APPENDIX B
USACE 2001 RI
ANALYTICAL DATA AND QA/QC EVALUATION RESULTS

ATTACHMENT I

Data Validation Packages

Tonawanda Landfill Laboratory Results Database

Data Validation Package Index

Click on Lab I.D. to open Data Validation Package(*)

Mudflats Soil

Lab I.D.	Description
0107025	Mudflats Reference Area
0107026	Class 3A, Class 3B Random
0107027	Class 3A, Class 3B Random
0107028	Mudflats Reference Area, Class 3A, Class 3B Random
0107029	Mudflats Reference Area
0107030	Mudflats Reference Area, Class 3A
0107095	Class 3B Random, Class 3B Biased
0107096	Class 3B Random, Class 3B Biased
0107106	Class 3B Biased, Class 2 Area C, Class 1 Area C
0107106 (C)	Chemical – Class 1 Area C
0107107	Class 3B Biased, Class 2 Area C
0107108	Class 2 Area C
0107115	Class 2 Area C
0107116	Class 2 Area C, Class 1 Area C
0108014	Class 2 Area C, Class 1 Area C

Landfill Soil

Lab I.D.	Description
G01070024	Landfill Reference Area, Class 3 Random
G01070025	Landfill Reference Area, Class 3 Random
G01070026	Landfill Reference Area, Class 3 Random, Class 2 Area B
G01070031	Class 3 Random, Class 3 Biased, Class 2 Area B, Class 1 Area B1A, Class 1 Area B1B
G01070034	Class 3 Biased, Class 2 Area B
G01070035	Class 2 Area B – 'Porcelain' sample
G01070037 (C)	Chemical – Class 1 Area A
G01070038	Class 3 Random, Class 3 Biased, Class 2 Area A, Class 1 Area B1A
G01070039	Class 3 Random, Class 3 Biased, Class 2 Area A, Class 2 Area B
G01070040	Class 3 Random, Class 3 Biased, Class 2 Area A, Class 2 Area B
G01070041	Class 3 Random, Class 1 Area A
G01070042	Class 3 Random, Class 3 Biased, Class 2 Area A, Class 1 Area A
G01070043	Class 3 Biased, Class 2 Area A (includes Addendum)
G01070044	Class 3 Random, Class 3 Biased, Class 2 Area A, Class 2 Area B
G01080001	Class 1 Area A (includes Addendum)
G01080002	Class 1 Area A
G01080003	Class 1 Area A
G01080004	Class 3 Random, Class 1 Area A

(*) ADDENDUM: For those Data Validation Packages that discuss gross beta results, the following statement is also applicable to the discussion under Quantification: "All samples were qualified as estimated (J) since the radionuclides used for gross beta calibration do not closely match the energy of the radionuclides found by the project. The error introduced was judged to be greater than the established accuracy measurement quality objective (MQO) of +/- 25%."

Data Validation Package Index

Click on Lab I.D. to open Data Validation Package(*)

Aqueous Samples (Groundwater, Surface Water and QC)

Lab I.D.	Description
45784	QC samples
46757	Surface water and QC samples
49323	Groundwater
49379	Groundwater and QC samples
49386	Groundwater

(*) ADDENDUM: For those Data Validation Packages that discuss gross beta results, the following statement is also applicable to the discussion under Quantification: "All samples were qualified as estimated (J) since the radionuclides used for gross beta calibration do not closely match the energy of the radionuclides found by the project. The error introduced was judged to be greater than the established accuracy measurement quality objective (MQO) of +/- 25%."

Radiological Analytical Data Verification
Comments on Data for SDG 0107025

This sample delivery group (SDG) contained twenty individual soil samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0021	0107025-1
TMF-0022	0107025-2
TMF-0011	0107025-3
TMF-0012	0107025-4
TMF-0029	0107025-5
TMF-0030	0107025-6
TMF-0033	0107025-7
TMF-0034	0107025-8
TMF-0031	0107025-9
TMF-0032	0107025-10
TMF-0003	0107025-11
TMF-0004	0107025-12
TMF-0005	0107025-13
TMF-0006	0107025-14
TMF-0013	0107025-15
TMF-0014	0107025-16
TMF-0023	0107025-17
TMF-0024	0107025-18
TMF-0025	0107025-19
TMF-0026	0107025-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the liquid samples.

Equipment Rinsate Sample:

There was no indication of contamination in equipment rinsate blank sample for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ac, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, $^{212/214}$Bi, $^{212/214}$Pb, ^{228}Ra, and ^{208}Tl gamma emitting radionuclides were reported for most samples.

The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. **Inclusion of ^{212}Pb, ^{214}Pb, ^{214}Bi, and ^{208}Tl in the database is not recommended since any modeling will assume equilibrium throughout the $^{235/238}$U and ^{232}Th decay chains.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{231}Pa result for samples TMF-0031 and TMF-0013. **Therefore, it is recommended that the ^{231}Pa result for samples TMF-0031 and TMF-0013 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination in the $^{234/235/238}$U alpha spectrometry analyses. There was an indication of blank contamination in the method blank for ^{230}Th. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). All samples have results that are greater than 5 times the blank value for the ^{230}Th analyses. No qualification is required.

Equipment Rinsate Sample:

There was an indication of ^{228}Th and ^{230}Th contamination of equipment rinsate blank contamination for alpha spectrometry analyses. All associated sample results less than 5 times the blank value for $^{228/230}$Th analyses should be qualified as estimated (J). All samples had $^{228/230}$Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 17.14% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the U alpha spectrometry analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the Th alpha spectrometry analyses. There is between 15.86% - 22.11% uncertainty in the sample specific recovery result for the Th analysis for all samples**. Therefore, it is recommended that the $^{228/230/232}$Th results for all samples be qualified as estimated (J).**

Spectral Analysis:

Relatively small spectral interferences were observed in four samples of the alpha spectra for isotopic thorium. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th in samples TMF-0031, TMF-0031 (laboratory duplicate), TMF-0004, and TMF-0006, including the matrix blank sample. The measured blank activity is below the MDC (1.0 pCi/g). **Therefore, it is recommended that the ^{230}Th results for samples TMF-0031, TMF-0031 (laboratory duplicate), TMF-0004, and TMF-0006 be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least five extra peaks. These peaks are in the 5.8 MeV, 6.3 MeV, 6.7 MeV, 6.9 MeV, and 7.1 MeV regions. It is assumed that the peaks can be attributed to ^{216}Po, ^{217}At, ^{225}Ac and ^{221}Fr, which are progeny of ^{228}Th and the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There no indication of blank contamination in the method blank for ^{226}Ra analyses.

Equipment Rinsate Sample:

There was an indication of ^{226}Ra contamination of equipment rinsate blank contamination for the radon emmination analyses. All associated sample results less than 5 times the blank value for ^{226}Ra analyses should be qualified as estimated (J). All samples had ^{226}Ra results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the ^{226}Ra analyses were within acceptable limits.

Matrix Spike Sample:

No MSS was included for the ^{226}Ra analyses as specified in the SOW.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/g for ^{226}Ra except for sample TMF-0024 with an MDL of 0.56 pCi/g.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Sample:

There was no indication of gross alpha or gross beta contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample Analysis:

The MSS result was within acceptable limits for both gross alpha and gross beta analyses.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. All of the samples results met the required MDL.

5.0 TOTAL ACTIVITY

Method Blank:

There was no indication of blank contamination for the total activity analyses.

Equipment Rinsate Sample:

There was no indication of total activity contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity laboratory duplicate DER is within acceptable limits.

Matrix Spike Sample:

The MSS recovery was within acceptable limits for the total activity analysis.

Method Detection Limit:

The required method detection limit (MDL) for the total activity analysis is 10 pCi/g. All of the samples results met the required MDL.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to

determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (2.39) for sample TMF-0030 indicates that the gross alpha analysis did not agree with the sum of the alpha emitters within a 99% confidence level. In addition, the RPD (89.2%) was also outside acceptable limits. The gross alpha activity was smaller than the alpha sum value. The gross alpha analysis was performed by gas proportional counting, which has uncertainties in corrections for geometry and self-absorption of the alpha particles, which may cause the negative bias observed in the gross alpha analysis. **Therefore, it is recommended that the gross alpha results for sample TMF-0030 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (from 2.97 to 4.88) for all samples are greater than or equal to 1.29 indicating that the gross beta analyses are in agreement with the sum of the beta emitters within a 99% confidence level. The corresponding RPDs (from 112% to 139) are also outside acceptable limits. The gross beta results are a factor of approximately 5 smaller than the beta sums. This difference may be indicative of a negative bias in the gross beta sample results. **Therefore, it is recommended that the gross beta results from all samples be qualified as estimated (J).**

Total Activity to Sum of Alpha and Beta Emitters:

The DERs (from 2.27 to 3.86) for all samples indicate that the total activity analysis do not agree with the sum of the alpha and beta emitters within a 99% confidence level. In addition, the corresponding RPDs (84.2% to 122%) are also outside acceptable limits. The total activity results range for a factor of 2 to 4 smaller than the total activity sums. Again, this may be indicative of a negative bias in the total activity. **Therefore, it is recommended that the total activity results from all samples be qualified as estimated (J).**

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to ^{232}Th activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity and ^{235}U activity, it was assumed that the protactinium was in equilibrium. The ^{231}Pa and ^{235}U activities are within the measurement uncertainties for all samples except TMF-0030 and TMF-0014. These two exceptions are indicative of incomplete equilibrium.

Summary:

For all samples, there was agreement within the measurement uncertainties between the total activity results and the sum of the gross alpha and gross beta results. However, there appears to be a negative bias on the gross alpha/beta and total activity results. **Therefore, it is recommended that the individual analysis results be used.**

0107025-1			TMF-0021					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	2.90E-01	2.30E-01	6.40E-01	**0.33**	**200**	U
Ra-226	3.00E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.36E+00	4.50E-01					J							
Th-230	9.40E-01	3.40E-01					J							
Th-232	9.60E-01	3.50E-01					J							
U-234	8.00E-01	2.20E-01												
U-235	5.50E-02	5.40E-02						-4.00E-02	3.50E-01	1.80E-01	4.10E-01	**0.41**	**314**	U
U-238	9.40E-01	2.50E-01												
Total U Alpha	**1.80E+00**	**3.37E-01**												
Alpha Sum	**5.18E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.40E-01	2.50E-01						9.00E-01	1.10E+00	4.00E-01	1.30E+00	**0.29**	**76.9**	U
Pa-234m (Assumed from U-238)	9.40E-01	2.50E-01						-4.40E+00	8.30E+00	2.10E+00	9.30E+00	**0.52**	**565**	U
K-40	2.48E+01	4.50E+00	2.22E+01	4.50E+00	**0.41**	**11.1**								
Ra-228	9.70E-01	2.40E-01	7.50E-01	2.60E-01	**0.62**	**25.6**								
Pa-231	-2.00E-01	1.70E+00	1.00E-01	2.10E+00	**0.11**	**600**	U							
Beta Sum	**2.76E+01**	**4.52E+00**						**2.22E+01**	**9.51E+00**	**2.55E+01**	**1.04E+01**			
Total Activity Sum	**3.28E+01**	**4.84E+00**						**2.74E+01**	**9.67E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.02E+00	9.20E-01						**0.08**	**(from gamma)**		**3.04**			
Gross Beta	4.95E+00	8.40E-01					J	**4.93**	**1.81**		**139**			
Total Activity	9.50E+00	3.80E+00					J	**3.79**	**1.73**		**110**			

0107025-2			TMF-0022					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.60E-01	4.90E-01					U
Ra-226	4.90E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	2.80E-01	1.23E+00	4.30E-01	**0.90**	**46.0**	J							
Th-230	7.90E-01	2.60E-01	8.90E-01	3.30E-01	**0.24**	**11.9**	J							
Th-232	9.20E-01	2.90E-01	9.20E-01	3.40E-01	**0.00**	**0.00**	J							
U-234	9.60E-01	2.60E-01												
U-235	7.60E-02	6.50E-02						-2.00E-02	3.10E-01					U
U-238	7.60E-01	2.30E-01												
Total U Alpha	**1.80E+00**	**3.53E-01**												
Alpha Sum	**4.32E+00**	**1.66E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.60E-01	2.30E-01						1.06E+00	9.90E-01					
Pa-234m (Assumed from U-238)	7.60E-01	2.30E-01						9.00E-01	9.20E+00					U
K-40	1.65E+01	3.40E+00												
Ra-228	6.70E-01	2.20E-01												
Pa-231	-5.00E-01	1.70E+00					U							
Beta Sum	**1.86E+01**	**3.43E+00**						**1.91E+01**	**9.86E+00**					
Total Activity Sum	**2.29E+01**	**3.81E+00**						**2.34E+01**	**1.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.93E+00	9.90E-01						**0.32**	**(from gamma)**		**13.3**			
Gross Beta	4.25E+00	7.50E-01					J	**4.10**	**1.50**		**126**			
Total Activity	8.90E+00	3.70E+00					J	**2.65**	**1.36**		**88.2**			

0107025-3			TMF-0011					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.70E-01	3.50E-01					U
Ra-226	3.20E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	3.10E-01					J							
Th-230	4.90E-01	2.20E-01					J							
Th-232	6.20E-01	2.50E-01					J							
U-234	8.30E-01	2.20E-01												
U-235	2.20E-02	3.30E-02					U	2.40E-01	3.20E-01					U
U-238	8.20E-01	2.20E-01												
Total U Alpha	**1.67E+00**	**3.13E-01**												
Alpha Sum	**3.13E+00**	**1.89E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.20E-01	2.20E-01						4.70E-01	8.20E-01					U
Pa-234m (Assumed from U-238)	8.20E-01	2.20E-01						2.00E+00	1.30E+01					U
K-40	1.66E+01	3.60E+00												
Ra-228	8.20E-01	2.80E-01												
Pa-231	-8.00E-01	2.00E+00					U							
Beta Sum	**1.90E+01**	**3.63E+00**						**1.98E+01**	**1.35E+01**					
Total Activity Sum	**2.21E+01**	**4.10E+00**						**2.29E+01**	**1.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.73E+00	9.00E-01						**0.76**	**(from gamma)**		**40.7**			
Gross Beta	4.39E+00	7.60E-01					J	**3.93**	**1.14**		**125**			
Total Activity	7.60E+00	3.70E+00					J	**2.63**	**1.08**		**97.6**			

0107025-4			TMF-0012					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.10E-02	8.60E-02					U
Ra-226	4.60E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	3.70E-01					J							
Th-230	7.40E-01	2.90E-01					J							
Th-232	7.20E-01	2.90E-01					J							
U-234	5.80E-01	1.80E-01	8.40E-01	2.30E-01	**0.89**	**36.6**								
U-235	4.90E-02	5.00E-02	3.50E-02	4.20E-02	**0.21**	**33.3**		-1.20E-01	2.70E-01					U
U-238	8.60E-01	2.30E-01	8.00E-01	2.30E-01	**0.18**	**7.23**								
Total U Alpha	**1.49E+00**	**2.96E-01**	**1.68E+00**	**3.28E-01**										
Alpha Sum	**4.37E+00**	**1.92E+00**	**1.68E+00**	**3.28E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01	8.00E-01	2.30E-01	**0.18**	**7.23**		9.40E-01	6.70E-01					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01	8.00E-01	2.30E-01	**0.18**	**7.23**		-5.00E+00	1.20E+01					U
K-40	1.68E+01	3.70E+00												
Ra-228	7.70E-01	3.00E-01												
Pa-231	-4.00E-01	2.00E+00					U							
Beta Sum	**1.92E+01**	**3.73E+00**	**1.60E+00**	**3.25E-01**				**1.35E+01**	**1.26E+01**					
Total Activity Sum	**2.36E+01**	**4.20E+00**	**3.28E+00**	**4.62E-01**				**1.78E+01**	**1.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.93E+00	9.30E-01						**0.26**	**(from gamma)**		**12.1**			
Gross Beta	4.13E+00	7.10E-01					J	**3.98**	**0.74**		**129**			
Total Activity	5.70E+00	3.60E+00					J	**3.24**	**0.92**		**122**			

0107025-5			TMF-0029					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01	-1.90E-01	2.90E-01	**0.76**	**343**	U
Ra-226	6.80E-01	2.30E-01	8.50E-01	2.90E-01	**0.46**	**22.2**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.33E+00	4.40E-01					J							
Th-230	1.17E+00	3.90E-01					J							
Th-232	1.17E+00	3.90E-01					J							
U-234	1.07E+00	2.70E-01												
U-235	4.60E-02	4.80E-02						1.90E-01	2.90E-01	2.70E-01	3.30E-01	**0.18**	**34.8**	U
U-238	1.15E+00	2.80E-01												
Total U Alpha	**2.27E+00**	**3.92E-01**												
Alpha Sum	**5.81E+00**	**1.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.15E+00	2.80E-01						1.20E+00	9.80E-01	2.60E-01	7.80E-01	**0.75**	**129**	
Pa-234m (Assumed from U-238)	1.15E+00	2.80E-01						4.00E+00	1.10E+01	7.50E+00	7.00E+00	**0.27**	**60.9**	U
K-40	1.86E+01	4.00E+00	2.20E+01	4.00E+00	**0.60**	**16.7**								
Ra-228	7.90E-01	2.50E-01	9.30E-01	2.30E-01	**0.41**	**16.3**								
Pa-231	-9.00E-01	1.80E+00	-1.00E+00	1.60E+00	**0.04**	**10.5**	U							
Beta Sum	**2.16E+01**	**4.03E+00**						**2.45E+01**	**1.18E+01**	**3.06E+01**	**8.11E+00**			
Total Activity Sum	**2.74E+01**	**4.43E+00**						**3.03E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.75E+00	9.90E-01	6.60E+00	1.10E+00	**0.57**	**13.8**		**0.03**	**(from gamma)**		**0.97**			
Gross Beta	4.99E+00	8.10E-01	5.54E+00	8.90E-01	**0.46**	**10.4**	J	**4.03**	**1.65**		**125**			
Total Activity	9.70E+00	3.90E+00	1.15E+01	3.90E+00	**0.33**	**17.0**	J	**3.00**	**1.65**		**95.4**			

0107025-6			TMF-0030					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	5.20E-01					U
Ra-226	-3.00E-02	1.80E-01					U							
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	3.10E-01					J							
Th-230	8.20E+00	2.90E+00					J							
Th-232	8.50E-01	2.90E-01					J							
U-234	7.60E-01	2.00E-01												
U-235	5.20E-02	4.90E-02						-2.70E-01	3.50E-01					U
U-238	6.90E-01	1.90E-01												
Total U Alpha	**1.50E+00**	**2.80E-01**												
Alpha Sum	**1.37E+01**	**3.41E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	1.90E-01						6.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	6.90E-01	1.90E-01						-7.00E+00	1.20E+01					U
K-40	1.65E+01	3.70E+00												
Ra-228	7.20E-01	3.00E-01												
Pa-231	2.60E+00	1.90E+00												
Beta Sum	**1.89E+01**	**3.73E+00**						**1.11E+01**	**1.26E+01**					
Total Activity Sum	**3.26E+01**	**5.05E+00**						**2.49E+01**	**1.31E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.26E+00	9.60E-01					J	**2.39**	**(from gamma)**		**89.2**			
Gross Beta	4.32E+00	7.40E-01					J	**3.84**	**0.54**		**126**			
Total Activity	9.20E+00	3.70E+00					J	**3.74**	**1.15**		**112**			

