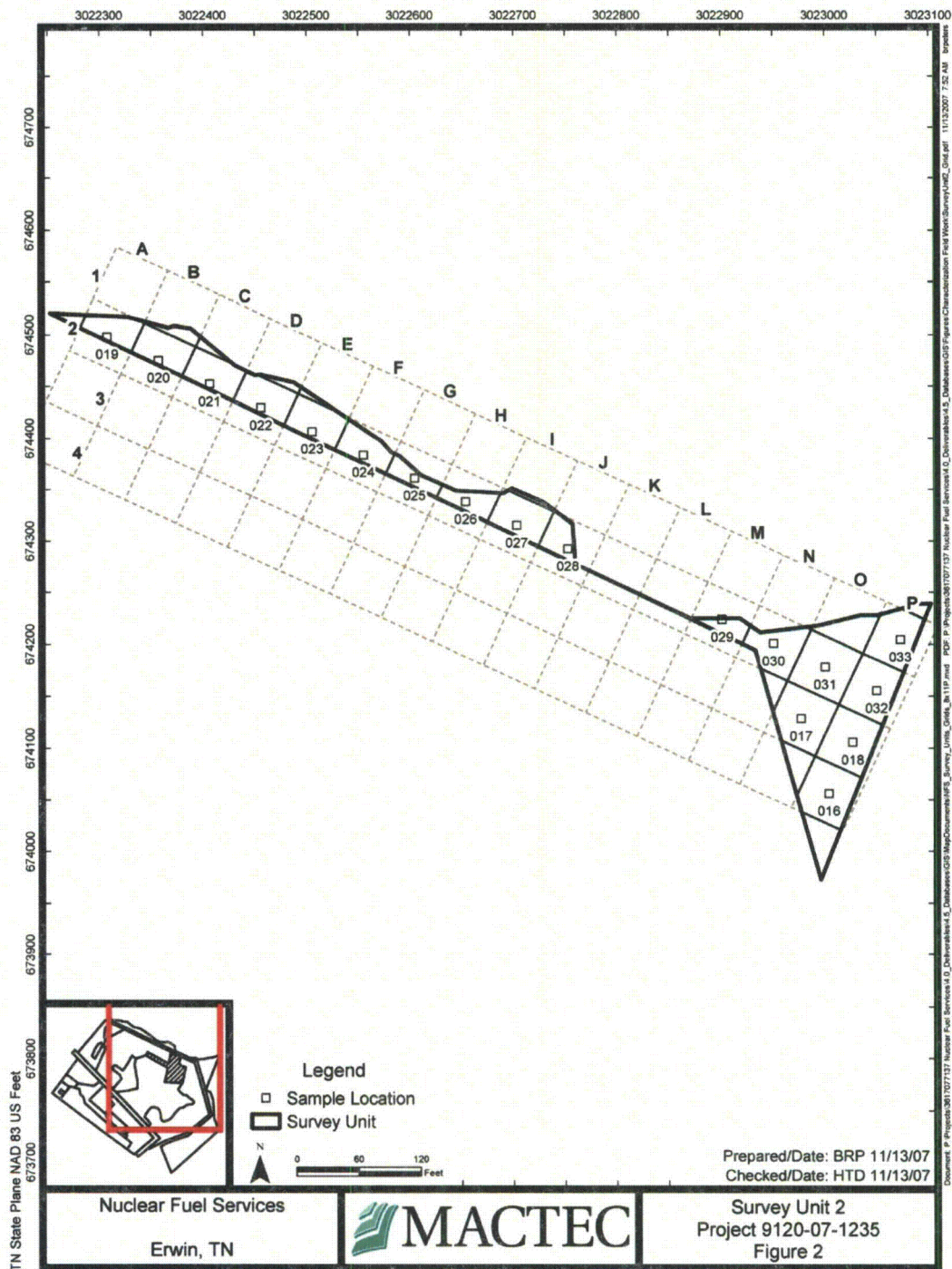


Table 1 In-Situ Static Gamma Measurements

Core Hole Location	Surface DCGL			306	3.7	SOF for Uranium and Thorium
	Net Am-241 Det-1 [net cps]	Net U-235 Det-1 [net cps]	Net K-40 Det-1 [pCi/g]	Net U-238 Det-1 [pCi/g]	Net Th-232 Det-1 [pCi/g]	
InSitu_B1	-4.83	-1.93	4.24	0.51	0.97	0.26
InSitu_B2	-4.79	-2.42	4.75	0.54	0.61	0.17
InSitu_B3	-4.04	-1.56	3.94	0.60	0.90	0.25
InSitu_B4	-4.73	-2.08	5.56	0.47	0.66	0.18
InSitu_B5	-4.24	-1.87	4.74	0.51	0.73	0.20
InSitu_B6	-3.91	-1.99	5.48	0.48	0.65	0.18
InSitu_B7	-3.51	-1.59	5.45	0.36	0.57	0.16
InSitu_B8	-3.52	-1.32	6.51	0.41	0.67	0.18
InSitu_B9	-3.84	-2.02	5.76	0.52	0.69	0.19
InSitu_B10	-3.64	-1.72	5.31	0.46	0.77	0.21
InSitu_B11	-3.30	-1.73	6.09	0.52	0.56	0.15
InSitu_B12	-3.78	-1.58	5.35	0.45	0.47	0.13
InSitu_B13	-4.07	-1.98	4.93	0.44	0.57	0.16
InSitu_B14	-4.53	-2.09	6.44	0.56	0.45	0.12
InSitu_B15	-5.51	-1.93	8.53	0.73	0.63	0.17
InSitu_B16	-2.51	-2.50	6.01	0.40	0.39	0.11
InSitu_B17	-2.99	-2.44	5.72	0.44	0.35	0.10
InSitu_B18	-2.33	-2.18	6.50	0.35	0.46	0.12
InSitu_B19	-5.12	-1.28	7.53	0.52	0.29	0.08
InSitu_B20	-4.51	-1.28	8.95	0.36	0.26	0.07
InSitu_B21	-5.21	-1.25	6.98	0.58	0.36	0.10
InSitu_B22	-4.85	-1.55	4.86	0.36	0.24	0.07
InSitu_B23	-4.70	-1.92	5.69	0.42	0.26	0.07
InSitu_B24	-5.27	-2.09	7.79	0.61	0.26	0.07
InSitu_B25	-5.47	-1.88	14.56	0.80	0.50	0.14
InSitu_B26	-5.92	-2.18	16.93	1.39	0.58	0.16
InSitu_B27	-5.24	-4.01	6.19	1.96	0.41	0.12
InSitu_B28	-4.65	-2.19	5.78	0.66	0.44	0.12
InSitu_B29	-4.36	-1.52	5.94	0.56	0.59	0.16
InSitu_B30	-3.47	-1.17	5.91	0.52	0.42	0.11
InSitu_B31	-3.82	-1.73	5.45	0.57	0.33	0.09
InSitu_B32	-2.35	-2.10	5.78	0.45	0.40	0.11
InSitu_B33	-4.24	-1.55	5.76	0.45	0.50	0.14

SOIL SAMPLE RESULTS

Soil samples were collected from the top 6 inches of surface soil at each core hole location in both survey units. The samples were collected in accordance with NFS procedure NFS-DC-103. The soil sample documentation was completed and maintained by an NFS sampling supervisor. Each sample was analyzed by the NFS gamma spec laboratory for U-235, U-238, Th-232, and Am-241. The samples were dried and the moisture corrected activity was calculated. Additionally, a sum of fractions of each contaminate of concern verse its respective surface soil derived concentration guideline (DCGL) was calculated. In the calculation of the sum of fractions, contaminants of concern with reported activities less than 0 were assumed to be 0, which is conservative.

Table 2 Soil Sample Results from Survey Unit 1

Sample ID	Date Analyzed	Net Weight	Surface DCGL	74	306	3.7	130	SOF
			% Moisture	U-235	U-238	Th-232	Am-241	
SB-001	10/21/2010	256.9	29.3	0.14	2.90	2.06	0.05	0.57
SB-002	10/21/2010	265.8	19.5	0.30	6.20	2.94	-0.90	0.82
SB-003	10/21/2010	302.9	31.5	0.26	-8.56	1.81	0.29	0.49
SB-004	10/21/2010	292.3	24.9	0.26	5.04	2.91	-0.46	0.81
SB-005	10/21/2010	299.5	28.0	0.06	-9.58	2.19	0.11	0.59
SB-006	10/21/2010	323.1	17.5	0.23	0.58	1.74	-0.98	0.47
SB-007	10/21/2010	345.7	24.1	0.25	-8.06	1.83	0.13	0.50
SB-008	10/21/2010	325.7	26.5	0.25	-17.59	2.68	-0.28	0.73
SB-009	10/21/2010	324.1	23.1	0.08	-10.43	1.60	-0.24	0.43
SB-010	10/21/2010	313.1	22.8	0.29	-9.82	2.47	-0.56	0.67
SB-011	10/22/2010	341.9	16.8	0.12	5.54	1.61	-0.14	0.46
SB-012	10/22/2010	282.1	16.1	0.24	5.06	1.90	-0.94	0.53
SB-013	10/22/2010	338.5	19.4	0.20	3.73	1.64	-0.17	0.46
SB-013FD	10/22/2010	326.1	22.1	0.23	13.53	1.63	-0.48	0.49
SB-014	10/22/2010	375.2	14.2	0.17	3.97	1.11	-0.08	0.31
SB-015	10/22/2010	310.1	20.3	0.24	8.76	1.85	-0.13	0.53
SB-015FD	10/22/2010	336.2	20.6	0.22	6.21	1.96	0.12	0.56