0107025-7			TMF-0033					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.40E-01	3.50E-01					U
Ra-226	6.00E-01	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	3.80E-01					J							
Th-230	9.80E-01	3.30E-01					J							
Th-232	6.50E-01	2.50E-01					J							
U-234	8.60E-01	2.10E-01												
U-235	5.90E-02	4.80E-02						-1.00E-01	3.40E-01					U
U-238	7.80E-01	2.00E-01												
Total U Alpha	**1.70E+00**	**2.94E-01**												
Alpha Sum	**5.41E+00**	**1.94E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.00E-01						1.70E+00	1.30E+00					
Pa-234m (Assumed from U-238)	7.80E-01	2.00E-01						-6.00E+00	1.10E+01					U
K-40	2.02E+01	4.10E+00												
Ra-228	8.10E-01	2.40E-01												
Pa-231	4.00E-01	2.00E+00					U							
Beta Sum	**2.26E+01**	**4.12E+00**						**1.68E+01**	**1.18E+01**					
Total Activity Sum	**2.80E+01**	**4.56E+00**						**2.22E+01**	**1.20E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.74E+00	1.00E+00						**0.15**	**(from gamma)**		**5.94**			
Gross Beta	4.70E+00	7.60E-01					J	**4.27**	**1.02**		**131**			
Total Activity	9.90E+00	3.80E+00					J	**3.06**	**0.98**		**95.6**			

0107025-8			TMF-0034					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.12E-01	9.80E-02					
Ra-226	5.50E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	3.00E-01					J							
Th-230	1.00E+00	3.00E-01					J							
Th-232	8.60E-01	2.70E-01					J							
U-234	7.60E-01	2.00E-01												
U-235	6.70E-02	5.20E-02						-6.00E-02	2.80E-01					U
U-238	9.00E-01	2.20E-01												
Total U Alpha	**1.73E+00**	**3.02E-01**												
Alpha Sum	**4.89E+00**	**1.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.20E-01						9.90E-01	6.90E-01					
Pa-234m (Assumed from U-238)	9.00E-01	2.20E-01						7.70E+00	9.20E+00					
K-40	2.00E+01	4.20E+00												
Ra-228	6.70E-01	2.40E-01												
Pa-231	-2.00E-01	2.10E+00					U							
Beta Sum	**2.24E+01**	**4.23E+00**						**2.93E+01**	**1.01E+01**					
Total Activity Sum	**2.73E+01**	**4.67E+00**						**3.42E+01**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.11E+00	9.30E-01						**0.10**	**(from gamma)**		**4.46**			
Gross Beta	4.11E+00	7.10E-01					J	**4.28**	**2.48**		**138**			
Total Activity	8.80E+00	3.70E+00					J	**3.11**	**2.32**		**103**			

0107025-9			TMF-0031					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.00E-01					U
Ra-226	9.90E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.26E+00	4.90E-01	1.20E+00	4.10E-01	**0.09**	**4.88**	J							
Th-230	9.10E-01	3.80E-01	8.20E-01	3.00E-01	**0.19**	**10.4**	J							
Th-232	1.13E+00	4.50E-01	9.30E-01	3.30E-01	**0.36**	**19.4**	J							
U-234	8.30E-01	2.20E-01												
U-235	6.40E-02	5.40E-02						4.00E-02	2.90E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.75E+00**	**3.23E-01**												
Alpha Sum	**4.51E+00**	**1.68E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						8.80E-01	7.10E-01					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						1.00E+00	1.00E+01					U
K-40	1.94E+01	4.00E+00												
Ra-228	6.70E-01	2.30E-01												
Pa-231	-1.70E+00	1.60E+00					U							
Beta Sum	**2.16E+01**	**4.02E+00**						**2.17E+01**	**1.08E+01**					
Total Activity Sum	**2.61E+01**	**4.36E+00**						**2.63E+01**	**1.09E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.54E+00	9.80E-01						**0.53**	**(from gamma)**		**20.4**			
Gross Beta	4.71E+00	7.90E-01					J	**4.11**	**1.57**		**128**			
Total Activity	9.10E+00	3.80E+00					J	**2.94**	**1.48**		**96.6**			

0107025-10			TMF-0032					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	5.30E-01					U
Ra-226	4.30E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	3.20E-01												
Th-230	9.30E-01	3.20E-01												
Th-232	8.40E-01	3.00E-01												
U-234	7.20E-01	2.00E-01	6.20E-01	1.80E-01	**0.37**	**14.9**	J							
U-235	3.90E-02	4.30E-02	4.70E-02	4.90E-02	**0.12**	**18.6**	J	-1.40E-01	3.30E-01					U
U-238	9.30E-01	2.30E-01	7.70E-01	2.10E-01	**0.51**	**18.8**	J							
Total U Alpha	**1.69E+00**	**3.08E-01**	**1.44E+00**	**2.81E-01**										
Alpha Sum	**3.41E+00**	**2.00E+00**	**1.44E+00**	**2.81E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	2.30E-01	7.70E-01	2.10E-01	**0.51**	**18.8**		5.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	9.30E-01	2.30E-01	7.70E-01	2.10E-01	**0.51**	**18.8**		-1.00E+00	1.30E+01					U
K-40	2.04E+01	4.40E+00												
Ra-228	7.50E-01	2.70E-01												
Pa-231	-1.40E+00	2.10E+00					U							
Beta Sum	**2.28E+01**	**4.43E+00**	**1.54E+00**	**2.97E-01**				**2.05E+01**	**1.38E+01**					
Total Activity Sum	**2.63E+01**	**4.86E+00**	**2.98E+00**	**4.09E-01**				**2.39E+01**	**1.39E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.47E+00	9.20E-01	4.04E+00	9.00E-01	**0.33**	**10.1**		**0.48**	**(from gamma)**		**26.9**			
Gross Beta	4.34E+00	7.70E-01	4.21E+00	7.50E-01	**0.12**	**3.04**	J	**4.12**	**1.17**		**136**			
Total Activity	8.40E+00	3.70E+00	7.20E+00	3.70E+00	**0.23**	**15.4**	J	**2.92**	**1.08**		**103**			

0107025-11			TMF-0003					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.20E-01	5.00E-02	1.20E-01	**0.06**	**18.2**	U
Ra-226	4.40E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.06E+00	4.10E-01					J							
Th-230	9.00E-01	3.50E-01					J							
Th-232	1.03E+00	3.80E-01					J							
U-234	7.80E-01	2.10E-01												
U-235	2.70E-02	3.60E-02					U	0.00E+00	4.00E-01	1.10E-01	4.20E-01	**0.19**	**200**	U
U-238	9.10E-01	2.30E-01												
Total U Alpha	**1.72E+00**	**3.14E-01**												
Alpha Sum	**5.60E+00**	**2.63E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.10E-01	2.30E-01						1.40E+00	1.10E+00	4.00E-01	1.20E+00	**0.61**	**111**	
Pa-234m (Assumed from U-238)	9.10E-01	2.30E-01						-1.60E+01	2.30E+01	-2.00E+00	1.80E+01	**0.48**	**156**	U
K-40	1.82E+01	5.20E+00	1.76E+01	4.70E+00	**0.09**	**3.35**								
Ra-228	6.10E-01	4.00E-01	5.60E-01	3.60E-01	**0.09**	**8.55**								
Pa-231	5.00E-01	2.80E+00	-1.10E+00	2.50E+00	**0.43**	**533**	U							
Beta Sum	**2.07E+01**	**5.24E+00**						**4.27E+00**	**2.36E+01**	**1.64E+01**	**1.86E+01**			
Total Activity Sum	**2.63E+01**	**5.86E+00**						**9.87E+00**	**2.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.19E+00	9.60E-01						**0.15**	**(from gamma)**		**7.55**			
Gross Beta	4.94E+00	8.30E-01					J	**2.97**	**0.03**		**123**			
Total Activity	1.03E+01	3.90E+00					J	**2.27**	**0.02**		**87.4**			

0107025-12			TMF-0004					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.40E-01					U
Ra-226	6.70E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.80E-01					J							
Th-230	1.00E+00	3.10E-01					J							
Th-232	7.70E-01	2.60E-01					J							
U-234	8.00E-01	2.30E-01												
U-235	3.90E-02	4.40E-02						1.70E-01	2.80E-01					U
U-238	7.20E-01	2.10E-01												
Total U Alpha	**1.56E+00**	**3.15E-01**												
Alpha Sum	**4.21E+00**	**1.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.10E-01						3.20E-01	8.10E-01					U
Pa-234m (Assumed from U-238)	7.20E-01	2.10E-01						6.80E+00	6.70E+00					
K-40	1.80E+01	3.30E+00												
Ra-228	7.10E-01	1.90E-01												
Pa-231	-6.00E-01	1.20E+00					U							
Beta Sum	**2.01E+01**	**3.32E+00**						**2.58E+01**	**7.52E+00**					
Total Activity Sum	**2.43E+01**	**3.55E+00**						**3.00E+01**	**7.62E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.95**	**(from gamma)**		**31.8**			
Gross Beta	4.25E+00	8.70E-01					J	**4.61**	**2.84**		**130**			
Total Activity	9.90E+00	3.70E+00					J	**2.81**	**2.37**		**84.2**			

0107025-13			TMF-0005					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-01	6.00E-01					
Ra-226	6.70E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.57E+00	5.20E-01					J							
Th-230	1.35E+00	4.60E-01					J							
Th-232	1.15E+00	4.10E-01					J							
U-234	9.00E-01	2.50E-01												
U-235	7.50E-02	6.40E-02						-1.00E-01	3.90E-01					U
U-238	8.10E-01	2.30E-01												
Total U Alpha	**1.79E+00**	**3.46E-01**												
Alpha Sum	**8.51E+00**	**2.27E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	1.16E-01	6.70E-02												
Th-234 (Assumed from U-238)	8.10E-01	2.30E-01						2.10E+00	1.40E+00					
Pa-234m (Assumed from U-238)	8.10E-01	2.30E-01						6.00E+00	1.20E+01					U
K-40	2.01E+01	4.10E+00												
Ra-228	9.70E-01	2.80E-01												
Pa-231	2.20E+00	2.30E+00												
Beta Sum	**2.31E+01**	**4.13E+00**						**2.96E+01**	**1.28E+01**					
Total Activity Sum	**3.16E+01**	**4.71E+00**						**3.81E+01**	**1.30E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+00	1.00E+00						**1.21**	**(from gamma)**		**42.9**			
Gross Beta	6.50E+00	1.00E+00					J	**3.90**	**1.80**		**112**			
Total Activity	9.90E+00	3.80E+00					J	**3.58**	**2.08**		**105**			

0107025-14			TMF-0006					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	3.10E-01					U
Ra-226	7.80E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	3.50E-01					J							
Th-230	7.80E-01	2.90E-01					J							
Th-232	1.03E+00	3.50E-01					J							
U-234	8.60E-01	2.20E-01												
U-235	4.20E-02	4.10E-02						5.00E-02	3.20E-01					U
U-238	7.20E-01	2.00E-01												
Total U Alpha	**1.62E+00**	**3.00E-01**												
Alpha Sum	**4.02E+00**	**1.68E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.00E-01						2.50E-01	5.00E-01					U
Pa-234m (Assumed from U-238)	7.20E-01	2.00E-01						5.20E+00	7.90E+00					U
K-40	1.63E+01	3.40E+00												
Ra-228	9.10E-01	2.50E-01												
Pa-231	-1.20E+00	1.70E+00					U							
Beta Sum	**1.85E+01**	**3.43E+00**						**2.25E+01**	**8.62E+00**					
Total Activity Sum	**2.25E+01**	**3.82E+00**						**2.65E+01**	**8.78E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.77E+00	9.20E-01						**0.39**	**(from gamma)**		**17.0**			
Gross Beta	4.18E+00	7.20E-01					J	**4.09**	**2.12**		**126**			
Total Activity	7.00E+00	3.60E+00					J	**2.96**	**2.06**		**105**			

0107025-15			TMF-0013					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.10E-01					U
Ra-226	1.07E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.22E+00	4.60E-01					J							
Th-230	1.49E+00	5.10E-01					J							
Th-232	9.10E-01	3.60E-01					J							
U-234	7.80E-01	2.10E-01												
U-235	7.30E-02	5.80E-02						1.40E-01	3.80E-01					U
U-238	6.80E-01	1.90E-01												
Total U Alpha	**1.53E+00**	**2.89E-01**												
Alpha Sum	**3.79E+00**	**2.08E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	3.80E-01	1.40E-01												
Th-234 (Assumed from U-238)	6.80E-01	1.90E-01						1.56E+00	9.80E-01					
Pa-234m (Assumed from U-238)	6.80E-01	1.90E-01						8.00E+00	1.00E+01					U
K-40	2.15E+01	4.80E+00												
Ra-228	8.80E-01	3.40E-01												
Pa-231	-2.70E+00	2.10E+00					U							
Beta Sum	**2.38E+01**	**4.83E+00**						**3.20E+01**	**1.11E+01**					
Total Activity Sum	**2.76E+01**	**5.26E+00**						**3.58E+01**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	9.40E-01						**0.66**	**(from gamma)**		**33.1**			
Gross Beta	5.30E+00	8.60E-01					J	**3.77**	**2.39**		**127**			
Total Activity	9.80E+00	3.80E+00					J	**2.74**	**2.17**		**95.2**			

0107025-16			TMF-0014					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								9.20E-02	9.70E-02					
Ra-226	6.30E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.90E-01					J							
Th-230	7.90E-01	2.80E-01					J							
Th-232	9.60E-01	3.10E-01					J							
U-234	7.00E-01	2.10E-01												
U-235	6.00E-02	5.40E-02						0.00E+00	2.70E-01					U
U-238	7.90E-01	2.20E-01												
Total U Alpha	**1.55E+00**	**3.09E-01**												
Alpha Sum	**3.28E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.90E-01	2.20E-01						1.03E+00	8.50E-01					
Pa-234m (Assumed from U-238)	7.90E-01	2.20E-01						9.00E-01	7.20E+00					U
K-40	1.72E+01	3.60E+00												
Ra-228	7.40E-01	2.30E-01												
Pa-231	-1.60E+00	1.60E+00					U							
Beta Sum	**1.93E+01**	**3.63E+00**						**1.97E+01**	**8.10E+00**					
Total Activity Sum	**2.26E+01**	**3.95E+00**						**2.30E+01**	**8.25E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.75E+00	8.90E-01						**0.81**	**(from gamma)**		**36.6**			
Gross Beta	4.42E+00	7.50E-01					J	**4.03**	**1.88**		**126**			
Total Activity	8.70E+00	3.70E+00					J	**2.57**	**1.58**		**88.8**			

0107025-17			TMF-0023					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.90E-01	3.00E-01					U
Ra-226	9.10E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.05E+00	3.40E-01					J							
Th-230	1.16E+00	3.50E-01					J							
Th-232	1.11E+00	3.40E-01					J							
U-234	9.50E-01	2.40E-01												
U-235	3.00E-02	3.90E-02					U	-1.00E-01	3.40E-01					U
U-238	7.40E-01	2.10E-01												
Total U Alpha	**1.72E+00**	**3.21E-01**												
Alpha Sum	**5.32E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.10E-01						2.70E-01	7.60E-01					U
Pa-234m (Assumed from U-238)	7.40E-01	2.10E-01						-7.10E+00	8.70E+00					U
K-40	2.51E+01	4.50E+00												
Ra-228	1.10E+00	2.60E-01												
Pa-231	-7.00E-01	1.70E+00					U							
Beta Sum	**2.76E+01**	**4.52E+00**						**1.93E+01**	**9.83E+00**					
Total Activity Sum	**3.29E+01**	**4.83E+00**						**2.46E+01**	**9.98E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.10E+00						**0.58**	**(from gamma)**		**20.0**			
Gross Beta	5.14E+00	8.50E-01					J	**4.88**	**1.43**		**137**			
Total Activity	9.20E+00	3.80E+00					J	**3.86**	**1.44**		**113**			

0107025-18			TMF-0024					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.30E-01					U
Ra-226	8.30E-01	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	2.50E-01					J							
Th-230	6.80E-01	2.40E-01					J							
Th-232	8.10E-01	2.70E-01					J							
U-234	8.00E-01	2.20E-01												
U-235	1.40E-01	8.60E-02						1.00E-02	2.80E-01					U
U-238	6.00E-01	1.90E-01												
Total U Alpha	**1.54E+00**	**3.03E-01**												
Alpha Sum	**5.06E+00**	**1.34E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.00E-01	1.90E-01						1.17E+00	9.10E-01					
Pa-234m (Assumed from U-238)	6.00E-01	1.90E-01						6.50E+00	6.80E+00					
K-40	1.85E+01	3.40E+00												
Ra-228	6.80E-01	1.80E-01												
Pa-231	6.00E-01	1.30E+00					U							
Beta Sum	**2.05E+01**	**3.42E+00**						**2.69E+01**	**7.66E+00**					
Total Activity Sum	**2.55E+01**	**3.67E+00**						**3.20E+01**	**7.78E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.37E+00	9.90E-01						**0.19**	**(from gamma)**		**5.94**			
Gross Beta	4.44E+00	7.40E-01					J	**4.58**	**2.92**		**129**			
Total Activity	8.90E+00	3.70E+00					J	**3.19**	**2.68**		**96.5**			

0107025-19			TMF-0025					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-0.02	0.56					U
Ra-226	6.50E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.35E+00	4.30E-01					J							
Th-230	1.24E+00	3.90E-01					J							
Th-232	1.06E+00	3.50E-01					J							
U-234	7.80E-01	2.00E-01												
U-235	4.60E-02	4.60E-02						9.00E-02	3.30E-01					U
U-238	8.30E-01	2.10E-01												
Total U Alpha	**1.66E+00**	**2.94E-01**												
Alpha Sum	**4.61E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.10E-01						1.36E+00	9.90E-01					
Pa-234m (Assumed from U-238)	8.30E-01	2.10E-01						6.00E+00	1.10E+01					U
K-40	2.18E+01	4.40E+00												
Ra-228	8.50E-01	2.60E-01												
Pa-231	-1.50E+00	1.80E+00					U							
Beta Sum	**2.41E+01**	**4.42E+00**						**2.98E+01**	**1.19E+01**					
Total Activity Sum	**2.87E+01**	**4.77E+00**						**3.44E+01**	**1.20E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.10E+00						**0.66**	**(from gamma)**		**26.3**			
Gross Beta	6.12E+00	9.50E-01					J	**3.98**	**1.99**		**119**			
Total Activity	1.11E+01	3.80E+00					J	**2.89**	**1.85**		**88.5**			

0107025-20			TMF-0026					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	3.60E-01					U
Ra-226	6.90E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	3.40E-01					J							
Th-230	7.80E-01	3.10E-01					J							
Th-232	1.28E+00	4.30E-01					J							
U-234	8.40E-01	2.30E-01												
U-235	2.60E-02	3.60E-02					U	3.70E-01	3.50E-01					
U-238	7.80E-01	2.20E-01												
Total U Alpha	**1.65E+00**	**3.20E-01**												
Alpha Sum	**4.20E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.20E-01						1.07E+00	9.90E-01					
Pa-234m (Assumed from U-238)	7.80E-01	2.20E-01						2.00E+00	1.10E+01					U
K-40	1.85E+01	3.90E+00												
Ra-228	9.00E-01	3.00E-01												
Pa-231	-1.10E+00	2.00E+00					U							
Beta Sum	**2.08E+01**	**3.93E+00**						**2.23E+01**	**1.17E+01**					
Total Activity Sum	**2.50E+01**	**4.39E+00**						**2.65E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.14E+00	9.80E-01						**0.43**	**(from gamma)**		**20.2**			
Gross Beta	4.41E+00	7.50E-01					J	**4.10**	**1.53**		**130**			
Total Activity	7.60E+00	3.70E+00					J	**3.04**	**1.52**		**107**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107026

This sample delivery group (SDG) contained fourteen (14) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 6, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-9089	0107026-1 and 0107026-1-D1
TMF-9090	0107026-2
TMF-0085	0107026-3
TMF-0086	0107026-4
TMF-0101	0107026-5 and 0107026-5-D-1
TMF-0102	0107026-6
TMF-0107	0107026-7
TMF-0108	0107026-8
TMF-0111	0107026-9
TMF-0112	0107026-10
TMF-0115	0107026-11
TMF-0116	0107026-12
TMF-0117	0107026-13
TMF-0118	0107026-14

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was reported by the laboratory in the EQ-1 and EQ-02 equipment rinsate blanks. However, ^{137}Cs peak was identified in gamma spectrometry report for equipment rinsate sample # EQ-1. All associated sample results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). However, the ^{137}Cs activity was only reported for one sample (TMF-0117), but it was observed in the gamma spectrometry reports for other samples but not reported. In all cases the ^{137}Cs sample results are greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification on ^{137}Cs results in the samples is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses except for ^{231}Pa in sample TMF-9089, the DER (1.60) and RPD (2867%) are both outside acceptable limits. **Therefore it is recommended that the Pa-231 results for all samples be qualified as estimated (J).**

Identification and Quantification:

All target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am) were reported. There were no incidents of identified radionuclides being excluded from the laboratory reports. No problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination for all alpha spectrometry analyses.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses. No qualification is required.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 17.53% for all samples for the alpha analyses. The sample-specific percent recovery results of $^{224/235/238}$U for all samples have less than 10% uncertainty. However, due to low sample-specific percent recovery of $^{228/230/232}$Th for all samples, there is greater than 10% uncertainty in the sample-specific percent recovery results for all samples for the isotopic thorium analysis. There is between 11.7% - 19.3% uncertainty in the sample-specific percent recovery results for the isotopic thorium analysis for all samples. **Therefore, it is recommended that the $^{228/230/232}$Th results for all samples be qualified as estimated (J).**

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination either in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analysis were within acceptable limits.

Duplicate Analysis:

One of the two duplicate DERs (1.72) is outside acceptable limits for the ^{226}Ra analysis. The RPD (122%) was also outside acceptable limits. **Therefore it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J).**

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}KCl, and ^{40}KF). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. All of the samples results did not meet the required MDL indicating that the laboratory did not meet the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses. Therefore, no qualification is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis by liquid scintillation counting.

Duplicate Analysis:

The total activity by LCS duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantification:

It is recommended that the total activity analysis results for samples TMF-9089, TMF-9090, TMF-0085, TMF-0086, TMF-0102, TMF-0107, TMF-0108, TMF-0112, TMF-0115, TMF-0116, TMF-0117, and TMF-0118 be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}KCl, and ^{40}KF). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER (1.49) for sample TMF-0111 total activity analysis indicates that the gross alpha analyses did not agree with the sum of the alpha emitters within a 99% confidence level. In addition, the RPD (59.1%) was also outside acceptable limits. The gross alpha activity was

greater than the alpha sum value by a factor of approximately 2. This may be indicative of missing activity, sample heterogeneity, or some bias on the analyses. There is not enough information to determine which of these or combinations of these possible problems exist. Since this one sample is an isolated instance, no further qualification of the results is recommended.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (1.39 to 4.75) for all samples are outside the acceptable limits as well as the RPD (51.4% to 133) values. The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

For the comparison of total activity to the sum of the alpha and beta emitters, the DERs for samples TMF-9089 (3.13), TMF-9090 (3.09), TMF-0085 (3.88), TMF-0086 (3.08), TMF-0102 (3.65), TMF-0107 (2.00), TMF-0108 (2.65), TMF-0112 (3.39), TMF-0115 (4.11), TMF-0116 (3.63), TMF-0117 (2.86), and TMF-0118 (3.18) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (81.1%, 118%, 155%, 89.5%, 111%, 78.1%, 74.3%, 107%, 139%, 114%, 86.0%, and 106% respectively) are also outside acceptable limits. Samples TMF-9089, TMF-9090, TMF-0085, TMF-0086, TMF-0102, TMF-0107, TMF-0108, TMF-0112, TMF-0115, TMF-0116, TMF-0117, and TMF-0118 have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 2 to 8. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta in gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples.

0107026-1			TMF-9089					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	2.90E-01	-3.00E-02	5.90E-01	**0.06**	**400**	U
Ra-226	8.50E-01	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.70E-01					J							
Th-230	8.00E-01	2.60E-01					J							
Th-232	9.80E-01	2.90E-01					J							
U-234	1.21E+00	2.80E-01												
U-235	8.00E-02	6.00E-02						2.20E-01	3.20E-01	3.70E-01	3.90E-01	**0.30**	**50.8**	U
U-238	1.02E+00	2.50E-01												
Total U Alpha	**2.31E+00**	**3.80E-01**												
Alpha Sum	**7.83E+00**	**1.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	1.02E+00	2.50E-01						3.00E-01	1.10E+00	1.00E+00	1.50E+00	**0.38**	**108**	U
Pa-234m (Assumed from U-238)	1.02E+00	2.50E-01						2.00E-01	8.50E+00	1.00E+00	8.80E+00	**0.07**	**133**	U
K-40	2.04E+01	3.70E+00	2.26E+01	4.60E+00	**0.37**	**10.2**								
Ra-228	9.10E-01	2.30E-01	9.60E-01	2.80E-01	**0.14**	**5.35**								
Pa-231	2.30E+00	1.40E+00	-2.00E+00	2.30E+00	**1.60**	**2867**	J							
Beta Sum	**2.36E+01**	**3.73E+00**						**2.21E+01**	**9.34E+00**	**2.53E+01**	**1.01E+01**			
Total Activity Sum	**3.15E+01**	**3.99E+00**						**2.99E+01**	**9.45E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.10E+00	1.20E+00						**0.39**	**(from gamma)**		**9.78**			
Gross Beta	5.92E+00	9.60E-01					J	**4.60**	**1.72**		**120**			
Total Activity	1.33E+01	4.20E+00					J	**3.13**	**1.61**		**81.1**			

0107026-2			TMF-9090					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.70E-01	5.20E-01					U
Ra-226	8.90E-01	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	3.10E-01	1.26E+00	3.40E-01	**0.52**	**21.1**	J							
Th-230	9.40E-01	2.80E-01	9.90E-01	2.80E-01	**0.13**	**5.18**	J							
Th-232	1.02E+00	2.90E-01	1.24E+00	3.30E-01	**0.50**	**19.5**	J							
U-234	8.90E-01	1.80E-01												
U-235	7.50E-02	4.30E-02						-6.00E-02	3.30E-01					U
U-238	7.40E-01	1.60E-01												
Total U Alpha	**1.71E+00**	**2.45E-01**												
Alpha Sum	**3.60E+00**	**1.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.40E-01	1.60E-01						1.90E-01	7.20E-01					U
Pa-234m (Assumed from U-238)	7.40E-01	1.60E-01						5.30E+00	9.10E+00					U
K-40	1.71E+01	3.60E+00												
Ra-228	1.00E+00	2.90E-01												
Pa-231	-2.20E+00	1.90E+00					UJ							
Beta Sum	**1.96E+01**	**3.62E+00**						**2.36E+01**	**9.82E+00**					
Total Activity Sum	**2.32E+01**	**4.05E+00**						**2.72E+01**	**9.98E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**1.04**	**(from gamma)**		**46.9**			
Gross Beta	4.62E+00	8.10E-01					J	**4.03**	**1.93**		**124**			
Total Activity	6.00E+00	3.80E+00					J	**3.09**	**1.98**		**118**			

0107026-3			TMF-0085					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.10E-01					U
Ra-226	8.90E-01	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	2.70E-01					J							
Th-230	7.80E-01	2.30E-01					J							
Th-232	8.30E-01	2.40E-01					J							
U-234	7.70E-01	1.60E-01	9.10E-01	1.80E-01	**0.58**	**16.7**								
U-235	1.44E-01	6.00E-02	7.00E-02	4.20E-02	**1.01**	**69.2**		1.90E-01	2.90E-01					U
U-238	9.40E-01	1.90E-01	1.01E+00	2.00E-01	**0.25**	**7.18**								
Total U Alpha	**1.85E+00**	**2.56E-01**	**1.99E+00**	**2.72E-01**										
Alpha Sum	**5.27E+00**	**5.53E-01**	**1.99E+00**	**2.72E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	9.40E-01	1.90E-01	1.01E+00	2.00E-01	**0.25**	**7.18**		4.20E-01	9.20E-01					U
Pa-234m (Assumed from U-238)	9.40E-01	1.90E-01	1.01E+00	2.00E-01	**0.25**	**7.18**		7.00E+00	1.10E+01					U
K-40	1.65E+01	3.90E+00												
Ra-228	7.50E-01	3.10E-01												
Pa-231	-9.00E-01	2.00E+00					UJ							
Beta Sum	**1.91E+01**	**3.92E+00**	**2.02E+00**	**2.83E-01**				**2.47E+01**	**1.17E+01**					
Total Activity Sum	**2.44E+01**	**3.96E+00**	**4.01E+00**	**3.93E-01**				**2.99E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.30E+00	1.10E+00						**0.83**	**(from gamma)**		**17.7**			
Gross Beta	5.44E+00	8.90E-01					J	**3.40**	**1.64**		**111**			
Total Activity	3.10E+00	3.80E+00					UJ	**3.88**	**2.18**		**155**			

0107026-4			TMF-0086					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	2.30E-01					U
Ra-226	1.06E+00	3.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	2.20E-01					J							
Th-230	7.20E-01	2.20E-01					J							
Th-232	8.10E-01	2.40E-01					J							
U-234	7.70E-01	1.60E-01												
U-235	2.70E-02	2.90E-02						2.00E-02	2.70E-01					U
U-238	8.20E-01	1.70E-01												
Total U Alpha	**1.62E+00**	**2.35E-01**												
Alpha Sum	**4.91E+00**	**5.64E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.20E-01	1.70E-01						8.10E-01	7.20E-01					
Pa-234m (Assumed from U-238)	8.20E-01	1.70E-01						1.14E+01	7.80E+00					
K-40	1.94E+01	3.50E+00												
Ra-228	7.60E-01	1.90E-01												
Pa-231	-7.00E-01	2.00E+00					UJ							
Beta Sum	**2.18E+01**	**3.51E+00**						**3.24E+01**	**8.58E+00**					
Total Activity Sum	**2.67E+01**	**3.56E+00**						**3.73E+01**	**8.60E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.40E+00	1.10E+00						**1.21**	**(from gamma)**		**26.4**			
Gross Beta	4.83E+00	7.90E-01					J	**4.71**	**3.20**		**127**			
Total Activity	1.02E+01	4.00E+00					J	**3.08**	**2.85**		**89.5**			

0107026-5			TMF-0101					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.50E-01	2.40E-01	8.00E-02	3.90E-01	**0.15**	**60.9**	U
Ra-226	1.80E-01	2.10E-01	7.40E-01	2.50E-01	**1.72**	**122**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.80E-01	1.20E-01	3.10E-01	2.30E-01	**0.50**	**53.1**	J							
Th-230	3.40E-01	1.50E-01	3.80E-01	2.00E-01	**0.16**	**11.1**	J							
Th-232	2.50E-01	1.30E-01	3.50E-01	1.90E-01	**0.43**	**33.3**	J							
U-234	3.59E-01	1.00E-01												
U-235	2.90E-02	2.80E-02						-2.10E-01	2.30E-01	5.00E-02	2.70E-01	**0.73**	**325**	U
U-238	3.90E-01	1.10E-01												
Total U Alpha	**7.78E-01**	**1.51E-01**												
Alpha Sum	**2.27E+00**	**1.13E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	3.90E-01	1.10E-01						3.10E-01	6.80E-01	9.20E-01	1.00E+00	**0.50**	**99.2**	U
Pa-234m (Assumed from U-238)	3.90E-01	1.10E-01						1.70E+00	6.40E+00	-5.20E+00	8.00E+00	**0.67**	**394**	U
K-40	4.10E+00	1.10E+00	3.20E+00	1.20E+00	**0.55**	**24.7**								
Ra-228	1.40E-01	1.50E-01	9.00E-02	2.00E-01	**0.20**	**43.5**								
Pa-231	6.00E-01	1.20E+00	0.00E+00	1.60E+00	**0.30**	**200**	UJ							
Beta Sum	**5.09E+00**	**1.13E+00**						**6.32E+00**	**6.53E+00**	**-9.90E-01**	**8.16E+00**			
Total Activity Sum	**7.36E+00**	**1.60E+00**						**8.59E+00**	**6.63E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.90E+00	1.20E+00	3.10E+00	1.10E+00	**0.49**	**22.9**		**0.99**	**(from gamma)**		**52.9**			
Gross Beta	3.01E+00	9.90E-01	3.00E+00	1.00E+00	**0.01**	**0.33**	J	**1.39**	**0.50**		**51.4**			
Total Activity	5.00E+00	3.80E+00						**0.57**	**0.47**		**38.2**			

0107026-6			TMF-0102					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.20E-01	1.10E-01					
Ra-226	1.03E+00	2.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	2.30E-01					J							
Th-230	9.10E-01	2.20E-01					J							
Th-232	8.70E-01	2.20E-01					J							
U-234	1.07E+00	2.20E-01	1.27E+00	2.50E-01	**0.60**	**17.1**								
U-235	8.30E-02	4.80E-02	1.17E-01	6.00E-02	**0.44**	**34.0**		1.50E-01	2.90E-01					U
U-238	1.04E+00	2.10E-01	1.00E+00	2.10E-01	**0.13**	**3.92**								
Total U Alpha	**2.19E+00**	**2.10E-01**	**2.39E+00**	**3.32E-01**										
Alpha Sum	**5.92E+00**	**5.68E-01**	**2.39E+00**	**3.32E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	1.04E+00	2.10E-01	1.00E+00	2.10E-01	**0.13**	**3.92**		1.40E+00	7.80E-01					
Pa-234m (Assumed from U-238)	1.04E+00	2.10E-01	1.00E+00	2.10E-01	**0.13**	**3.92**		1.00E+00	1.20E+01					U
K-40	2.26E+01	4.70E+00												
Ra-228	8.40E-01	3.10E-01												
Pa-231	-1.10E+00	1.90E+00					UJ							
Beta Sum	**2.55E+01**	**4.72E+00**	**2.00E+00**	**2.97E-01**				**2.58E+01**	**1.29E+01**					
Total Activity Sum	**3.14E+01**	**4.75E+00**	**4.39E+00**	**4.45E-01**				**3.18E+01**	**1.29E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.00E+00						**0.15**	**(from gamma)**		**2.94**			
Gross Beta	5.10E+00	8.40E-01					J	**4.26**	**1.60**		**133**			
Total Activity	9.00E+00	3.90E+00					J	**3.65**	**1.69**		**111**			

0107026-7			TMF-0107					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	9.60E-02					U
Ra-226	6.90E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	2.10E-01					J							
Th-230	8.80E-01	2.30E-01					J							
Th-232	6.60E-01	1.90E-01					J							
U-234	7.70E-01	1.70E-01												
U-235	3.30E-02	2.90E-02						3.00E-01	2.90E-01					
U-238	7.40E-01	1.70E-01												
Total U Alpha	**1.54E+00**	**2.42E-01**												
Alpha Sum	**4.53E+00**	**1.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.40E-01	1.70E-01						1.29E+00	7.20E-01					
Pa-234m (Assumed from U-238)	7.40E-01	1.70E-01						1.00E+01	1.30E+01					U
K-40	1.38E+01	3.40E+00												
Ra-228	7.30E-01	2.80E-01												
Pa-231	0.00E+00	1.90E+00					UJ							
Beta Sum	**1.60E+01**	**3.43E+00**						**2.58E+01**	**1.35E+01**					
Total Activity Sum	**2.05E+01**	**3.86E+00**						**3.04E+01**	**1.36E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	8.90E-01						**0.39**	**(from gamma)**		**15.6**			
Gross Beta	3.96E+00	6.70E-01					J	**3.45**	**1.62**		**121**			
Total Activity	9.00E+00	4.30E+00					J	**2.00**	**1.50**		**78.1**			

0107026-8			TMF-0108					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	2.40E-01					U
Ra-226	1.18E+00	3.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.70E-01					J							
Th-230	8.20E-02	2.50E-01					UJ							
Th-232	9.20E-01	2.80E-01					J							
U-234	8.30E-01	1.70E-01												
U-235	5.90E-02	3.80E-02						-2.00E-02	2.80E-01					U
U-238	7.70E-01	1.60E-01												
Total U Alpha	**1.66E+00**	**2.37E-01**												
Alpha Sum	**4.67E+00**	**6.10E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.70E-01	1.60E-01						5.90E-01	7.80E-01					U
Pa-234m (Assumed from U-238)	7.70E-01	1.60E-01						3.00E-01	7.00E+00					U
K-40	1.94E+01	3.50E+00												
Ra-228	5.60E-01	1.60E-01												
Pa-231	-2.00E-01	1.30E+00					UJ							
Beta Sum	**2.15E+01**	**3.51E+00**						**2.09E+01**	**7.87E+00**					
Total Activity Sum	**2.62E+01**	**3.56E+00**						**2.55E+01**	**7.89E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.00E+00						**0.28**	**(from gamma)**		**6.80**			
Gross Beta	4.32E+00	8.80E-01					J	**4.75**	**2.09**		**133**			
Total Activity	1.20E+01	4.00E+00					J	**2.65**	**1.53**		**74.3**			

0107026-9			TMF-0111					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.60E-02	8.40E-02					U
Ra-226	1.40E-01	1.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	3.40E-01	1.60E-01					J							
Th-230	3.90E-01	1.60E-01					J							
Th-232	2.50E-01	1.20E-01					J							
U-234	5.60E-01	1.40E-01												
U-235	3.00E-02	2.80E-02						1.00E-02	2.60E-01					U
U-238	5.20E-01	1.30E-01												
Total U Alpha	**1.11E+00**	**1.93E-01**												
Alpha Sum	**2.23E+00**	**3.58E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	5.20E-01	1.30E-01						8.10E-01	5.40E-01					
Pa-234m (Assumed from U-238)	5.20E-01	1.30E-01						0.00E+00	1.00E+01					U
K-40	9.10E+00	2.60E+00												
Ra-228	5.80E-01	2.60E-01												
Pa-231	-1.00E+00	1.70E+00					UJ							
Beta Sum	**1.07E+01**	**2.62E+00**						**1.05E+01**	**1.03E+01**					
Total Activity Sum	**1.30E+01**	**2.64E+00**						**1.27E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.10E+00	1.20E+00						**1.49**	**(from gamma)**		**59.1**			
Gross Beta	3.10E+00	1.10E+00					J	**2.68**	**0.71**		**110**			
Total Activity	7.10E+00	4.00E+00						**1.22**	**0.51**		**58.4**			