Table 3 Soil Sample Results from Survey Unit 2

			Surface DCGL	74	306	3.7	130	
	Date	Net	Moisture Corrected Activity [pCi/g]					
Sample ID	Analyzed	Weight	% Moisture	U-235	U-238	Th-232	Am-241	SOF
SB-016	11/2/2010	333.2	14.8	0.13	0.80	1.09	-0.42	0.30
SB-017	11/2/2010	379.8	13.7	0.10	-9.38	1.59	0.95	0.44
SB-018	11/2/2010	353.2	16.9	0.12	-9.00	1.53	0.02	0.41
SB-019	11/8/2010	309.9	28.4	0.27	10.59	1.31	-0.28	0.39
SB-020	11/8/2010	394	21.8	0.24	-5.58	1.70	-0.47	0.46
SB-021	11/8/2010	339.1	28	0.19	14.08	2.02	-0.41	0.59
SB-022	11/8/2010	345.2	27.2	0.19	1.96	2.33	-0.68	0.64
SB-023	11/8/2010	359.7	21	0.09	8.84	1.00	-0.56	0.30
SB-024	11/8/2010	323.7	28.2	0.17	-6.57	0.97	0.05	0.27
SB-025	11/8/2010	301.1	36.1	0.21	12.01	2.36	0.38	0.68
SB-026	11/8/2010	301.4	34.9	0.16	0.18	2.00	-1.14	0.54
SB026FD	11/8/2010	296.8	36.2	0.07	6.51	2.37	-0.43	0.66
SB-027	11/8/2010	319.7	34.8	0.36	-8.95	1.53	-0.97	0.42
SB027FD	11/9/2010	302.8	32.8	0.13	11.62	2.17	0.29	0.63
SB-028	11/9/2010	371	19.4	0.02	6.42	1.15	0.07	0.33
SB-029	11/9/2010	329.6	29.2	0.18	7.62	2.24	0.23	0.63
SB-030	11/2/2010	360.1	16.8	0.07	3.31	1.43	0.33	0.40
SB-031	11/2/2010	342.6	15.8	0.21	3.15	1.16	-0.89	0.33
SB031FD	11/3/2010	357	15.3	0.03	0.20	1.35	0.65	0.37
SB-032	11/3/2010	353.3	17.9	0.23	-0.17	1.79	-0.77	0.49
SB-033	11/3/2010	317.5	12.7	0.05	20.06	1.73	-0.17	0.53
SB033FD	11/3/2010	315.4	13.4	0.08	12.55	1.77	0.34	0.52

The tables above include field duplicate measurements to confirm quality and consistency in the collection and analysis processes. The soil samples underwent data validation per NFS procedure NFS-DC-008. The validation packages are provided in Appendix 2.

GAMMA SCANNING RESULTS

Gamma scanning was performed using MACTEC's ORION Scan Plot technology. Two each, 3" x 3" NaI detectors coupled to ORTEC digibase's were connected to a laptop running MACTEC's Spartan gamma scanning software. A Trimble global positioning system (GPS) unit was also attached to the laptop in order to log the position of each measurement. The survey files were collected using 1 second acquisitions of spectral data and gps locations. The spectral data was processed in a manner similar to the in-situ static measurement data. Net photo peak count rates were determined for a variety of ROIs.

Appendix 1 provides two-dimensional color scale maps of the radiological net count rates (for U-235 and Am-241) and concentrations (for U-238, Th-232, and K-40). Excluding K-40, the isotopes measured appear to be uniform and there does not appear to be any localized hotspots that would warrant investigation. Furthermore, the uniform nature of the concentrations would support the use of the soil samples alone to assess the radiological condition of the two survey units. The K-40 concentration varied in SU-1 and SU-2; there is an elevated K-40 concentration that can be seen in the middle of SU-2 near core locations 25 and 26. The K-40 in-situ measurements for core holes 25 and 26 were also elevated compared to the rest of the measurements taken.

QUALITY CONTROL

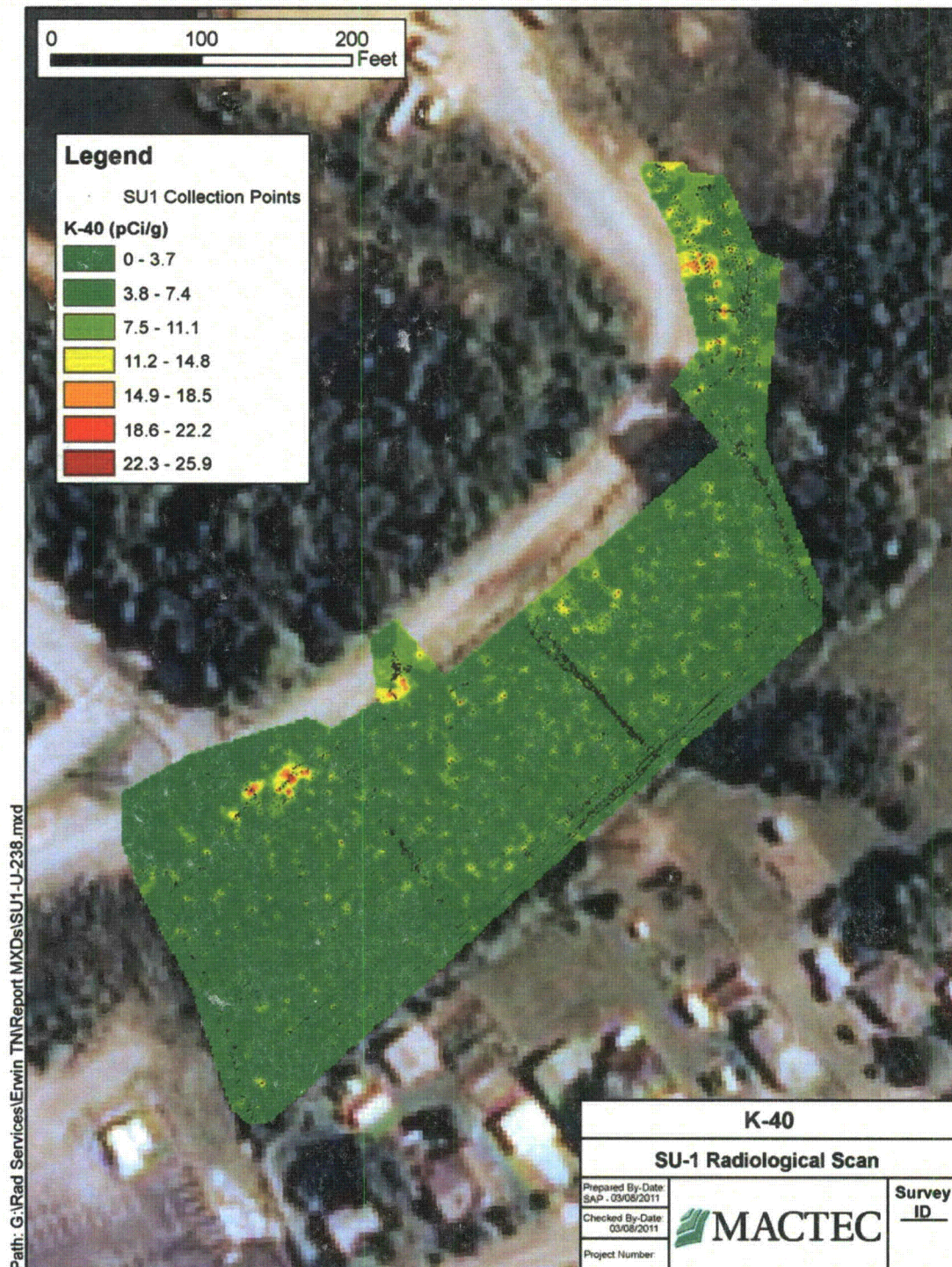
Numerous quality control measures were implemented during the surface investigation of Survey Units 1 and 2. The collection and analysis of soil samples were subject NFS quality control measures for samples. The results underwent data validation which is summarized in appendix 2. The gamma scans and gamma insitu measurements included three key control measures to ensure the quality of the data. These include routine spectral alignment for each detector, routine source response checks, and analysis and reporting of K-40 (a naturally occurring radioactive element).