0107026-10			TMF-0112					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.10E-01					U
Ra-226	1.33E+00	3.30E-01	1.21E+00	3.00E-01	**0.27**	**9.45**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	3.30E-01					J							
Th-230	1.38E+00	3.90E-01					J							
Th-232	1.13E+00	3.40E-01					J							
U-234	7.40E-01	1.60E-01												
U-235	9.90E-02	5.00E-02						1.00E-01	2.70E-01					U
U-238	7.90E-01	1.70E-01												
Total U Alpha	**1.63E+00**	**2.39E-01**												
Alpha Sum	**6.60E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.90E-01	1.70E-01						1.03E+00	7.90E-01					
Pa-234m (Assumed from U-238)	7.90E-01	1.70E-01						3.70E+00	9.00E+00					U
K-40	1.90E+01	4.00E+00												
Ra-228	1.13E+00	3.10E-01												
Pa-231	1.00E-01	1.50E+00					UJ							
Beta Sum	**2.17E+01**	**4.02E+00**						**2.49E+01**	**9.89E+00**					
Total Activity Sum	**2.83E+01**	**4.31E+00**						**3.15E+01**	**1.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.00E+00	6.60E+00	1.10E+00	**0.34**	**7.87**		**0.27**	**(from gamma)**		**7.86**			
Gross Beta	4.84E+00	8.00E-01	4.60E+00	7.70E-01	**0.22**	**5.08**	J	**4.12**	**2.02**		**127**			
Total Activity	8.60E+00	3.90E+00					J	**3.39**	**2.13**		**107**			

0107026-11			TMF-0115					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	5.00E-01					U
Ra-226	1.60E-01	2.70E-01					UJ							
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	3.00E-01					J							
Th-230	9.80E-01	3.00E-01					J							
Th-232	1.19E+00	3.40E-01					J							
U-234	9.40E-01	1.90E-01												
U-235	1.27E-01	5.80E-02						-7.00E-02	3.50E-01					U
U-238	9.20E-01	1.90E-01												
Total U Alpha	**1.99E+00**	**2.75E-01**												
Alpha Sum	**5.27E+00**	**6.66E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	9.20E-01	1.90E-01						7.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	9.20E-01	1.90E-01						1.10E+01	1.20E+01					
K-40	2.07E+01	4.20E+00												
Ra-228	7.90E-01	2.40E-01												
Pa-231	-2.10E+00	1.80E+00					UJ							
Beta Sum	**2.33E+01**	**4.22E+00**						**3.32E+01**	**1.28E+01**					
Total Activity Sum	**2.86E+01**	**4.27E+00**						**3.85E+01**	**1.28E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.70E+00	1.00E+00						**0.36**	**(from gamma)**		**7.90**			
Gross Beta	4.70E+00	8.10E-01					J	**4.34**	**2.23**		**133**			
Total Activity	5.10E+00	3.80E+00					J	**4.11**	**2.50**		**139**			

0107026-12			TMF-0116					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	2.40E-01					U
Ra-226	7.70E-01	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.80E-01	2.00E-01					J							
Th-230	6.80E-01	1.90E-01					J							
Th-232	7.70E-01	2.10E-01					J							
U-234	7.00E-01	1.50E-01												
U-235	1.08E-01	5.10E-02						-6.00E-02	2.70E-01					U
U-238	8.40E-01	1.70E-01												
Total U Alpha	**1.65E+00**	**2.32E-01**												
Alpha Sum	**5.27E+00**	**1.27E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.40E-01	1.70E-01						1.22E+00	9.00E-01					
Pa-234m (Assumed from U-238)	8.40E-01	1.70E-01						-4.20E+00	6.70E+00					U
K-40	1.93E+01	3.50E+00												
Ra-228	6.60E-01	2.00E-01												
Pa-231	8.00E-01	1.30E+00					UJ							
Beta Sum	**2.17E+01**	**3.52E+00**						**1.71E+01**	**7.62E+00**					
Total Activity Sum	**2.70E+01**	**3.74E+00**						**2.23E+01**	**7.72E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+00	1.00E+00						**0.29**	**(from gamma)**		**9.30**			
Gross Beta	4.75E+00	8.20E-01					J	**4.70**	**1.61**		**128**			
Total Activity	7.40E+00	3.90E+00					J	**3.63**	**1.73**		**114**			

0107026-13			TMF-0117					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.20E-01					U
Ra-226	8.60E-01	3.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	2.90E-01					J							
Th-230	1.00E+00	2.70E-01					J							
Th-232	1.20E+00	3.10E-01					J							
U-234	8.80E-01	1.90E-01												
U-235	1.71E-01	7.10E-02						2.90E-01	3.10E-01					
U-238	9.80E-01	2.00E-01												
Total U Alpha	**2.03E+00**	**2.85E-01**												
Alpha Sum	**6.18E+00**	**6.51E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	1.19E-01	7.20E-02												
Th-234 (Assumed from U-238)	9.80E-01	2.00E-01						2.37E+00	9.20E-01					
Pa-234m (Assumed from U-238)	9.80E-01	2.00E-01						-8.00E+00	1.10E+01					U
K-40	1.80E+01	3.90E+00												
Ra-228	8.50E-01	2.70E-01												
Pa-231	-1.50E+00	1.70E+00					UJ							
Beta Sum	**2.09E+01**	**3.92E+00**						**1.33E+01**	**1.17E+01**					
Total Activity Sum	**2.71E+01**	**3.97E+00**						**1.95E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.10E+00						**0.25**	**(from gamma)**		**5.03**			
Gross Beta	5.70E+00	9.20E-01					J	**3.78**	**0.65**		**114**			
Total Activity	1.08E+01	4.10E+00					J	**2.86**	**0.70**		**86.0**			

0107026-14			TMF-0118					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.20E-02	8.40E-02					U
Ra-226	7.10E-01	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.40E-01					J							
Th-230	8.60E-01	2.40E-01					J							
Th-232	1.02E+00	2.70E-01					J							
U-234	9.30E-01	1.90E-01												
U-235	9.40E-02	5.00E-02						6.00E-02	2.80E-01					U
U-238	8.00E-01	1.70E-01												
Total U Alpha	**1.82E+00**	**2.60E-01**												
Alpha Sum	**5.23E+00**	**5.55E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.00E-01	1.70E-01						8.00E-01	6.30E-01					
Pa-234m (Assumed from U-238)	8.00E-01	1.70E-01						-2.00E+00	1.10E+01					U
K-40	1.80E+01	3.90E+00												
Ra-228	6.10E-01	2.30E-01												
Pa-231	-1.80E+00	1.80E+00					UJ							
Beta Sum	**2.02E+01**	**3.91E+00**						**1.74E+01**	**1.17E+01**					
Total Activity Sum	**2.54E+01**	**3.95E+00**						**2.26E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.14E+00	9.60E-01						**0.08**	**(from gamma)**		**1.81**			
Gross Beta	4.45E+00	7.50E-01					J	**3.95**	**1.11**		**128**			
Total Activity	7.80E+00	3.90E+00					J	**3.18**	**1.20**		**106**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107027

This sample delivery group (SDG) contained fourteen (14) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 6, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0071	0107027-1
TMF-0072	0107027-2
TMF-0105	0107023-3
TMF-0106	0107027-4
TMF-0109	0107027-5
TMF-0110	0107027-6
TMF-0113	0107027-7
TMF-0114	0107027-8
TMF-9119	0107027-9
TMF-9120	0107027-10
TMF-0123	0107027-11
TMF-0124	0107027-12
TMF-0125	0107027-13
TMF-0126	0107027-14

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\mathrm{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was observed in the EQ-1 and EQ-2 equipment rinsate blanks. However, ^{137}Cs activity was observed in the equipment rinsate blank EQ-1. All associated sample results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). There was ^{137}Cs activity reported by the laboratory in two samples TMF–0123 and TMF-0125. The ^{137}Cs peak was identified in gamma spectrometry report for TMF-0109 and TMF-9119 but not reported by the laboratory. The ^{137}Cs activity in those samples was higher than the DL (1.65*TPU). However, ^{137}Cs activity values observed in the samples are greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification of the ^{137}Cs results in the samples is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

All target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am) plus ^{40}K were reported for all samples. There were ^{137}Cs results reported in two samples TMF–0123 and TMF-0125. The ^{137}Cs peak was identified in the gamma spectrometry report for two samples TMF-0109 and

TMF-9119 but not reported by the laboratory. **It is recommended that the laboratory report all gamma emitters that are greater than the DL.** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for $^{234/235}U$ and ^{230}Th in the method blank. All associated samples result less than 5 times the blank value for $^{234/235}U$ and ^{230}Th analyses should be qualified as estimated (J). The ^{234}U and ^{230}Th results for all samples are greater than 5 times the method blank, therefore no qualification is necessary. **It is recommended that the ^{235}U results for samples TMF-0071, TMF-0072, TMF-0106, TMF-0109, TMF-0110, TMF-0113, TMF-0114, TMF-9119, TMF-9120, TMF-0123, TMF-0124, TMF-0125 and TMF-0126 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}Th$. All associated samples result less than 5 times the blank value for $^{228/230/232}Th$ analyses should be qualified as estimated (J). However, $^{228/230/232}Th$ activity values for all samples are greater than 5 times the $^{228/230/232}Th$ concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses. No qualification is required.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 33.06% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results of $^{224/235/238}U$ and $^{228/230/232}Th$ for all samples have less than 10% uncertainty. No qualification is necessary.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium analyses.

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 1.0 pCi/g for the isotopic uranium and thorium analyses.

3.0 ^{226}Ra ANALYSIS

Method Blank:

There is no indication of blank contamination in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all ^{226}Ra analyses.

Chemical Recoveries:

The sample-specific chemical recoveries were greater than 83.23% for ^{226}Ra analysis which is within acceptable limits.

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Quantitation and Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. All of the samples results that did not meet the required MDL as identified in the narrative section indicating that the laboratory did not meet the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis by liquid scintillation counting.

Duplicate Analysis:

The duplicate sample DER for total activity analysis is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation:

It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities are within acceptable limits indicating that the gross alpha analyses agree with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.67 – 4.48) for all samples are outside the acceptable limits as well as the RPD values (109% - 135%). The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts and/or the preparation method as discussed above. Since all of the gross beta

results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

For the comparison of total activity to the sum of the alpha and beta emitters, the DERs for samples TMF-0071 (2.91), TMF-0072 (1.91), TMF-0105 (2.96), TMF-0106 (2.33), TMF-0109 (1.83), TMF-0110 (3.06), TMF-0113 (1.88), TMF-0114 (1.95), TMF-9119 (1.95), TMF-9120 (2.62), TMF-0123 (1.80), TMF-0124 (2.54), TMF-0125 (2.04), and TMF-0126 (2.17) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (95.5%, 62.4%, 87.2%, 71.7%, 64.2%, 92.0%, 89.2%, 69.5%, 78.6%, 88.8%, 52.6%, 93.6%, 83.5%, and 74.6% respectively) are also outside acceptable limits. Samples TMF-0071, TMF-0072, TMF-0105, TMF-0106, TMF-0109, TMF-0110, TMF-0113, TMF-0114, TMF-9119, TMF-9120, TMF-0123, TMF-0124, TMF-0125, and TMF-0126 have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 1.6 to 2. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts and/or the preparation method as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta in gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-1			TMF-0071					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.10E-01	3.80E-01	5.00E-02	1.30E-01	**0.40**	**533**	U
Ra-226	9.70E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.50E-01	9.40E-01	1.80E-01	**0.21**	**5.46**								
Th-230	9.10E-01	1.50E-01	7.90E-01	1.50E-01	**0.57**	**14.1**								
Th-232	8.00E-01	1.40E-01	8.20E-01	1.50E-01	**0.10**	**2.47**								
U-234	6.70E-01	1.90E-01												
U-235	7.50E-02	5.70E-02					J	-2.00E-01	4.20E-01	7.00E-02	4.00E-01	**0.47**	**415**	U
U-238	5.80E-01	1.80E-01												
Total U Alpha	**1.33E+00**	**2.68E-01**												
Alpha Sum	**6.07E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.80E-01	1.80E-01						1.30E+00	1.40E+00	7.20E-01	8.50E-01	**0.35**	**57.4**	
Pa-234m (Assumed from U-238)	5.80E-01	1.80E-01						-1.00E+01	1.60E+01	-1.10E+01	1.90E+01	**0.04**	**9.52**	U
K-40	1.95E+01	4.10E+00	1.77E+01	5.20E+00	**0.27**	**9.68**								
Ra-228	8.30E-01	3.10E-01	6.00E-01	5.10E-01	**0.39**	**32.2**								
Pa-231	1.30E+00	2.40E+00	-2.80E+00	3.00E+00	**1.07**	**547**	U							
Beta Sum	**2.16E+01**	**4.13E+00**						**1.18E+01**	**1.66E+01**	**7.68E+00**	**1.97E+01**			
Total Activity Sum	**2.77E+01**	**4.68E+00**						**1.79E+01**	**1.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.30E+00						**0.17**	**(from gamma)**		**6.92**			
Gross Beta	5.30E+00	1.10E+00					J	**3.82**	**0.39**		**121**			
Total Activity	9.80E+00	4.00E+00					J	**2.91**	**0.47**		**95.5**			

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-2			TMF-0072					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.20E-01					U
Ra-226	9.80E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.50E-01												
Th-230	8.40E-01	1.40E-01												
Th-232	8.10E-01	1.30E-01												
U-234	1.01E+00	2.60E-01												
U-235	2.00E-01	1.00E-01					J	1.00E-01	3.70E-01					U
U-238	8.10E-01	2.30E-01												
Total U Alpha	**2.02E+00**	**3.61E-01**												
Alpha Sum	**5.54E+00**	**2.48E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E-01	2.30E-01						1.60E+00	1.10E+00					
Pa-234m (Assumed from U-238)	8.10E-01	2.30E-01						-4.00E+00	1.60E+01					U
K-40	1.94E+01	4.90E+00												
Ra-228	1.08E+00	4.10E-01												
Pa-231	0.00E+00	2.70E+00					U							
Beta Sum	**2.21E+01**	**4.94E+00**						**1.81E+01**	**1.68E+01**					
Total Activity Sum	**2.76E+01**	**5.53E+00**						**2.36E+01**	**1.70E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+00	1.00E+00						**0.28**	**(from gamma)**		**14.3**			
Gross Beta	4.95E+00	8.40E-01					J	**3.42**	**0.78**		**127**			
Total Activity	1.45E+01	4.10E+00					J	**1.91**	**0.52**		**62.4**			

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-3			TMF-0105					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.90E-01	7.00E-02	1.10E-01	**0.29**	**360**	U
Ra-226	1.05E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	1.60E-01												
Th-230	9.10E-01	1.50E-01												
Th-232	9.00E-01	1.50E-01												
U-234	1.02E+00	2.40E-01												
U-235	2.70E-01	1.10E-01						-6.00E-02	3.10E-01	2.10E-01	3.30E-01	**0.60**	**360**	U
U-238	1.02E+00	2.40E-01												
Total U Alpha	**2.31E+00**	**3.57E-01**												
Alpha Sum	**6.66E+00**	**2.23E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.02E+00	2.40E-01						8.50E-01	9.30E-01	1.52E+00	9.80E-01	**0.50**	**56.5**	
Pa-234m (Assumed from U-238)	1.02E+00	2.40E-01						2.80E+00	8.20E+00	1.20E+01	1.10E+01	**0.67**	**124**	U
K-40	1.89E+01	3.50E+00	1.85E+01	4.20E+00	**0.07**	**2.14**								
Ra-228	8.40E-01	2.10E-01	8.70E-01	3.30E-01	**0.08**	**3.51**								
Pa-231	6.00E-01	2.40E+00	-1.50E+00	1.90E+00	**0.69**	**467**	U							
Beta Sum	**2.19E+01**	**3.53E+00**						**2.35E+01**	**8.97E+00**	**3.27E+01**	**1.18E+01**			
Total Activity Sum	**2.85E+01**	**4.18E+00**						**3.01E+01**	**9.24E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00						**0.18**	**(from gamma)**		**7.15**			
Gross Beta	5.40E+00	1.00E+00					J	**4.48**	**2.00**		**121**			
Total Activity	1.12E+01	4.10E+00					J	**2.96**	**1.87**		**87.2**			

0107027-4			TMF-0106					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.30E-01	4.90E-01					U
Ra-226	9.00E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	1.50E-01												
Th-230	8.50E-01	1.40E-01												
Th-232	8.50E-01	1.40E-01												
U-234	7.80E-01	2.10E-01												
U-235	8.30E-02	6.40E-02					J	2.00E-01	3.10E-01					U
U-238	9.80E-01	2.50E-01												
Total U Alpha	**1.84E+00**	**3.33E-01**												
Alpha Sum	**5.05E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.80E-01	2.50E-01						1.70E-01	9.80E-01					U
Pa-234m (Assumed from U-238)	9.80E-01	2.50E-01						-3.90E+00	8.70E+00					U
K-40	1.83E+01	3.70E+00												
Ra-228	7.80E-01	2.30E-01												
Pa-231	-3.00E-01	2.40E+00					U							
Beta Sum	**2.10E+01**	**3.74E+00**						**1.53E+01**	**9.51E+00**					
Total Activity Sum	**2.61E+01**	**4.34E+00**						**2.04E+01**	**9.77E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.70E+00	1.20E+00						**0.65**	**(from gamma)**		**28.0**			
Gross Beta	5.13E+00	8.30E-01					J	**4.15**	**1.07**		**121**			
Total Activity	1.23E+01	4.00E+00					J	**2.33**	**0.76**		**71.7**			

Revised
TONAWANDA L.F Groundwater Data Summary Tables

0107027-5			TMF-0109					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-01	4.00E-01					U
Ra-226	1.28E+00	4.00E-01	1.01E+00	2.70E-01	**0.56**	**23.6**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	1.80E-01	1.13E+00	1.90E-01	**0.15**	**3.60**								
Th-230	1.01E+00	1.60E-01	9.90E-01	1.60E-01	**0.09**	**2.00**								
Th-232	1.01E+00	1.60E-01	1.07E+00	1.70E-01	**0.26**	**5.77**								
U-234	1.02E+00	2.70E-01												
U-235	1.72E-01	1.00E-01					J	-1.40E-01	5.00E-01					U
U-238	1.06E+00	2.80E-01												
Total U Alpha	**2.25E+00**	**4.02E-01**												
Alpha Sum	**5.20E+00**	**2.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+00	2.80E-01						6.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	1.06E+00	2.80E-01						1.40E+01	1.60E+01					
K-40	1.53E+01	3.60E+00												
Ra-228	7.30E-01	3.20E-01												
Pa-231	-1.60E+00	2.60E+00					U							
Beta Sum	**1.80E+01**	**3.65E+00**						**3.04E+01**	**1.64E+01**					
Total Activity Sum	**2.32E+01**	**4.38E+00**						**3.56E+01**	**1.66E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.00E+00						**0.34**	**(from gamma)**		**15.9**			
Gross Beta	5.30E+00	8.40E-01					J	**3.38**	**1.53**		**109**			
Total Activity	1.19E+01	4.30E+00					J	**1.83**	**1.38**		**64.2**			