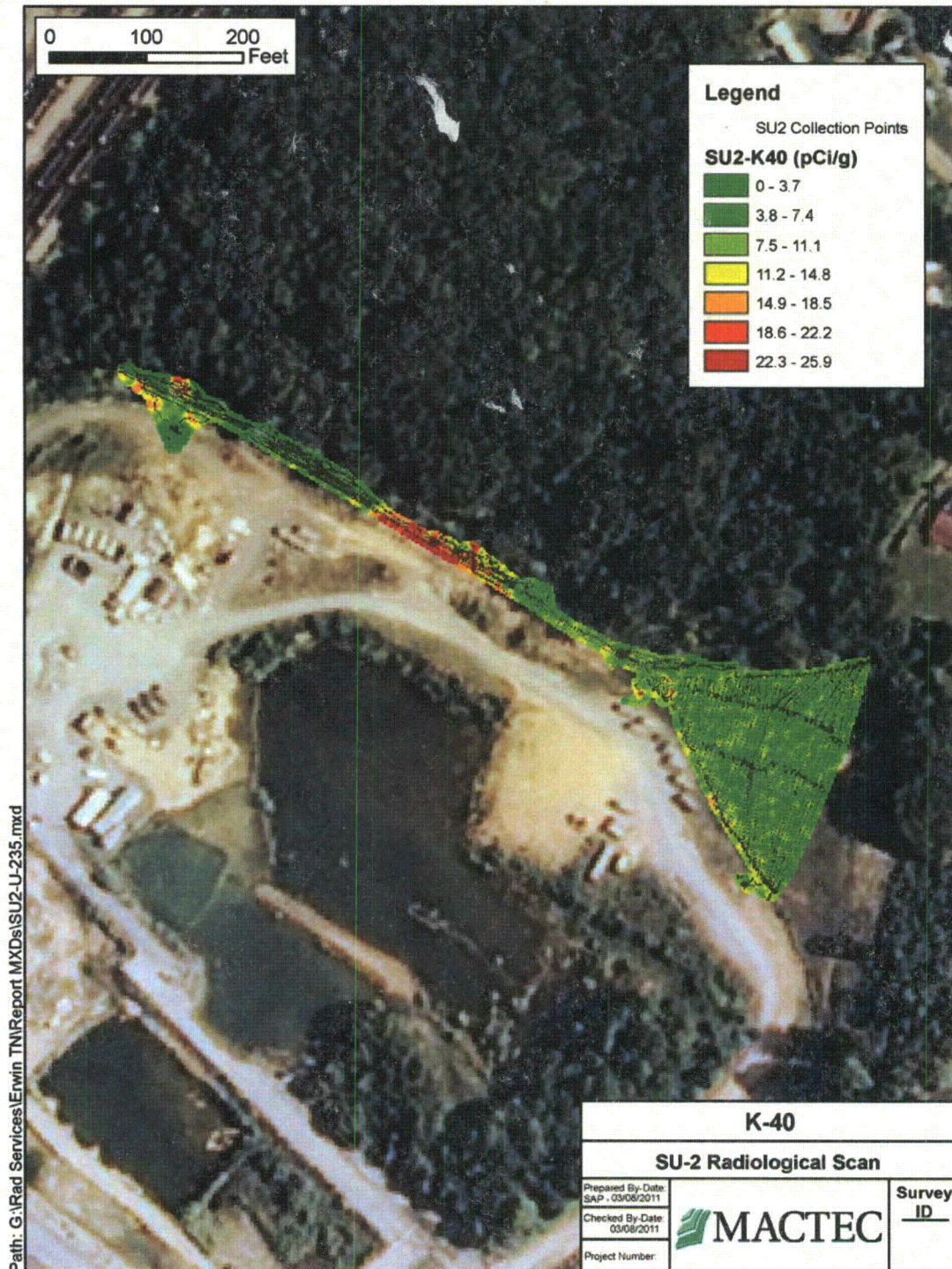
Spectral alignment was performed at the beginning of each shift of work and throughout the day at least every 4 hours. It was also performed after any delay or break in survey work. The energy spectrum was aligned so that the K-40 peak and Cs-137 peak (from a check source) were within ± 2 ($\pm <0.5\%$) channels of their target channels as established during the commissioning and calibration of each detector.

The detectors were subject to source response checks to a Cs-137 button source on the same or greater frequency as the spectral alignments. The spectrum from the 1 minute response checks was processed in the same manner as survey data; ROIs were analyzed and net photopeak count rates were calculated. The source response checks were required to be within 20% of the the mean or target count rate in order to continue survey activities.

The last quality control measure utilized for the SU1 and SU2 surveys was collection and analysis of the K-40 concentrations throughout each survey unit. K-40 analysis provides a number of quality assurance benefits for gamma scanning. K-40 provides a radioactive signal when the real contaminants of concern may not be present in a survey area. Analysis of K-40 can also provide comparisons across different measurements such as scanning, in situ measurements, and soil sample. The K-40 scanning results are provided below to qualitatively demonstrate the sensitivity and spatial resolution produced by the ORION surface scans.

It should be noted that K-40 concentrations vary naturally across many different materials such as soil, rock, and vegetation. Elevated K-40 concentrations are not an indication of contamination or a need for remediation. Changing K-40 concentrations can produce a number of undesirable effects on gross gamma scans such as false positives or improper application of background values. ORION scan plot system is immune to these issues because it collects full gamma spectra and reports individual isotopes.



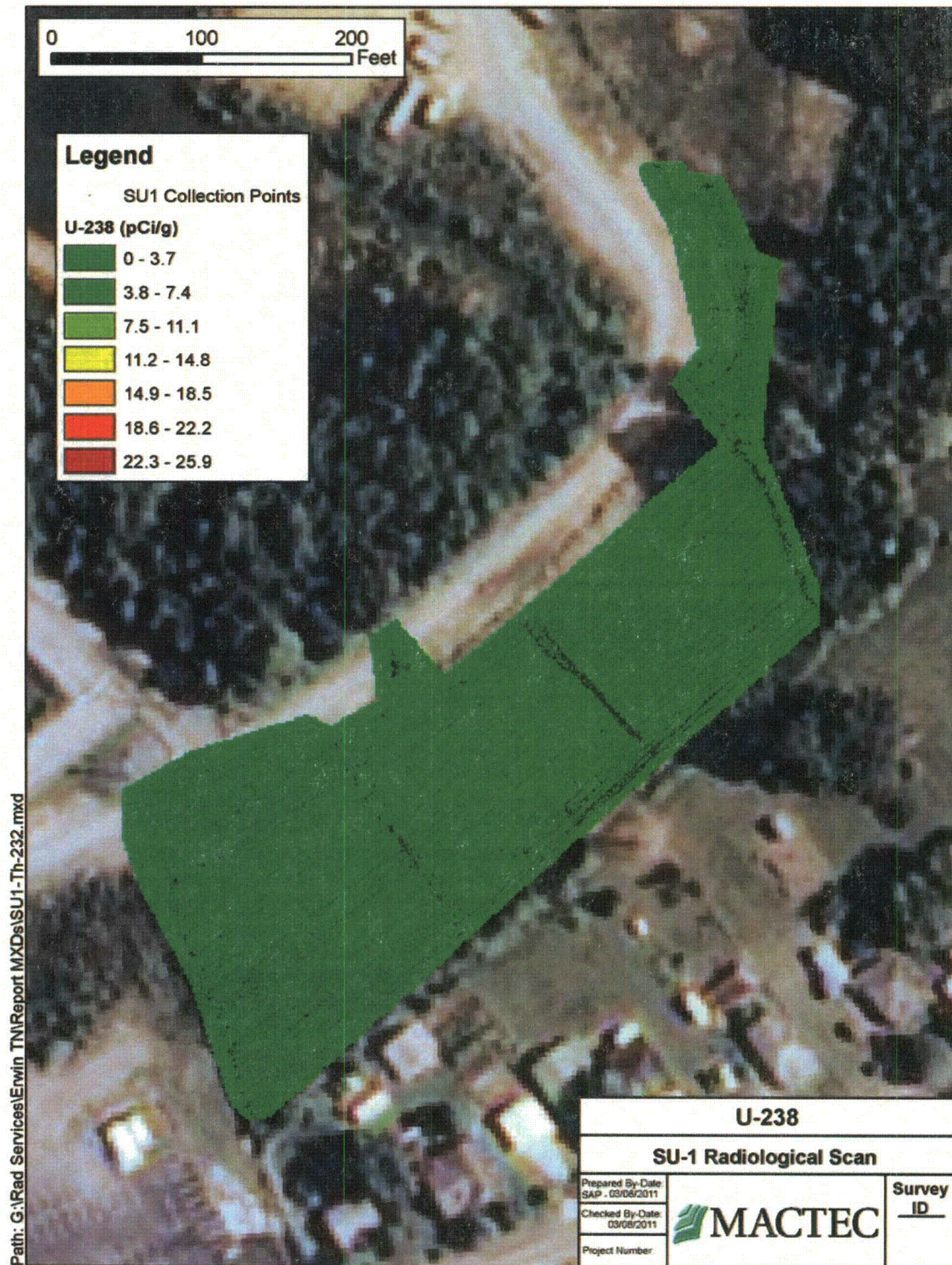


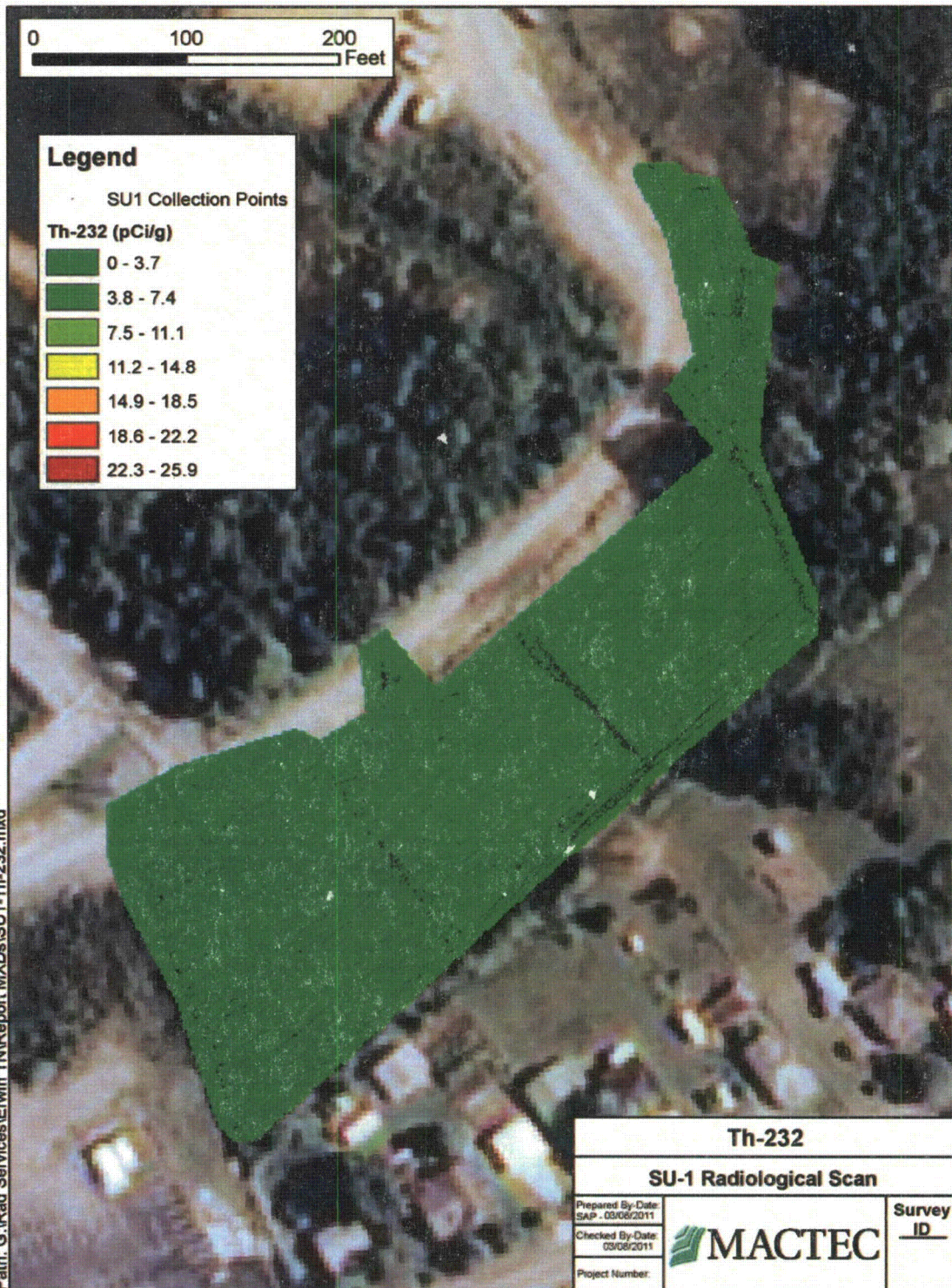
CONCLUSIONS

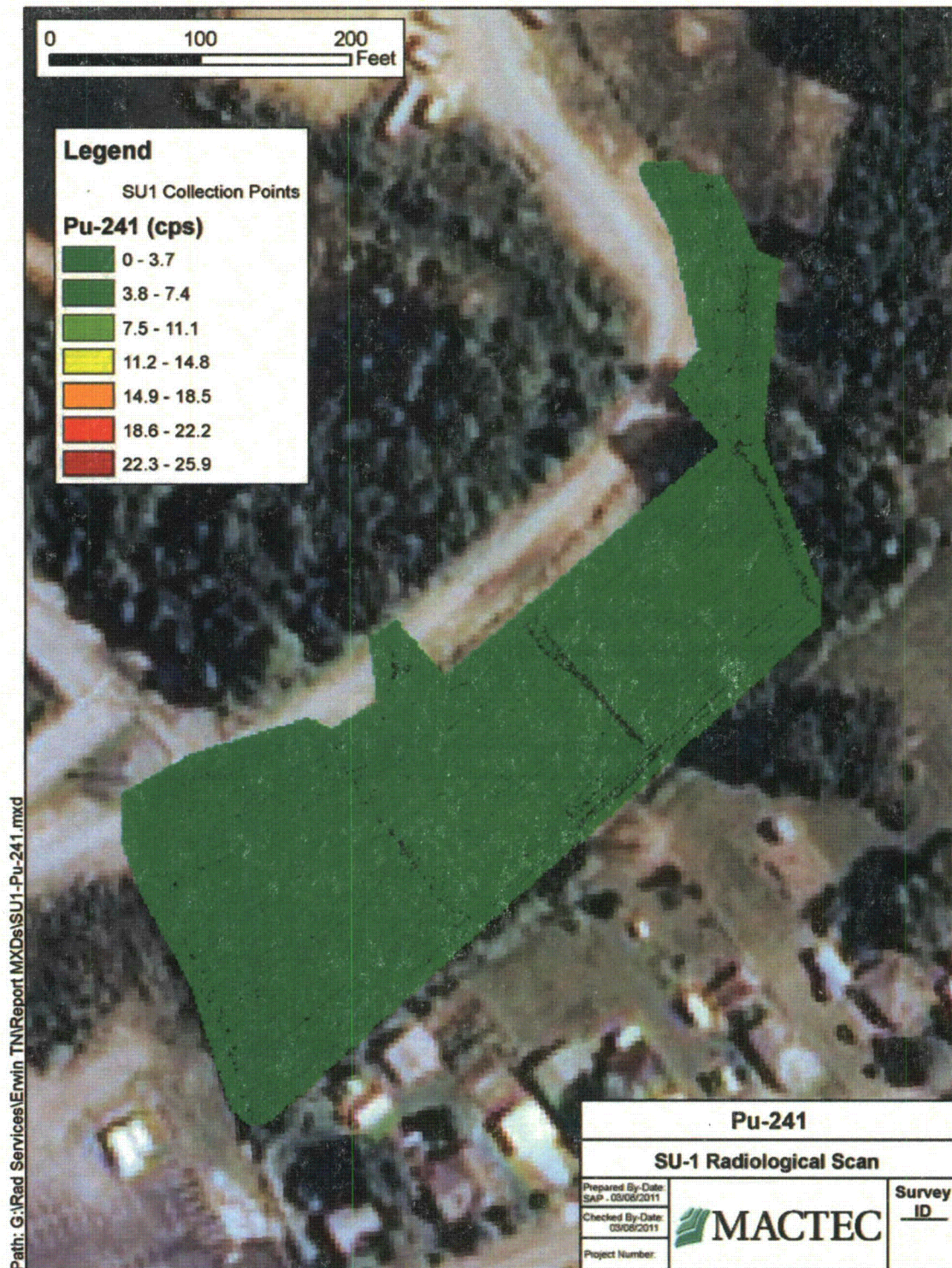
The surface scans show that the concentrations of the isotopes of concern were uniform across the two survey units. The in-situ measurements also show that the concentrations of U-235, U-238, Am-241, and Th-232 were stable across the survey units. The soil samples collected provide a very accurate assessment of the soil concentrations, all of which were below the applicable surface DCGL and the sum of fractions were all less than 1.0. The surface of survey units 1 and 2 meet the established requirements for free release.