0107027-6			TMF-0110					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	3.70E-01					U
Ra-226	8.10E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.01E+00	1.70E-01												
Th-230	8.60E-01	1.50E-01												
Th-232	8.60E-01	1.50E-01												
U-234	8.90E-01	2.30E-01												
U-235	9.50E-02	6.70E-02					J	-1.30E-01	3.40E-01					U
U-238	8.40E-01	2.20E-01												
Total U Alpha	**1.83E+00**	**3.25E-01**												
Alpha Sum	**5.82E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.20E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.40E-01	2.20E-01						2.00E+00	1.10E+01					U
K-40	2.07E+01	4.20E+00												
Ra-228	9.40E-01	2.70E-01												
Pa-231	5.00E-01	1.60E+00					U							
Beta Sum	**2.34E+01**	**4.22E+00**						**2.45E+01**	**1.18E+01**					
Total Activity Sum	**2.92E+01**	**4.49E+00**						**3.03E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.10E+00						**0.20**	**(from gamma)**		**6.41**			
Gross Beta	4.80E+00	9.00E-01					J	**4.30**	**1.66**		**132**			
Total Activity	1.08E+01	4.00E+00					J	**3.06**	**1.55**		**92.0**			

0107027-7			TMF-0113					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.50E-01					U
Ra-226	6.70E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	1.60E-01												
Th-230	9.70E-01	1.50E-01												
Th-232	8.60E-01	1.40E-01												
U-234	9.80E-01	2.70E-01												
U-235	7.10E-02	6.40E-02					J	2.00E-01	5.70E-01					U
U-238	6.50E-01	2.10E-01												
Total U Alpha	**1.70E+00**	**3.48E-01**												
Alpha Sum	**3.26E+00**	**3.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.50E-01	2.10E-01						1.20E+00	1.20E+00					
Pa-234m (Assumed from U-238)	6.50E-01	2.10E-01						7.00E+00	2.30E+01					U
K-40	1.91E+01	5.90E+00												
Ra-228	8.50E-01	6.60E-01												
Pa-231	-2.10E+00	3.60E+00					U							
Beta Sum	**2.10E+01**	**5.96E+00**						**2.79E+01**	**2.38E+01**					
Total Activity Sum	**2.43E+01**	**6.80E+00**						**3.12E+01**	**2.40E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.91E+00	9.80E-01						**0.77**	**(from gamma)**		**57.8**			
Gross Beta	4.95E+00	8.10E-01					J	**2.67**	**0.96**		**124**			
Total Activity	9.30E+00	4.10E+00					J	**1.88**	**0.90**		**89.2**			

0107027-8			TMF-0114					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.40E-02	9.90E-02					U
Ra-226	1.12E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	1.60E-01												
Th-230	9.10E-01	1.50E-01												
Th-232	8.50E-01	1.40E-01												
U-234	7.30E-01	2.10E-01												
U-235	1.12E-01	7.40E-02					J	4.00E-01	3.20E-01					
U-238	8.40E-01	2.30E-01												
Total U Alpha	**1.68E+00**	**3.20E-01**												
Alpha Sum	**2.89E+00**	**1.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.30E-01						5.60E-01	8.00E-01					U
Pa-234m (Assumed from U-238)	5.80E-01	2.30E-01						1.10E+01	1.10E+01					
K-40	1.78E+01	4.00E+00												
Ra-228	7.50E-01	3.00E-01												
Pa-231	-2.90E+00	1.90E+00					U							
Beta Sum	**1.96E+01**	**4.03E+00**						**2.98E+01**	**1.17E+01**					
Total Activity Sum	**2.25E+01**	**4.41E+00**						**3.27E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.10E+00						**1.20**	**(from gamma)**		**60.5**			
Gross Beta	5.01E+00	9.80E-01					J	**3.52**	**2.10**		**119**			
Total Activity	1.09E+01	4.00E+00					J	**1.95**	**1.74**		**69.5**			

0107027-9			TMF-9119					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.20E-01	1.20E-01					U
Ra-226	6.80E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	1.80E-01												
Th-230	9.10E-01	1.60E-01												
Th-232	1.06E+00	1.80E-01												
U-234	8.50E-01	2.40E-01												
U-235	9.20E-02	7.00E-02					J	-8.00E-02	3.90E-01					U
U-238	8.20E-01	2.30E-01												
Total U Alpha	**1.76E+00**	**3.40E-01**												
Alpha Sum	**3.16E+00**	**2.66E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.20E-01	2.30E-01						4.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	8.20E-01	2.30E-01						-7.00E+00	1.70E+01					U
K-40	1.95E+01	5.10E+00												
Ra-228	7.70E-01	4.80E-01												
Pa-231	-2.50E+00	2.90E+00					U							
Beta Sum	**2.16E+01**	**5.14E+00**						**1.34E+01**	**1.78E+01**					
Total Activity Sum	**2.48E+01**	**5.79E+00**						**1.65E+01**	**1.80E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.02E+00	9.90E-01						**1.01**	**(from gamma)**		**62.3**			
Gross Beta	5.06E+00	8.10E-01					J	**3.18**	**0.47**		**124**			
Total Activity	1.08E+01	4.20E+00					J	**1.95**	**0.31**		**78.6**			

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-10			TMF-9120					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	1.20E-01					U
Ra-226	1.12E+00	3.20E-01	1.04E+00	2.50E-01	**0.20**	**7.41**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.80E-01												
Th-230	8.40E-01	1.50E-01												
Th-232	1.04E+00	1.80E-01												
U-234	7.60E-01	2.10E-01												
U-235	7.10E-02	5.60E-02					J	-1.10E-01	2.60E-01					U
U-238	8.00E-01	2.10E-01												
Total U Alpha	**1.63E+00**	**3.02E-01**												
Alpha Sum	**4.42E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.10E-01						6.90E-01	9.00E-01					U
Pa-234m (Assumed from U-238)	8.00E-01	2.10E-01						-2.00E+00	9.60E+00					U
K-40	1.73E+01	3.70E+00												
Ra-228	7.30E-01	2.50E-01												
Pa-231	-1.30E+00	1.60E+00					U							
Beta Sum	**1.95E+01**	**3.73E+00**						**1.66E+01**	**1.03E+01**					
Total Activity Sum	**2.39E+01**	**4.03E+00**						**2.10E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.10E+00						**0.62**	**(from gamma)**		**23.5**			
Gross Beta	4.38E+00	8.70E-01					J	**3.95**	**1.18**		**127**			
Total Activity	9.20E+00	3.90E+00					J	**2.62**	**1.06**		**88.8**			

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-11			TMF-0123					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								3.00E-02	3.10E-01					U
Ra-226	9.30E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.11E+00	1.80E-01												
Th-230	1.00E+00	1.60E-01												
Th-232	9.60E-01	1.60E-01												
U-234	1.01E+00	2.70E-01												
U-235	2.10E-01	1.10E-01					J	-2.90E-01	3.30E-01					U
U-238	8.80E-01	2.40E-01												
Total U Alpha	**2.10E+00**	**3.78E-01**												
Alpha Sum	**5.02E+00**	**1.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	2.71E-01	8.50E-02												
Th-234 (Assumed from U-238)	8.80E-01	2.40E-01						1.30E+00	1.10E+00					
Pa-234m (Assumed from U-238)	8.80E-01	2.40E-01						3.00E-01	9.60E+00					U
K-40	1.79E+01	3.40E+00												
Ra-228	7.40E-01	2.10E-01												
Pa-231	-1.20E+00	1.50E+00					U							
Beta Sum	**2.05E+01**	**3.43E+00**						**2.04E+01**	**1.02E+01**					
Total Activity Sum	**2.55E+01**	**3.73E+00**						**2.54E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.00E+00						**0.55**	**(from gamma)**		**17.8**			
Gross Beta	5.74E+00	9.30E-01					J	**4.16**	**1.42**		**113**			
Total Activity	1.49E+01	4.60E+00					J	**1.80**	**0.93**		**52.6**			

0107027-12			TMF-0124					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.10E-01	5.20E-01					U
Ra-226	8.20E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	1.70E-01												
Th-230	7.30E-01	1.30E-01												
Th-232	8.60E-01	1.50E-01												
U-234	6.40E-01	1.90E-01												
U-235	5.70E-02	5.20E-02					J	2.80E-01	3.40E-01					U
U-238	8.00E-01	2.20E-01												
Total U Alpha	**1.50E+00**	**2.95E-01**												
Alpha Sum	**3.57E+00**	**1.77E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.20E-01						7.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.00E-01	2.20E-01						-2.00E+00	1.30E+01					U
K-40	1.72E+01	3.80E+00												
Ra-228	7.10E-01	3.10E-01												
Pa-231	-1.40E+00	1.90E+00					U							
Beta Sum	**1.93E+01**	**3.83E+00**						**1.64E+01**	**1.36E+01**					
Total Activity Sum	**2.29E+01**	**4.22E+00**						**2.00E+01**	**1.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**1.14**	**(from gamma)**		**50.9**			
Gross Beta	3.75E+00	8.70E-01					J	**3.97**	**0.93**		**135**			
Total Activity	8.30E+00	3.90E+00					J	**2.54**	**0.82**		**93.6**			

Revised

TONAWANDA L.F Groundwater Data Summary Tables

0107027-13			TMF-0125					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.20E-01					U
Ra-226	8.60E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	1.50E-01												
Th-230	9.10E-01	1.50E-01												
Th-232	8.50E-01	1.40E-01												
U-234	9.60E-01	2.40E-01												
U-235	1.02E-01	6.80E-02					J	1.90E-01	3.10E-01					U
U-238	9.60E-01	2.40E-01												
Total U Alpha	**2.02E+00**	**3.46E-01**												
Alpha Sum	**4.07E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	3.70E-01	1.30E-01												
Th-234 (Assumed from U-238)	9.60E-01	2.40E-01						1.40E+00	1.10E+00					
Pa-234m (Assumed from U-238)	9.60E-01	2.40E-01						1.00E+00	1.20E+01					U
K-40	1.27E+01	3.10E+00												
Ra-228	8.30E-01	2.90E-01												
Pa-231	-1.60E+00	2.10E+00					U							
Beta Sum	**1.56E+01**	**3.14E+00**						**1.61E+01**	**1.24E+01**					
Total Activity Sum	**1.97E+01**	**3.70E+00**						**2.02E+01**	**1.26E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.38E+00	7.50E-01						**0.15**	**(from gamma)**		**7.29**			
Gross Beta	3.58E+00	6.30E-01					J	**3.76**	**1.01**		**125**			
Total Activity	8.10E+00	4.30E+00					J	**2.04**	**0.91**		**83.5**			

0107027-14			TMF-0126					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	4.90E-01					U
Ra-226	7.40E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	1.80E-01												
Th-230	7.70E-01	1.50E-01												
Th-232	8.30E-01	1.50E-01												
U-234	7.90E-01	2.10E-01												
U-235	1.80E-01	9.00E-02					J	2.40E-01	3.20E-01					U
U-238	6.30E-01	1.80E-01												
Total U Alpha	**1.60E+00**	**2.91E-01**												
Alpha Sum	**5.79E+00**	**1.77E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.30E-01	1.80E-01						-6.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	6.30E-01	1.80E-01						1.00E+00	1.30E+01					U
K-40	1.36E+01	3.20E+00												
Ra-228	6.90E-01	2.70E-01												
Pa-231	1.00E+00	1.90E+00					U							
Beta Sum	**1.57E+01**	**3.23E+00**						**1.48E+01**	**1.34E+01**					
Total Activity Sum	**2.15E+01**	**3.68E+00**						**2.06E+01**	**1.36E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.10E+00						**0.38**	**(from gamma)**		**14.6**			
Gross Beta	5.13E+00	9.60E-01					J	**3.13**	**0.72**		**101**			
Total Activity	9.80E+00	3.90E+00					J	**2.17**	**0.77**		**74.6**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107028

This sample delivery group (SDG) contained twenty (20) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 6, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-9043	0107028-1
TMF-9044	0107028-2
TMF-0059	0107028-3
TMF-0060	0107028-4
TMF-0051	0107028-5
TMF-0052	0107028-6
TMF-0065	0107028-7
TMF-0066	0107028-8
TMF-0063	0107028-9
TMF-0064	0107028-10
TMF-0103	0107028-11
TMF-0104	0107028-12
TMF-0083	0107028-13
TMF-0084	0107028-14
TMF-0081	0107028-15
TMF-0082	0107028-16
TMF-9087	0107028-17
TMF-9088	0107028-18
TMF-0077	0107028-19
TMF-0078	0107028-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was observed in the EQ-1 and EQ-2 equipment rinsate blanks. ^{137}Cs activity was observed in the equipment rinsate blank EQ-1, but it was not observed in all samples. However, ^{137}Cs activity was reported by the laboratory in three samples TMF–9043, TMF-0059 and TMF-0083 as the ^{137}Cs activity in those samples was higher than the required DL (1.65*TPU). All associated samples results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). The ^{137}Cs activity values observed in these samples are greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification of Cs-137 results for these samples is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

All target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am) plus ^{40}K were reported for all samples. The result for the fission product ^{137}Cs activity was also reported for samples TMF-9043, TMF-0059 and TMF-0083 as the ^{137}Cs activity in those samples was higher than the required DL (1.65*TPU). There were no incidents of identified radionuclides being excluded from the laboratory reports.

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for ^{241}Am result for sample TMF-0060 (-4.20E-01±3.00E-01), ^{231}Pa result for samples TMF-0060 (-1.90±1.60), TMF-0103 (–2.30±2.10) and TMF-0083 (–3.6±3.10). **Therefore, it is recommended that the ^{241}Am result for TMF-0060 and ^{231}Pa results for samples TMF-0060, TMF-0103 and TMF-0083 be qualified as estimated (J).** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination for $^{224/235/238}$U and $^{228/230/232}$Th in the method blank.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses. No qualification is required.

Sample-Specific Chemical Recovery:

The tracer recoveries are within acceptable limit. The tracer recoveries were greater than 29.06% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results of $^{224/235/238}U$ and $^{228/230/232}Th$ for all samples have less than 10% uncertainty. No qualification is necessary.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for $^{224/235/238}U$ and $^{228/230/232}Th$ analysis.

Method Detection Limit and Quantitaion:

All samples met the required method detection limit (MDL) of 1.0 pCi/g for $^{224/235/238}U$ and $^{228/230/232}Th$.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination in the method blank sample for ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analysis were within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all ^{226}Ra analysis. No qualification is required.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit and Quantitaion:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses. Therefore, no qualification is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis by liquid scintillation counting.

Duplicate Analysis:

The total activity analysis duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC. **It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.**

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities are within acceptable limits for all samples except TMF-0060 and TMF-0083 indicating that the gross alpha analyses for all with the exception of samples TMF-0060 and TMF-0083 agree with the sum of the alpha emitters within a 99% confidence level. The DERs for samples TMF-0060 (1.63) and TMF-0083 (1.71) are outside the acceptable limits as well as the RPD values (68%) and (102%) respectively. The gross alpha result for samples TMF-0060 and TMF-0083 were greater than sum of the alpha

emitters by a factor of approximately 3. This may be due to heterogeneity or missing activity as analyzed for by individual analysis. **Therefore, it is recommended that the gross alpha results for samples TMF-0060 and TMF-0083 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.89 – 4.86) for all samples the sums of the beta emitters activity and gross beta activity are outside the acceptable limits as well as the RPD values (106% - 135%). The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the total activity sum i.e., the sums of the beta emitters and the sum of alpha, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (1.95 – 3.15) for all samples are out side the acceptable limits as well as the RPD values (71.1%-121.1%). This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

Revised
Tonawanda Data Summary Tables

0107028-1			TMF-9043					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.00E-02	3.80E-01	1.10E-01	1.30E-01	**0.30**	**240**	U
Ra-226	9.00E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	1.70E-01	1.01E+00	1.80E-01	**0.04**	**1.00**								
Th-230	9.80E-01	1.70E-01	9.30E-01	1.60E-01	**0.21**	**5.24**								
Th-232	9.50E-01	1.70E-01	8.90E-01	1.60E-01	**0.26**	**6.52**								
U-234	7.80E-01	2.00E-01												
U-235	2.80E-02	3.40E-02					U	4.20E-01	4.50E-01	1.70E-01	4.50E-01	**0.39**	**84.7**	
U-238	9.90E-01	2.40E-01												
Total U Alpha	**1.80E+00**	**3.14E-01**												
Alpha Sum	**4.73E+00**	**3.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	1.60E-01	1.10E-01												
Th-234 (Assumed from U-238)	9.90E-01	2.40E-01						2.00E-01	1.20E+00	-1.00E+00	1.00E+00	**0.77**	**300**	U
Pa-234m (Assumed from U-238)	9.90E-01	2.40E-01						4.00E+00	1.40E+01	2.60E+01	2.40E+01	**0.79**	**147**	U
K-40	2.22E+01	4.50E+00	1.54E+01	4.60E+00	**1.06**	**36.2**								
Ra-228	8.10E-01	3.70E-01	9.50E-01	5.40E-01	**0.21**	**15.9**								
Pa-231	-1.00E+00	3.60E+00	-8.00E-01	2.90E+00	**0.04**	**22.2**	U							
Beta Sum	**2.50E+01**	**4.55E+00**						**2.73E+01**	**1.48E+01**	**4.13E+01**	**2.45E+01**			
Total Activity Sum	**2.98E+01**	**5.61E+00**						**3.20E+01**	**1.51E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.30E+00	1.50E+00						**0.99**	**(from gamma)**		**54.8**			
Gross Beta	7.70E+00	1.30E+00					J	**3.66**	**1.32**		**106**			
Total Activity	1.21E+01	4.10E+00					J	**2.54**	**1.27**		**84.4**			

Revised
Tonawanda Data Summary Tables

0107028-2			TMF-9044					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.50E-01	5.00E-01	-5.00E-02	2.50E-01	**0.18**	**100.0**	U
Ra-226	1.33E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	1.60E-01												
Th-230	8.20E-01	1.40E-01												
Th-232	9.30E-01	1.60E-01												
U-234	6.40E-01	1.80E-01	6.10E-01	1.70E-01	**0.12**	**4.80**								
U-235	6.00E-02	5.00E-02	7.80E-02	5.60E-02	**0.24**	**26.1**		2.80E-01	3.20E-01	-2.40E-01	2.80E-01	**1.22**	**2600**	
U-238	6.60E-01	1.80E-01	7.00E-01	1.90E-01	**0.15**	**5.88**								
Total U Alpha	**1.36E+00**	**2.59E-01**	**1.39E+00**	**2.61E-01**										
Alpha Sum	**5.92E+00**	**1.53E+00**	**2.11E+00**	**1.29E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.60E-01	1.80E-01	7.00E-01	1.90E-01	**0.15**	**5.88**		1.30E+00	1.40E+00	7.80E-01	8.50E-01	**0.32**	**50.0**	
Pa-234m (Assumed from U-238)	6.60E-01	1.80E-01	7.00E-01	1.90E-01	**0.15**	**5.88**		-8.00E-01	8.00E+00	-1.00E+00	7.10E+00	**0.02**	**22.2**	U
K-40	1.86E+01	3.80E+00	1.91E+01	3.50E+00	**0.10**	**2.65**								
Ra-228	6.30E-01	2.20E-01	5.90E-01	1.70E-01	**0.14**	**6.56**								
Pa-231	6.00E-01	1.60E+00	8.00E-01	1.40E+00	**0.09**	**28.6**	U							
Beta Sum	**2.06E+01**	**3.82E+00**	**2.12E+01**	**3.52E+00**				**1.98E+01**	**8.97E+00**	**1.96E+01**	**7.96E+00**			
Total Activity Sum	**2.65E+01**	**4.11E+00**	**2.33E+01**	**3.75E+00**				**2.57E+01**	**9.10E+00**	**2.17E+01**	**8.07E+00**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.30E+00						**0.01**	**(from gamma)**		**0.34**			
Gross Beta	5.00E+00	1.00E+00					J	**3.96**	**1.64**		**122**			
Total Activity	1.00E+01	3.90E+00					J	**2.92**	**1.59**		**90.5**			

Revised
Tonawanda Data Summary Tables

0107028-3			TMF-0059					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	2.70E-01					U
Ra-226	1.20E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	1.50E-01												
Th-230	7.30E-01	1.40E-01												
Th-232	6.50E-01	1.30E-01												
U-234	8.40E-01	2.20E-01												
U-235	2.90E-02	3.60E-02					U	3.00E-02	2.90E-01					U
U-238	7.50E-01	2.00E-01												
Total U Alpha	**1.62E+00**	**2.99E-01**												
Alpha Sum	**5.44E+00**	**1.43E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	6.50E-02	4.50E-02												
Th-234 (Assumed from U-238)	7.50E-01	2.00E-01						5.50E-01	7.90E-01					U
Pa-234m (Assumed from U-238)	7.50E-01	2.00E-01						0.00E+00	7.80E+00					U
K-40	1.93E+01	3.50E+00												
Ra-228	7.70E-01	1.90E-01												
Pa-231	6.00E-01	1.50E+00					U							
Beta Sum	**2.17E+01**	**3.52E+00**						**2.08E+01**	**8.59E+00**					
Total Activity Sum	**2.71E+01**	**3.80E+00**						**2.62E+01**	**8.71E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.20E+00						**0.57**	**(from gamma)**		**17.8**			
Gross Beta	6.30E+00	1.10E+00					J	**4.18**	**1.67**		**110**			
Total Activity	1.27E+01	4.10E+00					J	**2.58**	**1.40**		**72.5**			

Revised
Tonawanda Data Summary Tables

0107028-4			TMF-0060					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.20E-01	3.00E-01					UJ
Ra-226	8.10E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	1.40E-01												
Th-230	7.90E-01	1.40E-01												
Th-232	7.40E-01	1.30E-01												
U-234	7.10E-01	1.90E-01												
U-235	1.02E-01	6.50E-02						1.70E-01	3.00E-01					U
U-238	7.40E-01	2.00E-01												
Total U Alpha	**1.55E+00**	**2.83E-01**												
Alpha Sum	**2.96E+00**	**1.51E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.00E-01						-2.40E-01	7.60E-01					U
Pa-234m (Assumed from U-238)	7.40E-01	2.00E-01						1.90E+00	1.00E+01					U
K-40	1.71E+01	3.50E+00												
Ra-228	7.60E-01	2.50E-01												
Pa-231	-1.90E+00	1.60E+00					UJ							
Beta Sum	**1.91E+01**	**3.53E+00**						**1.93E+01**	**1.06E+01**					
Total Activity Sum	**2.21E+01**	**3.84E+00**						**2.23E+01**	**1.07E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.10E+00					J	**1.63**	**(from gamma)**		**67.8**			
Gross Beta	5.17E+00	9.70E-01					J	**3.81**	**1.32**		**115**			
Total Activity	1.05E+01	3.90E+00					J	**2.12**	**1.03**		**71.1**			

Revised
Tonawanda Data Summary Tables

0107028-5			TMF-0051					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								5.20E-02	8.50E-02					U
Ra-226	9.60E-01	2.50E-01	7.70E-01	2.10E-01	**0.58**	**22.0**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	1.40E-01	9.00E-01	1.50E-01	**0.63**	**15.6**								
Th-230	7.70E-01	1.30E-01	8.30E-01	1.40E-01	**0.31**	**7.50**								
Th-232	8.00E-01	1.30E-01	8.30E-01	1.40E-01	**0.16**	**3.68**								
U-234	8.50E-01	2.20E-01												
U-235	5.10E-02	4.60E-02						1.60E-01	2.50E-01					U
U-238	8.30E-01	2.20E-01												
Total U Alpha	**1.73E+00**	**3.15E-01**												
Alpha Sum	**5.84E+00**	**1.51E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.20E-01						7.70E-01	6.10E-01					
Pa-234m (Assumed from U-238)	8.30E-01	2.20E-01						1.10E+00	8.80E+00					U
K-40	1.55E+01	3.50E+00												
Ra-228	6.70E-01	2.30E-01												
Pa-231	9.00E-01	1.60E+00					U							
Beta Sum	**1.79E+01**	**3.53E+00**						**1.81E+01**	**9.49E+00**					
Total Activity Sum	**2.38E+01**	**3.84E+00**						**2.40E+01**	**9.61E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+00	1.10E+00	5.90E+00	1.10E+00	**0.26**	**7.02**		**0.18**	**(from gamma)**		**6.01**			
Gross Beta	5.45E+00	1.00E+00	4.45E+00	9.10E-01	**0.74**	**20.2**	J	**3.41**	**1.33**		**107**			
Total Activity	9.60E+00	3.90E+00					J	**2.59**	**1.39**		**85.0**			

Revised
Tonawanda Data Summary Tables

0107028-6			TMF-0052					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	5.20E-01					U
Ra-226	9.20E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.50E-01												
Th-230	8.30E-01	1.40E-01												
Th-232	8.10E-01	1.40E-01												
U-234	7.50E-01	2.20E-01	9.40E-01	2.60E-01	**0.56**	**22.5**								
U-235	9.10E-02	6.90E-02	1.08E-01	7.70E-02	**0.16**	**17.1**		-3.00E-02	3.10E-01					U
U-238	6.40E-01	2.00E-01	8.60E-01	2.40E-01	**0.70**	**29.3**								
Total U Alpha	**1.48E+00**	**3.05E-01**	**1.91E+00**	**3.62E-01**										
Alpha Sum	**4.57E+00**	**1.60E+00**	**1.91E+00**	**3.62E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.40E-01	2.00E-01	8.60E-01	2.40E-01	**0.70**	**29.3**		7.70E-01	9.20E-01					
Pa-234m (Assumed from U-238)	6.40E-01	2.00E-01	8.60E-01	2.40E-01	**0.70**	**29.3**		-5.00E+00	1.20E+01					U
K-40	1.73E+01	3.70E+00												
Ra-228	9.40E-01	3.00E-01												
Pa-231	-3.00E-01	1.70E+00					U							
Beta Sum	**1.95E+01**	**3.73E+00**	**1.72E+00**	**3.39E-01**				**1.40E+01**	**1.26E+01**					
Total Activity Sum	**2.41E+01**	**4.06E+00**	**3.63E+00**	**4.96E-01**				**1.85E+01**	**1.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.66E+00	9.90E-01						**0.05**	**(from gamma)**		**1.93**			
Gross Beta	4.11E+00	8.80E-01					J	**4.01**	**0.78**		**130**			
Total Activity	9.40E+00	3.90E+00					J	**2.60**	**0.69**		**87.6**			

Revised
Tonawanda Data Summary Tables

0107028-7			TMF-0065					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.00E-02	3.20E-01					U
Ra-226	6.40E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	1.60E-01												
Th-230	8.20E-01	1.40E-01												
Th-232	7.70E-01	1.40E-01												
U-234	9.10E-01	2.30E-01												
U-235	1.51E-01	8.30E-02						0.00E+00	3.00E-01					U
U-238	8.90E-01	2.30E-01												
Total U Alpha	**1.95E+00**	**3.36E-01**												
Alpha Sum	**4.87E+00**	**1.77E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.30E-01						7.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.90E-01	2.30E-01						-3.60E+00	8.60E+00					U
K-40	1.74E+01	3.60E+00												
Ra-228	6.80E-01	2.30E-01												
Pa-231	-2.00E-01	1.90E+00					U							
Beta Sum	**1.98E+01**	**3.63E+00**						**1.52E+01**	**9.39E+00**					
Total Activity Sum	**2.47E+01**	**4.04E+00**						**2.00E+01**	**9.56E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.40E+00	1.20E+00						**0.71**	**(from gamma)**		**27.1**			
Gross Beta	5.01E+00	9.30E-01					J	**3.96**	**1.07**		**119**			
Total Activity	8.40E+00	3.90E+00					J	**2.90**	**1.13**		**98.5**			

Revised
Tonawanda Data Summary Tables

0107028-8			TMF-0066					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								2.00E-02	3.30E-01					U
Ra-226	7.10E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.70E-01												
Th-230	9.20E-01	1.60E-01												
Th-232	8.20E-01	1.50E-01												
U-234	8.20E-01	2.20E-01												
U-235	6.60E-02	5.70E-02						1.20E-01	3.80E-01					U
U-238	8.80E-01	2.30E-01												
Total U Alpha	**1.77E+00**	**3.23E-01**												
Alpha Sum	**4.36E+00**	**2.12E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.80E-01	2.30E-01						3.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.80E-01	2.30E-01						2.00E+00	1.40E+01					U
K-40	1.88E+01	3.90E+00												
Ra-228	6.40E-01	2.90E-01												
Pa-231	-8.00E-01	2.30E+00					U							
Beta Sum	**2.11E+01**	**3.93E+00**						**2.16E+01**	**1.46E+01**					
Total Activity Sum	**2.55E+01**	**4.47E+00**						**2.60E+01**	**1.47E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.76E+00	8.90E-01						**0.18**	**(from gamma)**		**8.86**			
Gross Beta	4.71E+00	7.80E-01					J	**4.09**	**1.16**		**127**			
Total Activity	8.30E+00	3.90E+00					J	**2.89**	**1.16**		**102**			

Revised
Tonawanda Data Summary Tables

0107028-9			TMF-0063					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.40E-01					U
Ra-226	1.10E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.29E+00	2.10E-01												
Th-230	1.10E+00	1.80E-01												
Th-232	1.24E+00	2.00E-01												
U-234	1.17E+00	3.00E-01												
U-235	2.80E-02	4.00E-02					U	3.10E-01	4.60E-01					U
U-238	1.03E+00	2.80E-01												
Total U Alpha	**2.23E+00**	**4.12E-01**												
Alpha Sum	**4.35E+00**	**3.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.03E+00	2.80E-01						6.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	1.03E+00	2.80E-01						0.00E+00	2.40E+01					U
K-40	2.18E+01	6.00E+00												
Ra-228	1.03E+00	4.90E-01												
Pa-231	-2.90E+00	3.50E+00					U							
Beta Sum	**2.45E+01**	**6.05E+00**						**2.31E+01**	**2.48E+01**					
Total Activity Sum	**2.89E+01**	**6.84E+00**						**2.74E+01**	**2.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.10E+00						**0.63**	**(from gamma)**		**39.7**			
Gross Beta	6.41E+00	1.00E+00					J	**2.96**	**0.67**		**117**			
Total Activity	7.10E+00	4.10E+00					J	**2.73**	**0.80**		**121**			

Revised
Tonawanda Data Summary Tables

0107028-10			TMF-0064					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-3.00E-02	1.10E-01					U
Ra-226	8.80E-01	2.20E-01	7.80E-01	2.80E-01	**0.28**	**12.0**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	1.50E-01												
Th-230	8.10E-01	1.40E-01												
Th-232	8.00E-01	1.40E-01												
U-234	8.20E-01	2.20E-01												
U-235	7.80E-02	5.90E-02						7.00E-02	3.90E-01					U
U-238	1.04E+00	2.60E-01												
Total U Alpha	**1.94E+00**	**3.46E-01**												
Alpha Sum	**3.66E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.04E+00	2.60E-01						3.80E-01	9.50E-01					U
Pa-234m (Assumed from U-238)	1.04E+00	2.60E-01						0.00E+00	1.50E+01					U
K-40	2.29E+01	5.60E+00												
Ra-228	1.12E+00	5.20E-01												
Pa-231	-1.70E+00	2.40E+00					U							
Beta Sum	**2.59E+01**	**5.64E+00**						**2.42E+01**	**1.61E+01**					
Total Activity Sum	**2.96E+01**	**6.06E+00**						**2.79E+01**	**1.62E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.10E+00	5.10E+00	1.20E+00	**0.18**	**5.71**		**0.71**	**(from gamma)**		**38.5**			
Gross Beta	5.00E+00	1.00E+00	5.40E+00	1.00E+00	**0.28**	**7.69**	J	**3.65**	**1.19**		**135**			
Total Activity	1.25E+01	4.00E+00					J	**2.35**	**0.92**		**81.1**			

Revised
Tonawanda Data Summary Tables

0107028-11			TMF-0103					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.30E-01	3.10E-01					U
Ra-226	7.80E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.60E-01												
Th-230	7.60E-01	1.40E-01												
Th-232	8.30E-01	1.50E-01												
U-234	6.90E-01	2.00E-01												
U-235	5.00E-03	2.40E-02					U	-2.30E-01	3.70E-01					U
U-238	7.60E-01	2.10E-01												
Total U Alpha	**1.46E+00**	**2.91E-01**												
Alpha Sum	**2.66E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.60E-01	2.10E-01						2.10E-01	9.10E-01					U
Pa-234m (Assumed from U-238)	7.60E-01	2.10E-01						9.00E+00	1.20E+01					U
K-40	1.90E+01	3.80E+00												
Ra-228	7.30E-01	2.50E-01												
Pa-231	-2.30E+00	2.10E+00					UJ							
Beta Sum	**2.10E+01**	**3.83E+00**						**2.87E+01**	**1.26E+01**					
Total Activity Sum	**2.36E+01**	**4.30E+00**						**3.13E+01**	**1.28E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.32E+00	9.90E-01						**1.22**	**(from gamma)**		**66.8**			
Gross Beta	4.98E+00	8.30E-01					J	**4.08**	**1.87**		**123**			
Total Activity	7.90E+00	3.90E+00					J	**2.71**	**1.75**		**99.8**			

Revised
Tonawanda Data Summary Tables

0107028-12			TMF-0104					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								1.00E-02	1.10E-01					U
Ra-226	1.16E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.23E+00	2.10E-01												
Th-230	1.21E+00	2.00E-01												
Th-232	1.15E+00	1.90E-01												
U-234	7.30E-01	2.10E-01												
U-235	5.30E-02	5.50E-02						2.00E-02	3.80E-01					U
U-238	1.02E+00	2.60E-01												
Total U Alpha	**1.80E+00**	**3.39E-01**												
Alpha Sum	**4.93E+00**	**2.67E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.02E+00	2.60E-01						1.10E+00	1.20E+00					
Pa-234m (Assumed from U-238)	1.02E+00	2.60E-01						3.00E+00	2.00E+01					U
K-40	2.10E+01	5.80E+00												
Ra-228	1.14E+00	5.30E-01												
Pa-231	-1.80E+00	2.90E+00					U							
Beta Sum	**2.40E+01**	**5.85E+00**						**2.60E+01**	**2.09E+01**					
Total Activity Sum	**2.89E+01**	**6.43E+00**						**3.10E+01**	**2.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.10E+00	1.20E+00						**0.74**	**(from gamma)**		**36.0**			
Gross Beta	5.59E+00	8.80E-01					J	**3.11**	**0.98**		**124**			
Total Activity	8.20E+00	3.90E+00					J	**2.75**	**1.06**		**112**			

Revised
Tonawanda Data Summary Tables

0107028-13			TMF-0083					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								7.00E-02	1.30E-01					U
Ra-226	7.00E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.20E+00	2.20E-01												
Th-230	1.23E+00	2.20E-01												
Th-232	1.09E+00	2.00E-01												
U-234	7.40E-01	2.00E-01												
U-235	2.90E-02	3.70E-02					U	-1.60E-01	4.40E-01					U
U-238	8.20E-01	2.20E-01												
Total U Alpha	**1.59E+00**	**3.00E-01**												
Alpha Sum	**2.57E+00**	**2.84E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	2.60E-01	1.40E-01												
Th-234 (Assumed from U-238)	8.20E-01	2.20E-01						8.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	8.20E-01	2.20E-01						1.20E+01	2.30E+01					U
K-40	2.18E+01	5.70E+00												
Ra-228	7.80E-01	5.30E-01												
Pa-231	-3.60E+00	3.10E+00					UJ							
Beta Sum	**2.40E+01**	**5.75E+00**						**3.52E+01**	**2.37E+01**					
Total Activity Sum	**2.66E+01**	**6.41E+00**						**3.78E+01**	**2.39E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.90E+00	1.30E+00					J	**1.71**	**(from gamma)**		**102**			
Gross Beta	6.50E+00	1.00E+00					J	**3.01**	**1.21**		**115**			
Total Activity	1.18E+01	4.10E+00					J	**1.95**	**1.07**		**77.1**			

Revised
Tonawanda Data Summary Tables

0107028-14			TMF-0084					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-1.90E-01	3.30E-01					U
Ra-226	2.40E-01	1.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.60E-01												
Th-230	8.60E-01	1.50E-01												
Th-232	9.00E-01	1.60E-01												
U-234	7.00E-01	1.90E-01												
U-235	4.80E-02	4.40E-02						-6.00E-02	3.80E-01					U
U-238	8.40E-01	2.10E-01												
Total U Alpha	**1.59E+00**	**2.87E-01**												
Alpha Sum	**4.40E+00**	**2.02E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.10E-01						-3.00E-02	8.60E-01					U
Pa-234m (Assumed from U-238)	8.40E-01	2.10E-01						-1.70E+01	1.40E+01					U
K-40	2.14E+01	4.30E+00												
Ra-228	6.00E-01	2.40E-01												
Pa-231	-1.00E-01	2.20E+00					U							
Beta Sum	**2.37E+01**	**4.32E+00**						**4.96E+00**	**1.47E+01**					
Total Activity Sum	**2.81E+01**	**4.78E+00**						**9.36E+00**	**1.48E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.20E+00						**0.60**	**(from gamma)**		**27.5**			
Gross Beta	4.79E+00	9.50E-01					J	**4.26**	**0.01**		**133**			
Total Activity	9.00E+00	3.90E+00					J	**3.09**	**0.02**		**103**			