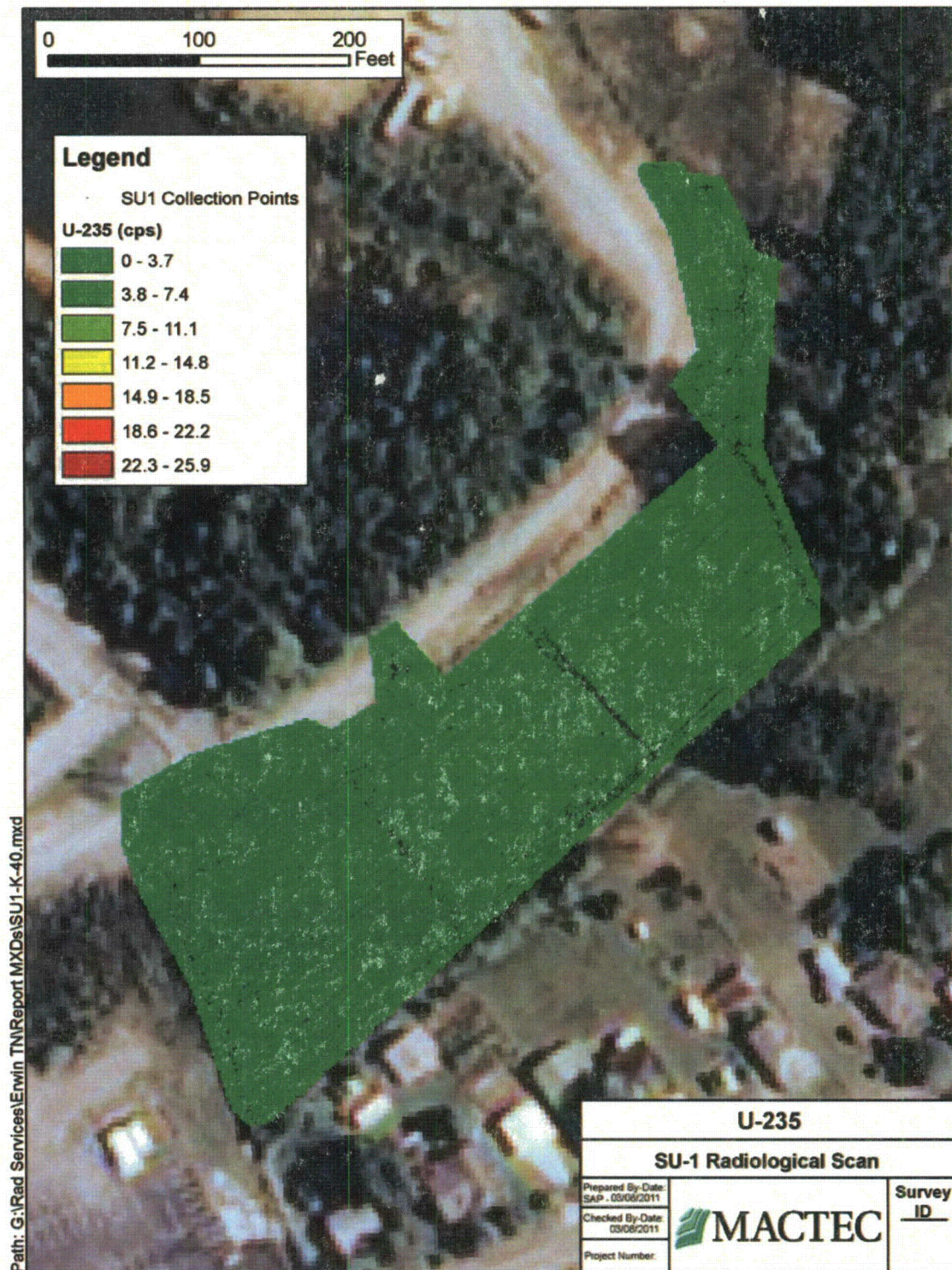
APPENDIX 1

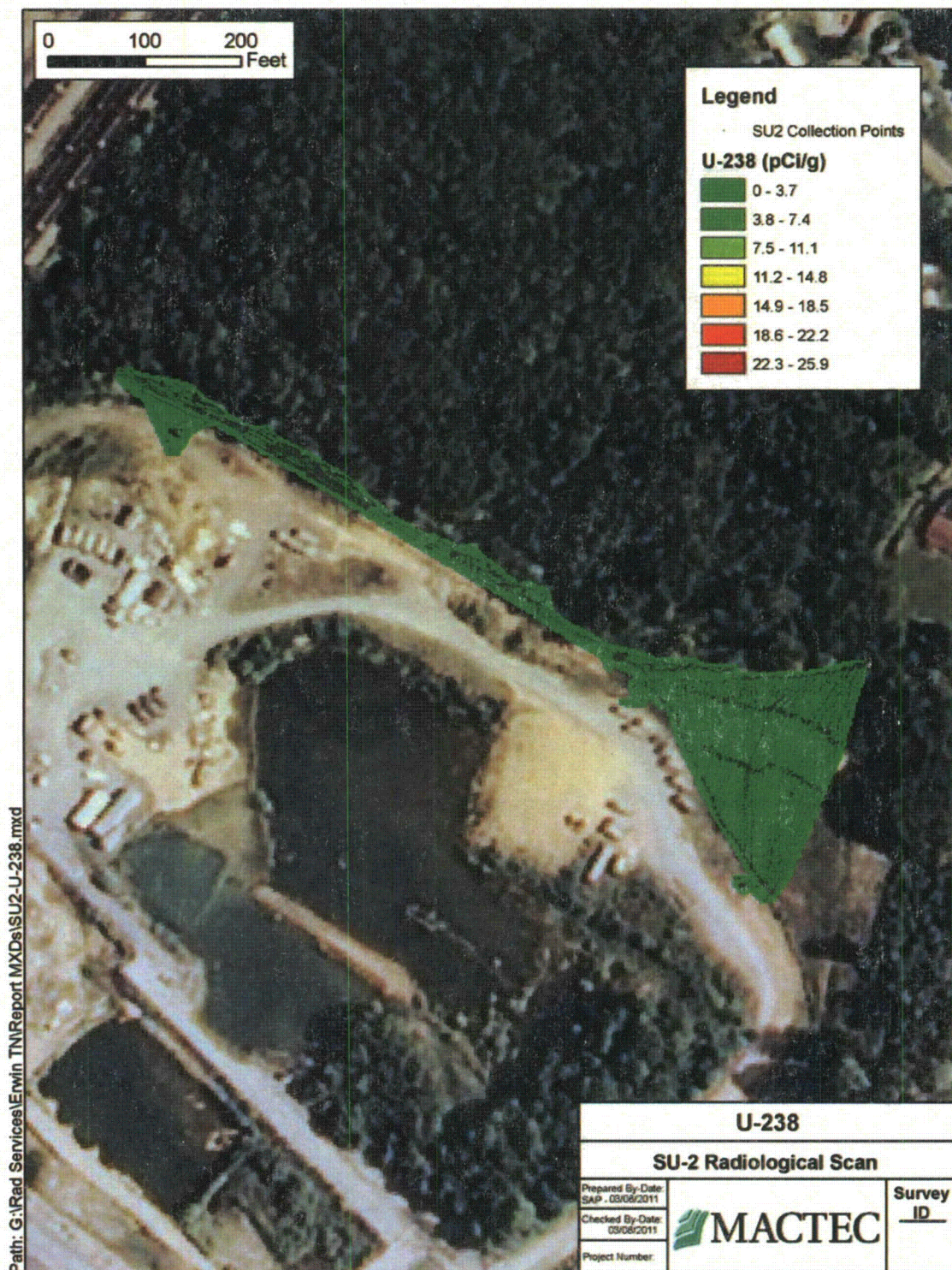
SURFACE SCANNING REPORTS

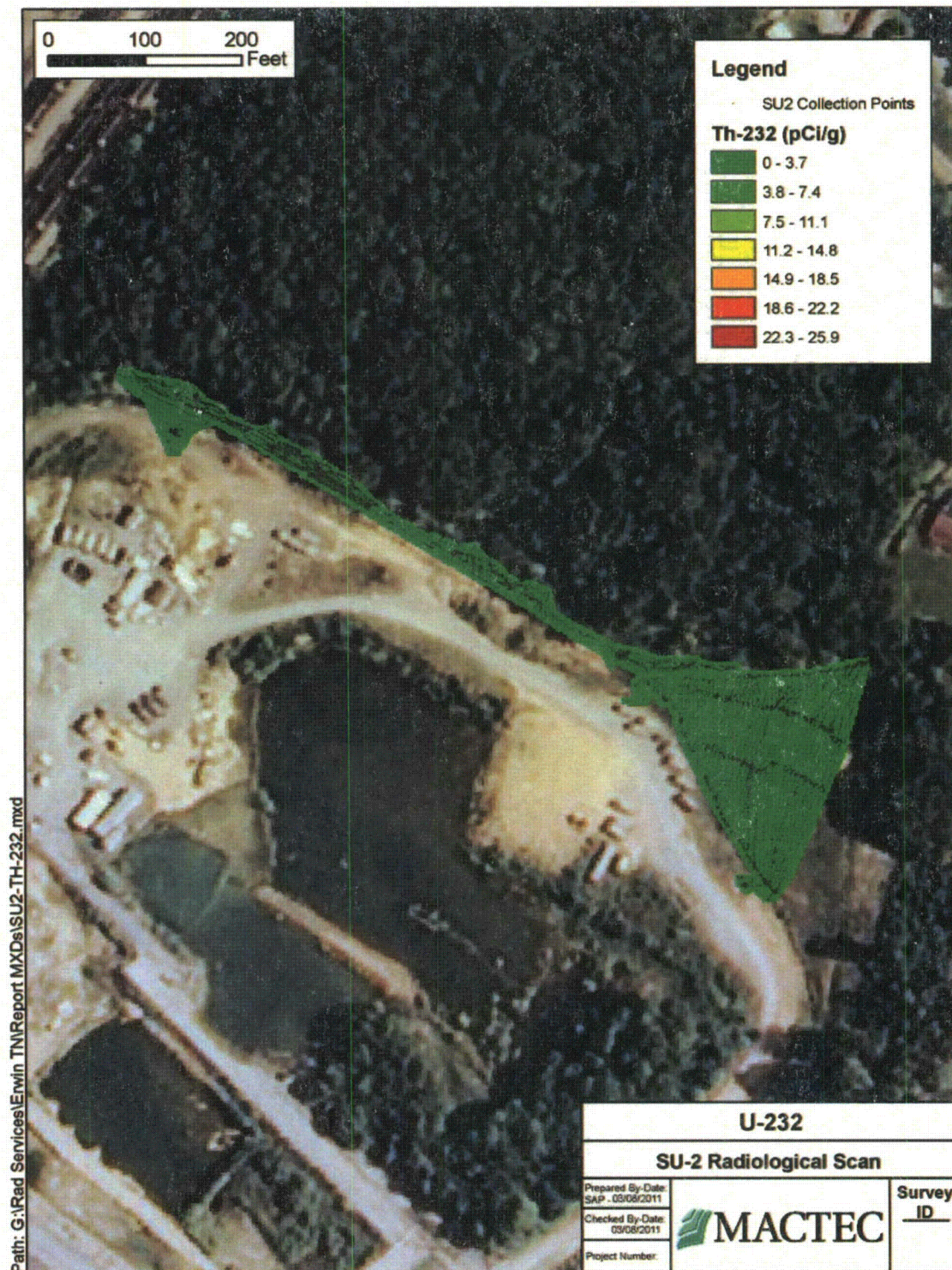


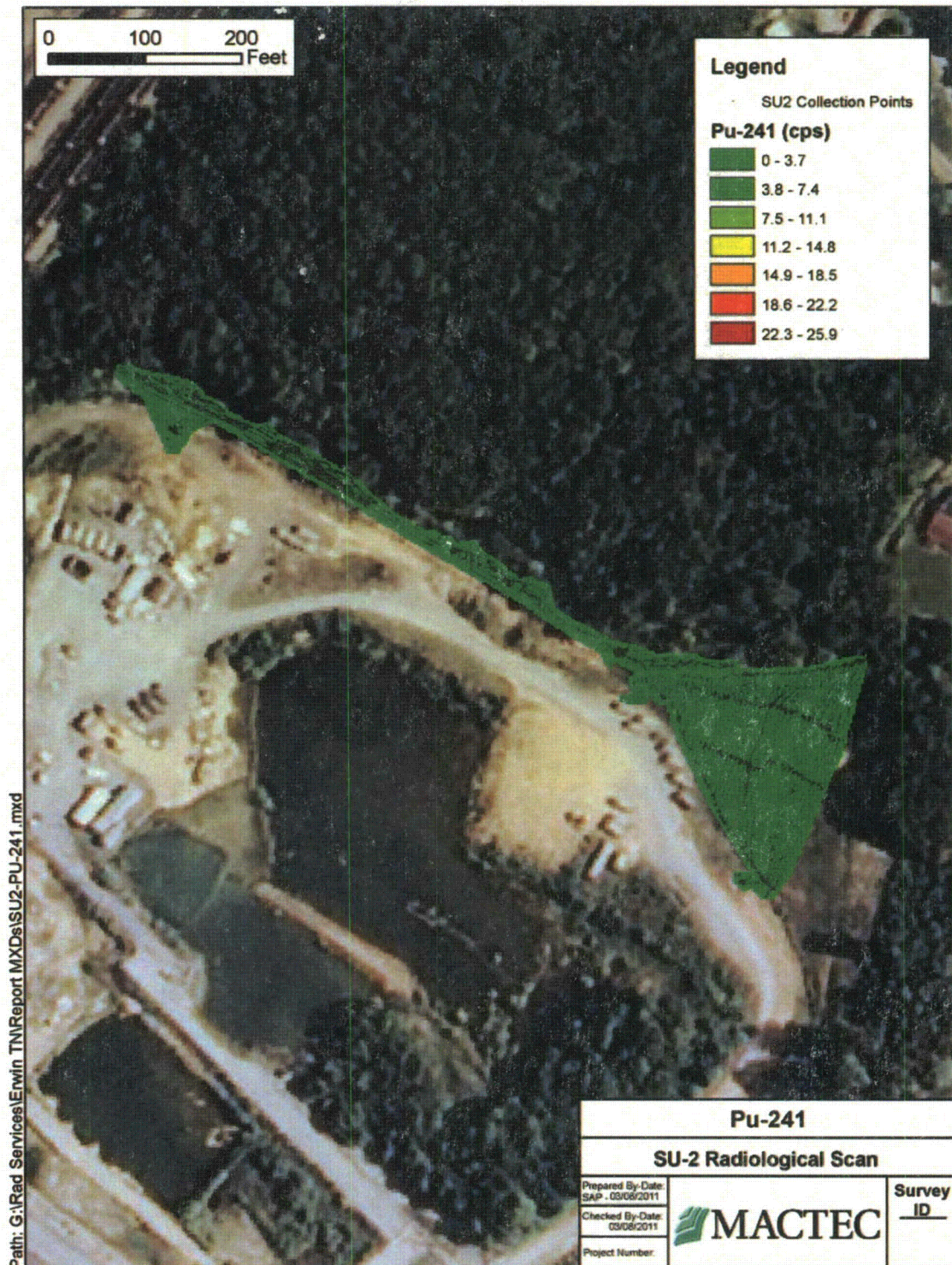


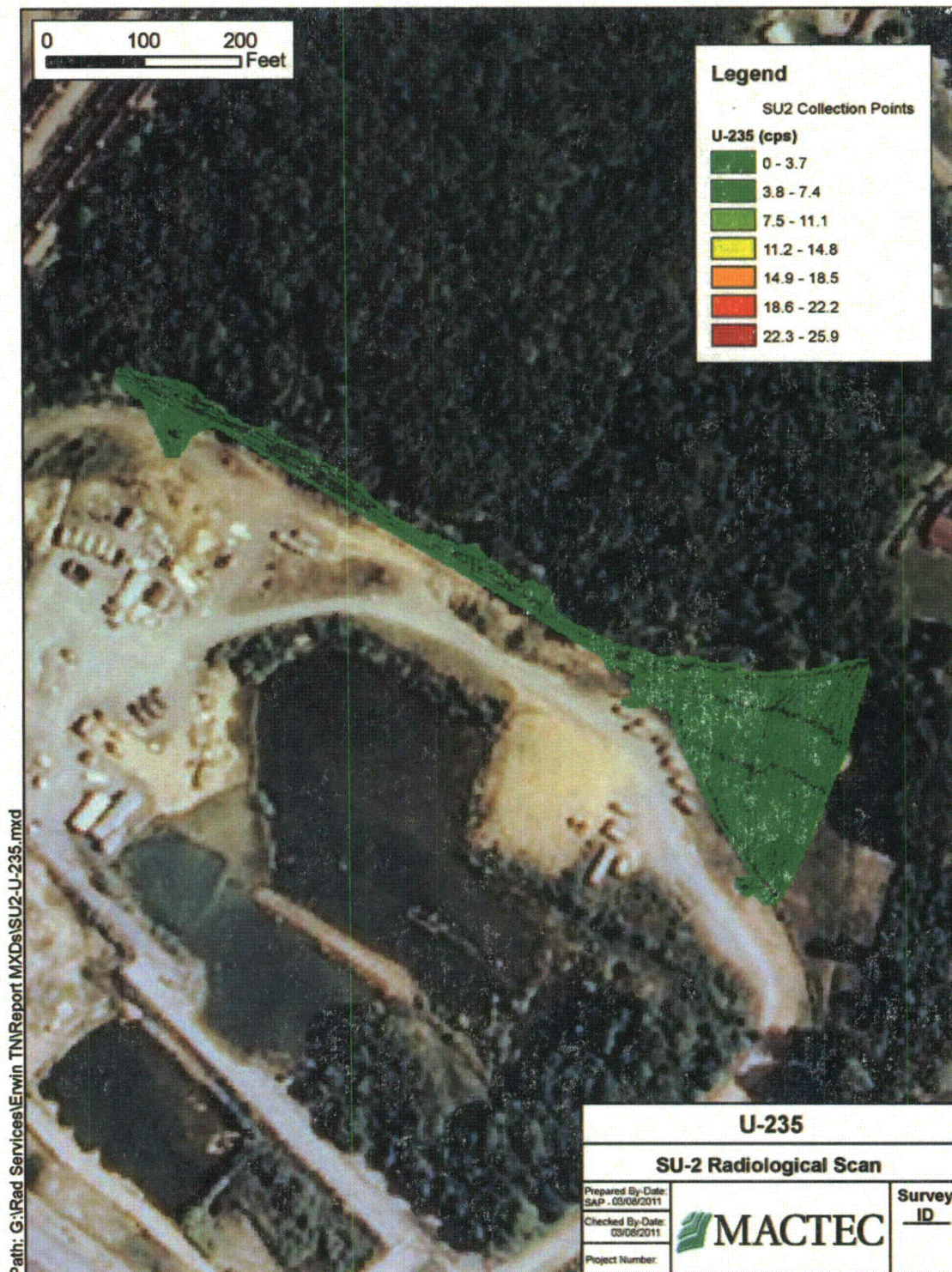












APPENDIX 2
SOIL SAMPLE VALIDATION

ATTACHMENT 8

DATA VALIDATION REPORT CHECKLIST
NFS SU_1 SURFACE SOIL

Reviewed by: *Julie Miranda*

Date: 3/8/11

ITEM	YES	NO
1. This data packet has been validated in accordance with procedure NFS-DC-008.	X	
2. All validation questions have been resolved with laboratory and/or applicable project personnel.	X	
3. Data validation corrections, additions, and qualifiers have been inserted on the original data sheets and are considered completed.	NA*	
4. Each data sheet on which data qualifiers were added has been initialed and dated by the data validator and maintained with the data validation documentation package.	NA*	

* No hardcopy data package was available for review. All information used during this validation was presented in the electronic deliverable.

Knowingly or willfully falsifying or concealing a material fact on this form, or making false, fictitious or fraudulent statements or representations

SUMMARY OF VALIDATED DRY WEIGHT RESULTS
NFS SU-1 SURFACE SOILS
MARCH 2011

SAMPLE and ANALYSIS INFORMATION

Sample ID	Container ID	Date Analyzed	Net Weight (g)	% Moist.	ASESAS Unit
SB-001	0	10/21/2010	256.9	29.3	1
SB-002	0	10/21/2010	265.8	19.5	2
SB-003	0	10/21/2010	302.9	31.5	1
SB-004	0	10/21/2010	292.3	24.9	2
SB-005	0	10/21/2010	299.5	28	1
SB-006	0	10/21/2010	323.1	17.5	2
SB-007	0	10/21/2010	345.7	24.1	1
SB-008	0	10/21/2010	325.7	26.5	2
SB-009	0	10/21/2010	324.1	23.1	1
SB-010	0	10/21/2010	313.1	22.8	2
SB-011	0	10/22/2010	341.9	16.8	1
SB-012	0	10/22/2010	282.1	16.1	2
SB-013	0	10/22/2010	338.5	19.4	1
SB-013FD	0	10/22/2010	326.1	22.1	1
SB-014	0	10/22/2010	375.2	14.2	2
SB-015	0	10/22/2010	310.1	20.3	2
SB-015FD	0	10/22/2010	336.2	20.6	1

MOISTURE CORRECTED DATA (pCi/g)

U-235 Result	Val	Qual	Error	MDC	U-238 Result	Val	Qual	Error	MDC
0.142291	U		0.097878	0.164074	2.895332	U		8.956153	15.20509
0.297391			0.119006	0.197516	6.196273	U		9.226087	14.24845
0.256204			0.089197	0.147737	-8.55766	U		9.413139	16.24818
0.264714			0.114647	0.191212	5.041278	U		7.762983	13.63515
0.055833	U		0.087222	0.147083	-9.57778	U		8.747222	15.13889
0.22897			0.099394	0.165818	0.583515	U		6.930909	11.82182
0.247563			0.075626	0.124901	-8.06192	U		8.042161	13.87352
0.254694			0.112517	0.187755	-17.5918	U		9.140136	15.98639
0.084655	U		0.080624	0.13498	-10.4265	U		8.447334	14.61638
0.28614			0.108549	0.18057	-9.81995	U		8.634715	14.96114
0.123077			0.071875	0.120072	5.543269	U		7.24399	12.21154
0.239571			0.080095	0.128725	5.059595	U		7.448153	12.57449
0.20335			0.073573	0.12196	3.728288	U		7.718362	13.05211
0.234917			0.074198	0.122465	13.53017	U		7.403081	11.78434
0.166434			0.064685	0.106643	3.973193	U		5.594406	9.44289
0.243287			0.08005	0.130238	8.761606	U		7.409034	12.40151
0.222544			0.077582	0.128589	6.212846	U		37.12846	12.9471

VALIDATION COMMENTS:

Dry weight ("Moisture Corrected Data" tabs) data that were provided for SU-1 Surface Soils were reviewed for the following QC checks:

- (1) comparison of Result to MDC;
- (2) comparison of Result to reported Error; and
- (3) calculation/evaluation of Duplicate Error Ratios (DERs) and Relative Percent Differences (RPDs) for all field duplicate pairs.

The following items were not validated because insufficient documentation was available for review:

- (1) holding time check;
- (2) completeness check; and
- (3) verification of sample IDs.

With the following exception results can be used without qualification:

A number of the reported results are below the sample MDC and should be qualified as non-detected (U) as indicated in the above table.

SUMMARY OF VALIDATED DRY WEIGHT RESULTS
NFS SU-1 SURFACE SOILS
MARCH 2011

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SB-004	0	10/21/2010	292.3	24.9	2
SB-005	0	10/21/2010	299.5	28	1
SB-006	0	10/21/2010	323.1	17.5	2
SB-007	0	10/21/2010	345.7	24.1	1
SB-008	0	10/21/2010	325.7	26.5	2
SB-009	0	10/21/2010	324.1	23.1	1
SB-010	0	10/21/2010	313.1	22.8	2
SB-011	0	10/22/2010	341.9	16.8	1
SB-012	0	10/22/2010	282.1	16.1	2
SB-013	0	10/22/2010	338.5	19.4	1
SB-013FD	0	10/22/2010	326.1	22.1	1
SB-014	0	10/22/2010	375.2	14.2	2
SB-015	0	10/22/2010	310.1	20.3	2
SB-015FD	0	10/22/2010	336.2	20.6	1

MOISTURE CORRECTED DATA (pCi/g)

Th-232 Result	Val	Qual	Error	MDC	Am-241 Result	Val	Qual	Error	MDC
2.059406			0.444979	0.712588	0.052475	U	0.488967	0.82843	
2.940373			0.390932	0.595528	-0.90348	U	0.502733	0.865714	
1.807299			0.403504	0.638686	0.290657	U	0.44219	0.745547	
2.910786			0.430892	0.668043	-0.45806	U	0.503196	0.861119	
2.1875			0.34625	0.537361	0.106528	U	0.418611	0.708333	
1.73697			0.437091	0.676727	-0.98352	U	0.483515	0.831273	
1.827404			0.31278	0.490909	0.128063	U	0.375626	0.635046	
2.682993			0.411973	0.640952	-0.27973	U	0.476327	0.812925	
1.602081			0.280364	0.436021	-0.24005	U	0.402471	0.685306	
2.467617			0.389508	0.612435	-0.56153	U	0.489119	0.837694	
1.611779			0.386899	0.437019	-0.13558	U	0.342428	0.582332	
1.899881			0.325507	0.508224	-0.94422	U	0.494756	0.851251	
1.636476			0.274442	0.428536	-0.17047	U	0.351737	0.598759	
1.632863			0.28113	0.436842	-0.48151	U	0.384211	0.657638	
1.10676			0.281935	0.456294	-0.08089	U	0.425291	0.72296	
1.854454			0.335885	0.525345	-0.13375	U	0.531368	0.903764	
1.964736			0.235013	0.343955	0.118766	U	0.370403	0.626322	

VALIDATION COMMENTS:

Dry weight ("Moisture Corrected Data" tabs) data that were provided for SU-1 Surface Soils were reviewed for the following QC checks:

- (1) comparison of Result to MDC;
- (2) comparison of Result to reported Error; and
- (3) calculation/evaluation of Duplicate Error Ratios (DERs) and Relative Percent Differences (RPDs) for all field duplicate pairs.

The following items were not validated because insufficient documentation was available for review:

- (1) holding time check;
- (2) completeness check; and
- (3) verification of sample IDs.

With the following exception results can be used without qualification:

A number of the reported results are below the sample MDC and should be qualified as non-detected (U) as indicated in the above table.

**Duplicate Error Ratio (DER) Calculation Check
Survey Unit 1 Surface Soil**

Field Sample ID	Parameter		Result	TPU	Duplicate Result	TPU		RPD	DER	Comments	Duplicate
Gamma Spec:											
SB-013	Uranium-235		0.20335	0.073573	0.234917	0.074198		14	0.30	Both Results less than 5x MDC	FD
SB-013	Uranium-238	U	3.728288	7.718362	13.53017	7.403081		114	0.92	Both Results less than 5x MDC	FD
SB-013	Thorium-232		1.636476	0.274442	1.632863	0.28113		0	0.01	Both Results less than 5x MDC	FD
SB-013	Americium-241	U	-0.17047	0.351737	-0.48151	0.384211	U	-95	0.60	Both results ND	FD
SB-015	Uranium-235		0.243287	0.08005	0.222544	0.077582		9	0.19	Both Results less than 5x MDC	FD
SB-015	Uranium-238	U	8.761606	7.409034	6.212846	37.12846	U	34	0.07	Both results ND	FD
SB-015	Thorium-232		1.854454	0.335885	1.964736	0.235013		6	0.27		FD
SB-015	Americium-241	U	-0.13375	0.531368	0.118766	0.370403	U	-3370	0.39	Both results ND	FD

RPD relative percent difference
DER duplicate error ratio
TPU total propagated error

ATTACHMENT 8

DATA VALIDATION REPORT CHECKLIST
NFS SU 2 SURFACE SOIL

Reviewed by: *Julie Mian*

Date: 3/8/11

ITEM	YES	NO
1. This data packet has been validated in accordance with procedure NFS-DC-008.	X	
2. All validation questions have been resolved with laboratory and/or applicable project personnel.	X	
3. Data validation corrections, additions, and qualifiers have been inserted on the original data sheets and are considered completed.	NA*	
4. Each data sheet on which data qualifiers were added has been initialed and dated by the data validator and maintained with the data validation documentation package.	NA*	

* No hardcopy data package was available for review. All information used during this validation was presented in the electronic deliverable.

Knowingly or willfully falsifying or concealing a material fact on this form, or making false, fictitious or fraudulent statements or representations.

SUMMARY OF VALIDATED DRY WEIGHT RESULTS
NFS SU-2 SURFACE SOILS
MARCH 2011

SAMPLE and ANALYSIS INFORMATION

Sample ID	Container	Date Analyzed	Net Weight (g)	% Moist.	ASESAS Unit
SB-016	0	11/2/2010	333.2	14.8	2
SB-017	0	11/2/2010	379.8	13.7	1
SB-018	0	11/2/2010	353.2	16.9	2
SB-030	0	11/2/2010	360.1	16.8	1
SB-031	0	11/2/2010	342.6	15.8	2
SB031FD	0	11/3/2010	357	15.3	1
SB-032	0	11/3/2010	353.3	17.9	2
SB-033	0	11/3/2010	317.5	12.7	1
SB033FD	0	11/3/2010	315.4	13.4	2
SB-019	0	11/8/2010	309.9	28.4	1
SB-020	0	11/8/2010	394	21.8	2
SB-021	0	11/8/2010	339.1	28	1
SB-022	0	11/8/2010	345.2	27.2	2
SB-023	0	11/8/2010	359.7	21	1
SB-024	0	11/8/2010	323.7	28.2	2
SB-025	0	11/8/2010	301.1	36.1	1
SB-026	0	11/8/2010	301.4	34.9	2
SB026FD	0	11/8/2010	296.8	36.2	1
SB-027	0	11/8/2010	319.7	34.8	2
SB027FD	0	11/9/2010	302.8	32.8	2
SB-028	0	11/9/2010	371	19.4	2
SB-029	0	11/9/2010	329.6	29.2	2