Revised
Tonawanda Data Summary Tables

0107028-15			TMF-0081					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-7.00E-02	1.30E-01	9.00E-02	1.40E-01	**0.84**	**1600**	U
Ra-226	1.23E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	1.80E-01												
Th-230	9.30E-01	1.60E-01												
Th-232	8.60E-01	1.50E-01												
U-234	7.50E-01	2.10E-01												
U-235	5.60E-02	5.30E-02						3.30E-01	4.70E-01	1.70E-01	4.10E-01	**0.26**	**64.0**	U
U-238	8.10E-01	2.20E-01												
Total U Alpha	**1.62E+00**	**3.09E-01**												
Alpha Sum	**6.56E+00**	**2.92E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E-01	2.20E-01						1.00E+00	1.00E+00	7.00E-01	1.10E+00	**0.20**	**35.3**	
Pa-234m (Assumed from U-238)	8.10E-01	2.20E-01						1.50E+01	2.30E+01	-2.00E+00	1.90E+01	**0.57**	**262**	U
K-40	1.97E+01	5.60E+00	1.85E+01	4.90E+00	**0.16**	**6.28**								
Ra-228	8.30E-01	6.10E-01	8.20E-01	4.30E-01	**0.01**	**1.21**								
Pa-231	1.00E+00	3.20E+00	6.00E-01	3.00E+00	**0.09**	**50.0**	U							
Beta Sum	**2.23E+01**	**5.65E+00**						**3.67E+01**	**2.37E+01**	**1.81E+01**	**1.97E+01**			
Total Activity Sum	**2.88E+01**	**6.37E+00**						**4.32E+01**	**2.39E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.40E+00	1.30E+00						**0.26**	**(from gamma)**		**12.1**			
Gross Beta	5.72E+00	9.20E-01					J	**2.89**	**1.30**		**118**			
Total Activity	1.03E+01	4.00E+00					J	**2.46**	**1.36**		**94.7**			

0107028-16			TMF-0082					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.30E-01	3.30E-01					U
Ra-226	1.08E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	1.60E-01												
Th-230	8.50E-01	1.50E-01												
Th-232	8.20E-01	1.50E-01												
U-234	7.30E-01	2.10E-01												
U-235	6.90E-02	5.70E-02						0.00E+00	4.00E-01					U
U-238	6.10E-01	1.90E-01												
Total U Alpha	**1.41E+00**	**2.89E-01**												
Alpha Sum	**3.73E+00**	**2.12E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.10E-01	1.90E-01						4.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	6.10E-01	1.90E-01						1.00E+00	1.50E+01					U
K-40	1.87E+01	3.90E+00												
Ra-228	6.70E-01	2.80E-01												
Pa-231	-1.40E+00	2.30E+00					U							
Beta Sum	**2.04E+01**	**3.93E+00**						**2.06E+01**	**1.55E+01**					
Total Activity Sum	**2.42E+01**	**4.47E+00**						**2.43E+01**	**1.57E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.00E+00						**0.63**	**(from gamma)**		**32.9**			
Gross Beta	4.92E+00	9.20E-01					J	**3.84**	**1.01**		**122**			
Total Activity	8.90E+00	3.90E+00					J	**2.57**	**0.96**		**92.3**			

0107028-17			TMF-9087					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.10E-01					U
Ra-226	1.05E+00	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.60E-01												
Th-230	9.20E-01	1.50E-01												
Th-232	9.30E-01	1.50E-01												
U-234	8.50E-01	2.20E-01												
U-235	1.17E-01	7.20E-02						7.00E-02	4.30E-01					U
U-238	9.70E-01	2.40E-01												
Total U Alpha	**1.94E+00**	**3.33E-01**												
Alpha Sum	**5.36E+00**	**2.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.70E-01	2.40E-01						2.20E-01	8.50E-01					U
Pa-234m (Assumed from U-238)	9.70E-01	2.40E-01						0.00E+00	2.30E+01					U
K-40	2.06E+01	5.60E+00												
Ra-228	4.80E-01	5.80E-01												
Pa-231	-5.00E-01	2.80E+00					U							
Beta Sum	**2.30E+01**	**5.65E+00**						**2.12E+01**	**2.37E+01**					
Total Activity Sum	**2.83E+01**	**6.21E+00**						**2.66E+01**	**2.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.50E+00	1.30E+00						**0.74**	**(from gamma)**		**33.3**			
Gross Beta	5.23E+00	8.50E-01					J	**3.10**	**0.68**		**126**			
Total Activity	1.00E+01	4.00E+00					J	**2.48**	**0.69**		**95.6**			

0107028-18			TMF-9088					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.20E-01					U
Ra-226	9.20E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.80E-01												
Th-230	8.80E-01	1.60E-01												
Th-232	8.30E-01	1.50E-01												
U-234	6.30E-01	1.90E-01												
U-235	7.50E-02	6.00E-02						6.00E-02	3.80E-01					U
U-238	7.20E-01	2.00E-01												
Total U Alpha	**1.43E+00**	**2.82E-01**												
Alpha Sum	**3.49E+00**	**2.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.00E-01						4.30E-01	8.60E-01					U
Pa-234m (Assumed from U-238)	7.20E-01	2.00E-01						6.00E+00	1.90E+01					U
K-40	1.99E+01	4.90E+00												
Ra-228	9.70E-01	3.80E-01												
Pa-231	-1.70E+00	2.50E+00					U							
Beta Sum	**2.21E+01**	**4.93E+00**						**2.71E+01**	**1.96E+01**					
Total Activity Sum	**2.56E+01**	**5.44E+00**						**3.06E+01**	**1.98E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.30E+00	1.10E+00						**1.11**	**(from gamma)**		**57.5**			
Gross Beta	4.76E+00	8.00E-01					J	**3.47**	**1.14**		**129**			
Total Activity	8.40E+00	3.90E+00					J	**2.57**	**1.10**		**101**			

0107028-19			TMF-0077					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.10E-01	3.80E-01					U
Ra-226	9.70E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	1.50E-01												
Th-230	1.20E+00	1.90E-01												
Th-232	8.50E-01	1.40E-01												
U-234	9.00E-01	2.30E-01												
U-235	3.80E-02	4.40E-02						-6.00E-02	4.70E-01					U
U-238	9.10E-01	2.30E-01												
Total U Alpha	**1.85E+00**	**3.28E-01**												
Alpha Sum	**5.45E+00**	**2.30E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.10E-01	2.30E-01						6.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	9.10E-01	2.30E-01						-6.00E+00	1.60E+01					U
K-40	1.81E+01	3.90E+00												
Ra-228	6.80E-01	2.70E-01												
Pa-231	-3.00E-01	2.50E+00					U							
Beta Sum	**2.06E+01**	**3.93E+00**						**1.33E+01**	**1.65E+01**					
Total Activity Sum	**2.60E+01**	**4.56E+00**						**1.88E+01**	**1.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.60E+00	1.10E+00						**0.45**	**(from gamma)**		**19.1**			
Gross Beta	5.17E+00	8.30E-01					J	**3.83**	**0.49**		**120**			
Total Activity	7.10E+00	3.90E+00					J	**3.15**	**0.68**		**114**			

0107028-20			TMF-0078					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.10E-01					U
Ra-226	1.03E+00	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.60E-01												
Th-230	8.80E-01	1.50E-01												
Th-232	8.80E-01	1.50E-01												
U-234	7.60E-01	2.20E-01												
U-235	6.30E-02	5.70E-02						7.00E-02	3.50E-01					U
U-238	6.90E-01	2.10E-01												
Total U Alpha	**1.51E+00**	**3.09E-01**												
Alpha Sum	**3.65E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	2.10E-01						5.40E-01	7.00E-01					U
Pa-234m (Assumed from U-238)	6.90E-01	2.10E-01						1.20E+01	1.90E+01					U
K-40	1.90E+01	5.10E+00												
Ra-228	7.20E-01	3.90E-01												
Pa-231	-1.80E+00	2.40E+00					U							
Beta Sum	**2.09E+01**	**5.13E+00**						**3.20E+01**	**1.97E+01**					
Total Activity Sum	**2.45E+01**	**5.59E+00**						**3.57E+01**	**1.98E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.10E+00						**0.91**	**(from gamma)**		**47.0**			
Gross Beta	4.29E+00	7.30E-01					J	**3.20**	**1.41**		**132**			
Total Activity	8.50E+00	3.90E+00					J	**2.35**	**1.35**		**97.1**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107029

This sample delivery group (SDG) contained twenty (20) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 6, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0035	0107029-1
TMF-0036	0107029-2
TMF-0037	0107029-3
TMF-0038	0107029-4
TMF-0039	0107029-5
TMF-0040	0107029-6
TMF-0015	0107029-7
TMF-0016	0107029-8
TMF-0007	0107029-9
TMF-0008	0107029-10
TMF-0001	0107029-11
TMF-0002	0107029-12
TMF-0009	0107029-13
TMF-0010	0107029-14
TMF-9019	0107029-15
TMF-9020	0107029-16
TMF-0017	0107029-17
TMF-0018	0107029-18
TMF-0027	0107029-19
TMF-0028	0107029-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was observed in the EQ-1 and EQ-2 equipment rinsate blanks. However, ^{137}Cs activity was observed in the equipment rinsate blank EQ-1, but it was not reported by the laboratory in any samples. All associated samples results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). The ^{137}Cs activity (8.81E-02 ± 6.07E-02) was identified in the gamma spectrometry report for the sample # TMF-0007 but not reported by the laboratory as required since the ^{137}Cs activity in the sample is higher than the DL (1.65*TPU). However, ^{137}Cs activity value in sample TMF-0007 is greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification on Cs-137 results for this sample is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

All target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am) plus ^{40}K were reported for all samples. There were no incidents of identified radionuclides being excluded from the laboratory reports except ^{137}Cs result for sample TMF-0007. The ^{137}Cs activity (8.81E-02 ± 6.07E-02) was identified in the gamma spectrometry report for the sample # TMF-0007 but not reported by the laboratory as required since the ^{137}Cs activity in the sample is higher than the DL (1.65*TPU).

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for ^{231}Pa for sample TMF-0007. **It is recommended that the ^{231}Pa result for sample TMF-0007 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{230}Th in the method blank. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). However, the ^{230}Th results for all samples were greater than 5 times the blank. No qualification is necessary.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 29.06% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results of $^{224/235/238}U$ and $^{228/230/232}Th$ for all samples have less than 10% uncertainty. No qualification is necessary.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium.

Method Detection Limit and Quantitaion:

All samples met the required method detection limit (MDL) of 1.0 pCi/g for $^{224/235/238}U$ and $^{228/230/232}Th$.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for ^{226}Ra analysis.

Laboratory Control Sample:

The percent recovery for the LCS (96%) for the ^{226}Ra analyses was within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all ^{226}Ra analyses. No qualification is required.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis for all samples were within acceptable limits. No qualification of the samples is necessary.

Method Detection Limit and Quantitaion:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. Some of the samples results did not meet the required MDC as identified in the narrative section indicating that the laboratory did not meet the project DQOs. The results for samples TMF-0035, TMF-0001, TMF-0002 and TMF-0017 did not meet the required MDC limits of both gross alpha and gross beta analyses. Whereas the results for samples TMF-0036, TMF-0038, TMF-0039, TMF-0040, TMF-0007, TMF-0009, TMF-0020 and TMF-0027 did not meet required MDC for gross beta analysis, Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in the method blank samples for the total activity analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis by liquid scintillation counting.

Duplicate Analysis:

The total activity by liquid scintillation counting duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitaion and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC. **It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.**

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities is within acceptable limits for all samples except for TMF-0007, indicating that the gross alpha analyses for this sample does not agree with the sum of the alpha emitters within a 99% confidence level. The DER (1.84) and RPD (105%) for TMF-0007 are outside the acceptable limit. The gross alpha result for sample TMF-0007 was greater than sum of the alpha emitters. This may be due to heterogeneity or missing activity as analyzed for by individual analysis. Since the gross alpha analysis is an estimated value, no qualification of the gross alpha result for sample TMF-007 is necessary.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.62 - 4.54) for all samples are outside the acceptable limits as well as the RPD values (107 % - 149%). The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the total activity sum i.e., the sums of the beta emitters and the sum of alpha, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (1.75 – 3.22) for all samples are outside the acceptable limits as well as the RPD values (63.7%-117.1%). All samples have total activity results that are less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 1.6 to 2. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was less than the sum of the gross activities.

0107029-1			TMF-0035					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.20E-01	-2.00E-02	1.20E-01	**0.00**	**0.00**	U
Ra-226	1.03E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	1.40E-01	8.60E-01	1.70E-01	**0.36**	**9.76**								
Th-230	7.30E-01	1.30E-01	8.70E-01	1.60E-01	**0.68**	**17.5**								
Th-232	8.00E-01	1.40E-01	8.50E-01	1.60E-01	**0.24**	**6.06**								
U-234	7.30E-01	2.10E-01												
U-235	7.40E-02	6.10E-02						1.00E-01	4.60E-01	2.20E-01	4.20E-01	**0.19**	**75.0**	U
U-238	5.80E-01	1.90E-01												
Total U Alpha	**1.38E+00**	**2.90E-01**												
Alpha Sum	**2.47E+00**	**2.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.80E-01	1.90E-01						1.00E+00	1.30E+00	6.20E-01	7.70E-01	**0.25**	**46.9**	U
Pa-234m (Assumed from U-238)	5.80E-01	1.90E-01						-2.40E+01	2.10E+01	1.00E+01	2.30E+01	**1.09**	**486**	U
K-40	1.64E+01	5.00E+00	1.54E+01	4.50E+00	**0.15**	**6.29**								
Ra-228	7.80E-01	6.50E-01	5.00E-01	3.80E-01	**0.37**	**43.8**								
Pa-231	-2.50E+00	2.90E+00	-4.00E-01	2.60E+00	**0.54**	**145**	U							
Beta Sum	**1.80E+01**	**5.06E+00**						**-6.12E+00**	**2.16E+01**	**2.65E+01**	**2.35E+01**			
Total Activity Sum	**2.05E+01**	**5.71E+00**						**-3.65E+00**	**2.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.10E+00	5.20E+00	1.10E+00	**0.13**	**3.77**		**1.02**	**(from gamma)**		**74.3**			
Gross Beta	4.55E+00	9.80E-01	5.40E+00	1.00E+00	**0.61**	**17.1**	J	**2.62**	**0.49**		**119**			
Total Activity	8.40E+00	3.90E+00	1.05E+01	4.00E+00	**0.38**	**22.2**	J	**1.75**	**0.54**		**83.8**			

0107029-2			TMF-0036					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	2.30E-01					U
Ra-226	1.74E+00	3.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	1.70E-01												
Th-230	6.90E-01	1.30E-01												
Th-232	8.00E-01	1.40E-01												
U-234	8.60E-01	2.30E-01	7.60E-01	2.10E-01	**0.16**	**5.13**								
U-235	9.90E-02	7.10E-02	1.33E-01	8.20E-02	**0.31**	**29.3**		-3.00E-02	2.70E-01					U
U-238	8.40E-01	2.30E-01	9.50E-01	2.50E-01	**0.32**	**12.3**								
Total U Alpha	**2.60E+00**	**2.78E-01**	**1.84E+00**	**3.37E-01**										
Alpha Sum	**4.89E+00**	**1.29E+00**	**1.84E+00**	**3.37E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.30E-01	9.50E-01	2.50E-01	**0.32**	**12.3**		6.20E-01	7.50E-01					
Pa-234m (Assumed from U-238)	8.40E-01	2.30E-01	9.50E-01	2.50E-01	**0.32**	**12.3**		-5.00E-01	6.90E+00					U
K-40	1.75E+01	3.20E+00												
Ra-228	6.50E-01	1.70E-01												
Pa-231	-1.20E+00	1.30E+00					U							
Beta Sum	**1.97E+01**	**3.22E+00**	**1.90E+00**	**3.54E-01**				**1.81E+01**	**7.65E+00**					
Total Activity Sum	**2.46E+01**	**3.47E+00**	**3.74E+00**	**4.88E-01**				**2.30E+01**	**7.76E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.60E+00	1.20E+00						**0.97**	**(from gamma)**		**29.8**			
Gross Beta	5.60E+00	1.10E+00					J	**4.13**	**1.62**		**111**			
Total Activity	1.27E+01	4.00E+00					J	**2.24**	**1.18**		**63.7**			

0107029-3			TMF-0037					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	3.40E-01	-5.00E-02	2.70E-01	**0.21**	**1800.0**	U
Ra-226	1.40E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.25E+00	2.30E-01												
Th-230	1.11E+00	2.00E-01												
Th-232	1.10E+00	2.00E-01												
U-234	9.80E-01	2.60E-01												
U-235	1.90E-01	1.00E-01						8.00E-02	3.40E-01	-1.80E-01	3.20E-01	**0.56**	**520**	U
U-238	9.20E-01	2.50E-01												
Total U Alpha	**2.09E+00**	**3.74E-01**												
Alpha Sum	**6.32E+00**	**1.90E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E-01	2.50E-01						6.00E-01	1.20E+00	7.30E-01	9.60E-01	**0.08**	**19.5**	U
Pa-234m (Assumed from U-238)	9.20E-01	2.50E-01						-1.10E+00	9.90E+00	8.40E+00	8.90E+00	**0.71**	**260**	U
K-40	1.84E+01	3.80E+00	2.10E+01	3.80E+00	**0.48**	**13.2**								
Ra-228	6.30E-01	2.40E-01	6.80E-01	2.00E-01	**0.16**	**7.63**								
Pa-231	-7.00E-01	2.00E+00	2.00E-01	2.00E+00	**0.32**	**360**	U							
Beta Sum	**2.08E+01**	**3.83E+00**						**1.84E+01**	**1.07E+01**	**3.08E+01**	**9.73E+00**			
Total Activity Sum	**2.71E+01**	**4.28E+00**						**2.48E+01**	**1.08E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.10E+00						**0.33**	**(from gamma)**		**12.1**			
Gross Beta	4.16E+00	8.50E-01					J	**4.24**	**1.33**		**133**			
Total Activity	1.01E+01	4.00E+00					J	**2.90**	**1.27**		**91.4**			

0107029-4			TMF-0038					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	3.10E-01					U
Ra-226	1.01E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.40E-01	1.70E-01												
Th-230	8.70E-01	1.60E-01												
Th-232	7.90E-01	1.50E-01												
U-234	6.20E-01	1.80E-01												
U-235	9.00E-02	6.00E-02						-3.10E-01	4.00E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.44E+00**	**2.76E-01**												
Alpha Sum	**4.50E+00**	**2.04E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						1.20E+00	1.00E+00					
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						1.00E+00	1.40E+01					U
K-40	1.78E+01	3.80E+00												
Ra-228	7.20E-01	2.90E-01												
Pa-231	-5.00E-01	2.20E+00					U							
Beta Sum	**1.99E+01**	**3.83E+00**						**2.07E+01**	**1.45E+01**					
Total Activity Sum	**2.44E+01**	**4.34E+00**						**2.52E+01**	**1.47E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.70E+00	1.40E+00						**1.29**	**(from gamma)**		**52.5**			
Gross Beta	6.00E+00	1.10E+00					J	**3.49**	**1.00**		**107**			
Total Activity	9.70E+00	3.90E+00					J	**2.52**	**1.02**		**86.3**			