MOISTURE CORRECTED DATA (pC/g)

U-235 Result	Val	Qual	Error	MDC	U-238 Result	Val	Qual	Error	MDC
0.130986			0.070423	0.117488	0.798239	U		6.320423	10.77582
0.096408	U		0.080834	0.101159	-9.38239	U		7.449594	12.14368
0.116005			0.069073	0.115523	-8.99519	U		6.927798	12.04573
0.068269	U		0.066587	0.111659	3.314904	U		7.554087	11.04688
0.209857			0.070784	0.115321	3.149644	U		6.413302	10.52494
0.025148	U		0.066234	0.111806	0.198701	U		7.322314	12.45573
0.226066			0.065408	0.107186	-0.17247	U		7.727162	13.17905
0.052119	U		0.068041	0.115006	20.05727			6.088202	9.822451
0.081871	U		0.069861	0.117321	12.55196			6.655889	11.00115
0.265782			0.082821	0.136732	10.59358	U		11.60615	19.67877
0.241944			0.071867	0.118159	-5.57545	U		6.923274	11.93095
0.192083			0.08375	0.139306	14.08333	U		11.05972	18.34722
0.187088			0.0875	0.137912	1.961538	U		6.289835	10.90659
0.089747	U		0.07557	0.124177	8.841772	U		9.777215	15.94937
0.172423			0.083565	0.137744	-6.56685	U		8.126741	14.039
0.212207			0.099374	0.161346	12.00939	U		13.88106	24.13148
0.160983	U		0.102919	0.169278	0.182488	U		8.526882	14.55914
0.073197	U		0.102508	0.171003	6.512539	U		14.85737	25.10972
0.363804			0.091104	0.14816	-8.94785	U		18.61963	15.38344
0.127381	U		0.094345	0.155357	11.62054	U		8.239583	13.76042
0.017122	U		0.063648	0.107692	6.418114	U		6.179901	10.30025
0.182486			0.08404	0.139548	7.622881	U		8.242938	13.86158

VALIDATION COMMENTS:

Dry weight ("Moisture Corrected Data" tabs) data that were provided for SU-2 Surface Soils were reviewed for the following QC checks:

- (1) comparison of Result to MDC;
- (2) comparison of Result to reported Error; and
- (3) calculation/evaluation of Duplicate Error Ratios (DERs) and Relative Percent Differences (RPDs) for all field duplicate pairs.

The following items were not validated because insufficient documentation was available for review:

- (1) holding time check;
- (2) completeness check; and
- (3) verification of sample IDs.

With the following exception results can be used without qualification:

A number of the reported results are below the sample MDC and should be qualified as non-detected (U) as indicated in the above table.

SUMMARY OF VALIDATED DRY WEIGHT RESULTS
NFS SU-2 SURFACE SOILS
MARCH 2011

SAMPLE and ANALYSIS INFORMATION

Sample ID	Container ID	Date Analyzed	Net Weight (g)	% Moist.	Unit	ASESAS
SB-016	0	11/2/2010	333.2	14.8	2	
SB-017	0	11/2/2010	379.8	13.7	1	
SB-018	0	11/2/2010	353.2	16.9	2	
SB-030	0	11/2/2010	360.1	16.8	1	
SB-031	0	11/2/2010	342.6	15.8	2	
SB031FD	0	11/3/2010	357	15.3	1	
SB-032	0	11/3/2010	353.3	17.9	2	
SB-033	0	11/3/2010	317.5	12.7	1	
SB033FD	0	11/3/2010	315.4	13.4	2	
SB-019	0	11/8/2010	309.9	28.4	1	
SB-020	0	11/8/2010	394	21.8	2	
SB-021	0	11/8/2010	339.1	28	1	
SB-022	0	11/8/2010	345.2	27.2	2	
SB-023	0	11/8/2010	359.7	21	1	
SB-024	0	11/8/2010	323.7	28.2	2	
SB-025	0	11/8/2010	301.1	36.1	1	
SB-026	0	11/8/2010	301.4	34.9	2	
SB026FD	0	11/8/2010	296.8	36.2	1	
SB-027	0	11/8/2010	319.7	34.8	2	
SB027FD	0	11/9/2010	302.8	32.8	2	
SB-028	0	11/9/2010	371	19.4	2	
SB-029	0	11/9/2010	329.6	29.2	2	

MOISTURE CORRECTED DATA (pCi/g)

Th-232	Val	Qual	Error	MDC	Am-241	Val	Qual	Error	MDC
Result					Result				
1.094718			0.328873	0.515845	-0.42453	U		0.437441	0.748122
1.589803			0.233951	0.358517	0.945655			0.311472	0.511819
1.525872			0.275933	0.433574	0.019615	U		0.446931	0.758243
1.427885			0.293149	0.46863	0.330889	U		0.326202	0.548197
1.15962			0.324584	0.52304	-0.89489	U		0.481116	0.825534
1.35183			0.291617	0.467769	0.647934			0.321724	0.534829
1.788063	U		1.247259	2.096224	-0.77186	U		0.519245	0.88916
1.729668			0.267239	0.4126	-0.16758	U		0.337457	0.574341
1.786744	U		1.288684	2.167436	0.341109	U		0.419053	0.705427
1.306704			0.323603	0.522067	-0.27849	U		0.444693	0.757682
1.695652			0.28688	0.415217	-0.4734	U		0.468031	0.802302
2.020833			0.295833	0.456528	-0.40972	U		0.440556	0.751667
2.325549			0.350962	0.54739	-0.67995	U		0.552335	0.945192
1.001519			0.274051	0.446582	-0.56025	U		0.383418	0.656709
0.972145			0.430501	0.666713	0.0539	U		0.554735	0.940808
2.355243			0.399218	0.829108	0.380438	U		0.493271	0.830829
2			0.529647	0.792934	-1.14101	U		0.677419	1.161751
2.374608			0.382915	0.595141	-0.42586	U		0.544984	0.92931
1.530368			0.402301	0.643558	-0.97331	U		0.628834	1.078374
2.166667			0.406994	0.842262	0.29122	U		0.594792	1.004613
1.149007			0.288337	0.463027	0.074814	U		0.456948	0.774318
2.237288			0.411017	0.646305	0.232062	U		0.625424	1.057203

VALIDATION COMMENTS:

Dry weight ("Moisture Corrected Data" tabs) data that were provided for SU-2 Surface Soils were reviewed for the following QC checks:

- (1) comparison of Result to MDC;
- (2) comparison of Result to reported Error; and
- (3) calculation/evaluation of Duplicate Error Ratios (DERs) and Relative Percent Differences (RPDs) for all field duplicate pairs.

The following items were not validated because insufficient documentation was available for review:

- (1) holding time check;
- (2) completeness check; and
- (3) verification of sample IDs.

With the following exception results can be used without qualification:

A number of the reported results are below the sample MDC and should be qualified as non-detected (U) as indicated in the above table.

**Duplicate Error Ratio (DER) Calculation Check
Survey Unit 2 Surface Soil**

Field Sample ID	Parameter		Result	TPU	Duplicate Result	TPU		RPD	DER	Comments	Duplicate
Gamma Spec:											FD
SB-031	Uranium-235		0.209857	0.070784	0.025148	0.066234	U	157	1.91	Both Results less than 5x MDC	FD
SB-031	Uranium-238	U	3.149644	6.413302	0.198701	7.322314	U	176	0.30	Both results ND	FD
SB-031	Thorium-232		1.15962	0.324584	1.35183	0.291617		15	0.44	Both Results less than 5x MDC	FD
SB-031	Americium-241	U	-0.89489	0.481116	0.647934	0.321724		-1249	2.67	Both Results less than 5x MDC	FD
SB-033	Uranium-235	U	0.052119	0.068041	0.081871	0.069861	U	44	0.31	Both results ND	FD
SB-033	Uranium-238		20.05727	6.088202	12.55196	6.655889		46	0.83	Both Results less than 5x MDC	FD
SB-033	Thorium-232		1.729668	0.267239	1.766744	1.288684	U	2	0.03	Both Results less than 5x MDC	FD
SB-033	Americium-241	U	-0.16758	0.337457	0.341109	0.419053	U	586	0.95	Both results ND	FD
SB-026	Uranium-235	U	0.160983	0.102919	0.073197	0.102508	U	75	0.60	Both results ND	FD
SB-026	Uranium-238	U	0.182488	8.526882	6.512539	14.85737	U	189	0.37	Both results ND	FD
SB-026	Thorium-232		2	0.529647	2.374608	0.382915		17	0.57	Both Results less than 5x MDC	FD
SB-026	Americium-241	U	-1.14101	0.677419	-0.42586	0.544984	U	-91	0.82	Both results ND	FD
SB-027	Uranium-235		0.363804	0.091104	0.127381	0.094345	U	96	1.80	Both Results less than 5x MDC	FD
SB-027	Uranium-238	U	-8.94785	18.61963	11.62054	8.239583	U	1539	1.01	Both results ND	FD
SB-027	Thorium-232		1.530368	0.402301	2.166687	0.406994		34	1.11	Both Results less than 5x MDC	FD
SB-027	Americium-241	U	-0.97331	0.628834	0.29122	0.594792	U	-371	1.46	Both results ND	FD

RPD relative percent difference
DER duplicate error ratio
TPU total propagated error