0107029-5			TMF-0039					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01					U
Ra-226	1.22E+00	2.80E-01	1.27E+00	2.70E-01	**0.13**	**4.02**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.11E+00	1.90E-01	1.30E+00	2.20E-01	**0.65**	**15.8**								
Th-230	1.03E+00	1.70E-01	1.11E+00	1.90E-01	**0.31**	**7.48**								
Th-232	1.04E+00	1.70E-01	1.17E+00	2.00E-01	**0.50**	**11.8**								
U-234	8.70E-01	2.30E-01												
U-235	2.90E-02	3.80E-02					U	1.20E-01	3.40E-01					U
U-238	9.50E-01	2.40E-01												
Total U Alpha	**1.85E+00**	**3.35E-01**												
Alpha Sum	**5.53E+00**	**1.88E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.50E-01	2.40E-01						6.40E-01	6.60E-01					
Pa-234m (Assumed from U-238)	9.50E-01	2.40E-01						1.00E+00	1.40E+01					U
K-40	1.99E+01	4.40E+00												
Ra-228	9.40E-01	3.50E-01												
Pa-231	-8.00E-01	2.00E+00					U							
Beta Sum	**2.26E+01**	**4.43E+00**						**2.24E+01**	**1.47E+01**					
Total Activity Sum	**2.82E+01**	**4.81E+00**						**2.79E+01**	**1.48E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.50E+00	1.30E+00						**0.86**	**(from gamma)**		**30.3**			
Gross Beta	6.20E+00	1.10E+00					J	**3.60**	**1.10**		**114**			
Total Activity	1.22E+01	4.10E+00					J	**2.53**	**1.02**		**79.1**			

0107029-6			TMF-0040					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.30E-01	1.10E-01					
Ra-226	7.80E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.70E-01												
Th-230	7.30E-01	1.30E-01												
Th-232	8.30E-01	1.40E-01												
U-234	9.00E-01	2.30E-01	8.80E-01	2.30E-01	**0.06**	**2.25**								
U-235	3.10E-02	3.60E-02	5.20E-02	4.80E-02	**0.35**	**50.6**		3.00E-02	2.60E-01					U
U-238	8.40E-01	2.20E-01	9.70E-01	2.40E-01	**0.40**	**14.4**								
Total U Alpha	**1.77E+00**	**3.20E-01**	**1.90E+00**	**3.36E-01**										
Alpha Sum	**4.35E+00**	**1.43E+00**	**1.90E+00**	**3.36E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.20E-01	9.70E-01	2.40E-01	**0.40**	**14.4**		1.24E+00	7.80E-01					
Pa-234m (Assumed from U-238)	8.40E-01	2.20E-01	9.70E-01	2.40E-01	**0.40**	**14.4**		5.00E+00	1.10E+01					U
K-40	2.08E+01	4.30E+00												
Ra-228	7.70E-01	2.60E-01												
Pa-231	-8.00E-01	1.50E+00					U							
Beta Sum	**2.32E+01**	**4.32E+00**	**1.94E+00**	**3.39E-01**				**2.77E+01**	**1.18E+01**					
Total Activity Sum	**2.75E+01**	**4.55E+00**	**3.84E+00**	**4.77E-01**				**3.21E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.10E+00	1.00E+00						**0.43**	**(from gamma)**		**15.9**			
Gross Beta	4.49E+00	9.20E-01					J	**4.22**	**1.96**		**135**			
Total Activity	9.60E+00	3.90E+00					J	**2.99**	**1.79**		**96.5**			

0107029-7			TMF-0015					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.70E-01	-1.00E-01	3.50E-01	**0.39**	**600.0**	U
Ra-226	9.10E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	2.00E-01												
Th-230	9.50E-01	1.80E-01												
Th-232	1.00E+00	1.90E-01												
U-234	8.30E-01	2.20E-01												
U-235	7.20E-02	5.80E-02						-1.10E-01	2.70E-01	2.30E-01	3.30E-01	**0.80**	**567**	U
U-238	7.60E-01	2.10E-01												
Total U Alpha	**1.66E+00**	**3.10E-01**												
Alpha Sum	**4.78E+00**	**1.27E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.60E-01	2.10E-01						8.20E-01	6.70E-01	1.20E+00	1.00E+00	**0.32**	**37.6**	
Pa-234m (Assumed from U-238)	7.60E-01	2.10E-01						-1.40E+00	8.20E+00	0.00E+00	1.10E+01	**0.10**	**200**	U
K-40	1.96E+01	3.60E+00	1.92E+01	3.90E+00	**0.08**	**2.06**								
Ra-228	8.20E-01	2.20E-01	8.10E-01	2.70E-01	**0.03**	**1.23**								
Pa-231	-8.00E-01	1.30E+00	0.00E+00	1.80E+00	**0.36**	**200**	U							
Beta Sum	**2.18E+01**	**3.62E+00**						**1.97E+01**	**8.98E+00**	**2.12E+01**	**1.17E+01**			
Total Activity Sum	**2.66E+01**	**3.84E+00**						**2.45E+01**	**9.07E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.60**	**(from gamma)**		**19.2**			
Gross Beta	5.00E+00	9.30E-01					J	**4.50**	**1.63**		**125**			
Total Activity	9.00E+00	3.90E+00					J	**3.22**	**1.57**		**99.0**			

0107029-8			TMF-0016					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.70E-01	5.30E-01					U
Ra-226	9.10E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	1.90E-01												
Th-230	8.40E-01	1.60E-01												
Th-232	8.60E-01	1.60E-01												
U-234	7.50E-01	2.10E-01												
U-235	1.09E-01	7.30E-02						-6.00E-02	3.20E-01					U
U-238	7.70E-01	2.10E-01												
Total U Alpha	**1.63E+00**	**3.06E-01**												
Alpha Sum	**3.82E+00**	**1.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.10E-01						6.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	7.70E-01	2.10E-01						9.00E+00	1.20E+01					U
K-40	2.05E+01	4.30E+00												
Ra-228	8.40E-01	3.20E-01												
Pa-231	-1.50E+00	1.90E+00					U							
Beta Sum	**2.27E+01**	**4.33E+00**						**3.08E+01**	**1.28E+01**					
Total Activity Sum	**2.65E+01**	**4.68E+00**						**3.46E+01**	**1.29E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.10E+00	1.00E+00						**0.63**	**(from gamma)**		**28.7**			
Gross Beta	4.60E+00	9.10E-01					J	**4.09**	**2.04**		**133**			
Total Activity	1.13E+01	4.00E+00					J	**2.47**	**1.72**		**80.5**			

0107029-9			TMF-0007					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	3.40E-01					U
Ra-226	1.08E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	1.90E-01												
Th-230	9.30E-01	1.80E-01												
Th-232	9.30E-01	1.80E-01												
U-234	1.15E+00	3.10E-01												
U-235	5.90E-02	6.00E-02						-2.40E-01	4.20E-01					U
U-238	9.70E-01	2.70E-01												
Total U Alpha	**2.18E+00**	**4.15E-01**												
Alpha Sum	**2.26E+00**	**2.41E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.70E-01	2.70E-01						6.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	9.70E-01	2.70E-01						-1.00E+00	1.40E+01					U
K-40	2.23E+01	4.50E+00												
Ra-228	8.00E-01	2.80E-01												
Pa-231	-4.20E+00	2.60E+00					UJ							
Beta Sum	**2.45E+01**	**4.54E+00**						**2.22E+01**	**1.48E+01**					
Total Activity Sum	**2.68E+01**	**5.14E+00**						**2.45E+01**	**1.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.30E+00	1.30E+00						**1.84**	**(from gamma)**		**105**			
Gross Beta	7.10E+00	1.20E+00					J	**3.72**	**1.02**		**110**			
Total Activity	1.18E+01	4.10E+00					J	**2.28**	**0.82**		**77.7**			

0107029-10			TMF-0008					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.20E-02	9.30E-02					U
Ra-226	9.50E-01	3.90E-01	7.40E-01	2.00E-01	**0.48**	**24.9**								
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.60E-01												
Th-230	8.10E-01	1.40E-01												
Th-232	8.40E-01	1.50E-01												
U-234	7.90E-01	2.10E-01												
U-235	4.80E-02	4.80E-02						-7.00E-02	2.70E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.57E+00**	**2.94E-01**												
Alpha Sum	**5.06E+00**	**1.08E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						1.05E+00	6.30E-01					
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						-7.00E-01	1.90E+00					U
K-40	1.65E+01	3.80E+00												
Ra-228	7.00E-01	3.40E-01												
Pa-231	0.00E+00	1.20E+01					U							
Beta Sum	**1.87E+01**	**4.09E+00**						**1.76E+01**	**4.54E+00**					
Total Activity Sum	**2.37E+01**	**1.16E+01**						**2.26E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.10E+00	6.20E+00	1.20E+00	**0.18**	**4.96**		**0.08**	**(from gamma)**		**15.4**			
Gross Beta	5.16E+00	9.60E-01	4.32E+00	8.80E-01	**0.65**	**17.7**	J	**3.22**	**2.67**		**113**			
Total Activity	1.22E+01	4.00E+00	8.50E+00	3.90E+00	**0.66**	**35.7**	J	**0.94**	**0.84**		**64.1**			

0107029-11			TMF-0001					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.10E-01					U
Ra-226	1.23E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.70E-01	1.30E-01												
Th-230	7.00E-01	1.30E-01												
Th-232	6.60E-01	1.20E-01												
U-234	7.10E-01	2.10E-01												
U-235	7.80E-02	6.40E-02						1.30E-01	2.80E-01					U
U-238	9.80E-01	2.50E-01												
Total U Alpha	**1.77E+00**	**3.33E-01**												
Alpha Sum	**4.67E+00**	**1.69E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.80E-01	2.50E-01						1.10E+00	6.70E-01					
Pa-234m (Assumed from U-238)	9.80E-01	2.50E-01						-7.40E+00	9.80E+00					U
K-40	1.91E+01	4.10E+00												
Ra-228	6.90E-01	2.90E-01												
Pa-231	-4.00E-01	1.80E+00					U							
Beta Sum	**2.17E+01**	**4.13E+00**						**1.34E+01**	**1.07E+01**					
Total Activity Sum	**2.64E+01**	**4.46E+00**						**1.81E+01**	**1.08E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.10E+00	1.30E+00						**1.14**	**(from gamma)**		**41.3**			
Gross Beta	4.38E+00	9.70E-01					J	**4.08**	**0.85**		**133**			
Total Activity	8.70E+00	3.90E+00					J	**2.98**	**0.82**		**101**			

0107029-12			TMF-0002					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.50E-01	1.60E-01					
Ra-226	4.20E-01	1.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.70E-01												
Th-230	7.60E-01	1.30E-01												
Th-232	8.50E-01	1.50E-01												
U-234	7.80E-01	2.10E-01												
U-235	1.50E-01	8.50E-02						-8.00E-02	2.60E-01					U
U-238	6.40E-01	1.90E-01												
Total U Alpha	**1.57E+00**	**2.96E-01**												
Alpha Sum	**5.02E+00**	**1.16E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.40E-01	1.90E-01						3.10E-01	6.50E-01					U
Pa-234m (Assumed from U-238)	6.40E-01	1.90E-01						3.00E+00	6.80E+00					U
K-40	1.77E+01	3.30E+00												
Ra-228	7.00E-01	1.90E-01												
Pa-231	5.00E-01	1.20E+00					U							
Beta Sum	**1.97E+01**	**3.32E+00**						**2.18E+01**	**7.59E+00**					
Total Activity Sum	**2.48E+01**	**3.52E+00**						**2.68E+01**	**7.68E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+00	1.20E+00						**0.29**	**(from gamma)**		**9.13**			
Gross Beta	5.30E+00	1.00E+00					J	**4.17**	**2.15**		**115**			
Total Activity	1.13E+01	4.00E+00					J	**2.53**	**1.79**		**74.7**			

0107029-13			TMF-0009					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.20E-01					U
Ra-226	9.70E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	1.80E-01												
Th-230	7.80E-01	1.40E-01												
Th-232	7.60E-01	1.40E-01												
U-234	7.80E-01	2.30E-01												
U-235	6.10E-02	5.90E-02						-3.30E-01	3.80E-01					U
U-238	6.20E-01	2.00E-01												
Total U Alpha	**1.46E+00**	**3.10E-01**												
Alpha Sum	**5.13E+00**	**2.39E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.20E-01	2.00E-01						1.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	6.20E-01	2.00E-01						3.00E+00	2.20E+01					U
K-40	1.67E+01	4.90E+00												
Ra-228	5.60E-01	5.90E-01												
Pa-231	2.00E-01	2.60E+00					U							
Beta Sum	**1.85E+01**	**4.95E+00**						**2.04E+01**	**2.26E+01**					
Total Activity Sum	**2.37E+01**	**5.50E+00**						**2.55E+01**	**2.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.10E+00						**0.18**	**(from gamma)**		**8.74**			
Gross Beta	4.93E+00	9.80E-01					J	**2.69**	**0.68**		**116**			
Total Activity	1.01E+01	4.00E+00					J	**1.99**	**0.67**		**80.3**			

0107029-14			TMF-0010					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.20E-01					U
Ra-226	8.90E-01	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	1.40E-01												
Th-230	7.70E-01	1.40E-01												
Th-232	7.80E-01	1.40E-01												
U-234	8.50E-01	2.30E-01												
U-235	3.60E-02	4.30E-02						2.30E-01	4.10E-01					U
U-238	8.90E-01	2.40E-01												
Total U Alpha	**1.78E+00**	**3.35E-01**												
Alpha Sum	**5.42E+00**	**2.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.40E-01						1.37E+00	7.70E-01					
Pa-234m (Assumed from U-238)	8.90E-01	2.40E-01						-1.40E+01	1.70E+01					U
K-40	1.57E+01	4.20E+00												
Ra-228	8.20E-01	3.80E-01												
Pa-231	5.00E-01	2.50E+00					U							
Beta Sum	**1.84E+01**	**4.24E+00**						**3.95E+00**	**1.75E+01**					
Total Activity Sum	**2.38E+01**	**4.83E+00**						**9.37E+00**	**1.77E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.20E+00						**0.42**	**(from gamma)**		**18.2**			
Gross Beta	5.24E+00	9.70E-01					J	**3.02**	**0.07**		**111**			
Total Activity	9.60E+00	3.90E+00					J	**2.28**	**0.01**		**84.9**			

0107029-15			TMF-9019					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	3.20E-01	-1.00E-01	3.50E-01	**0.13**	**85.7**	U
Ra-226	1.02E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	1.40E-01												
Th-230	7.80E-01	1.40E-01												
Th-232	7.70E-01	1.40E-01												
U-234	7.50E-01	2.10E-01												
U-235	6.60E-02	5.50E-02						3.80E-01	3.80E-01	2.30E-01	3.30E-01	**0.30**	**49.2**	
U-238	7.20E-01	2.00E-01												
Total U Alpha	**1.54E+00**	**2.95E-01**												
Alpha Sum	**3.81E+00**	**3.01E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.00E-01						5.00E-01	1.00E+00	1.20E+00	1.00E+00	**0.49**	**82.4**	U
Pa-234m (Assumed from U-238)	7.20E-01	2.00E-01						6.00E+00	1.20E+01	0.00E+00	1.10E+01	**0.37**	**200**	U
K-40	1.57E+01	3.40E+00	1.92E+01	3.90E+00	**0.68**	**20.1**								
Ra-228	6.20E-01	2.50E-01	8.10E-01	2.70E-01	**0.52**	**26.6**								
Pa-231	-1.20E+00	3.30E+00					U							
Beta Sum	**1.76E+01**	**3.44E+00**						**2.27E+01**	**1.25E+01**	**2.12E+01**	**1.17E+01**			
Total Activity Sum	**2.14E+01**	**4.57E+00**						**2.65E+01**	**1.29E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.73E+00	9.90E-01						**0.29**	**(from gamma)**		**21.6**			
Gross Beta	4.23E+00	8.70E-01					J	**3.77**	**1.47**		**123**			
Total Activity	5.60E+00	3.80E+00					J	**2.66**	**1.56**		**117**			

0107029-16			TMF-9020					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.10E-01					U
Ra-226	8.10E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.50E-01												
Th-230	8.50E-01	1.40E-01												
Th-232	8.20E-01	1.40E-01												
U-234	9.10E-01	2.30E-01												
U-235	9.50E-02	6.40E-02						-2.20E-01	4.00E-01					U
U-238	8.40E-01	2.20E-01												
Total U Alpha	**1.85E+00**	**3.25E-01**												
Alpha Sum	**6.12E+00**	**3.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.20E-01						6.30E-01	6.70E-01					
Pa-234m (Assumed from U-238)	8.40E-01	2.20E-01						-7.00E+00	2.10E+01					U
K-40	1.59E+01	4.50E+00												
Ra-228	8.70E-01	3.70E-01												
Pa-231	1.00E+00	3.70E+00					U							
Beta Sum	**1.86E+01**	**4.55E+00**						**1.05E+01**	**2.15E+01**					
Total Activity Sum	**2.47E+01**	**5.66E+00**						**1.66E+01**	**2.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.10E+00						**0.26**	**(from gamma)**		**16.2**			
Gross Beta	5.13E+00	9.80E-01					J	**2.89**	**0.25**		**113**			
Total Activity	9.40E+00	3.90E+00					J	**2.22**	**0.33**		**89.7**			

0107029-17			TMF-0017					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.20E-01					U
Ra-226	8.20E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.70E-01												
Th-230	8.80E-01	1.60E-01												
Th-232	8.20E-01	1.50E-01												
U-234	7.50E-01	2.00E-01												
U-235	9.60E-02	6.40E-02						4.00E-02	3.60E-01					U
U-238	7.70E-01	2.00E-01												
Total U Alpha	**1.62E+00**	**2.90E-01**												
Alpha Sum	**3.75E+00**	**2.38E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.00E-01						8.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	7.70E-01	2.00E-01						6.00E+00	1.30E+01					U
K-40	2.12E+01	5.30E+00												
Ra-228	7.80E-01	4.10E-01												
Pa-231	-1.50E+00	2.60E+00					U							
Beta Sum	**2.33E+01**	**5.33E+00**						**2.86E+01**	**1.41E+01**					
Total Activity Sum	**2.71E+01**	**5.84E+00**						**3.23E+01**	**1.43E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.40E+00	1.00E+00						**0.25**	**(from gamma)**		**16.1**			
Gross Beta	3.41E+00	8.30E-01					J	**3.69**	**1.78**		**149**			
Total Activity	8.70E+00	3.90E+00					J	**2.62**	**1.60**		**103**			

0107029-18			TMF-0018					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.80E-01	5.40E-01					U
Ra-226	9.20E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.60E-01												
Th-230	8.90E-01	1.50E-01												
Th-232	9.20E-01	1.50E-01												
U-234	9.60E-01	2.40E-01												
U-235	1.67E+00	8.50E-02						-2.50E-01	3.60E-01					U
U-238	9.40E-01	2.30E-01												
Total U Alpha	**3.57E+00**	**3.43E-01**												
Alpha Sum	**5.74E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.40E-01	2.30E-01						1.00E+00	1.30E+00					U
Pa-234m (Assumed from U-238)	9.40E-01	2.30E-01						-2.00E+00	1.30E+01					U
K-40	1.73E+01	3.80E+00												
Ra-228	5.40E-01	2.90E-01												
Pa-231	-1.70E+00	2.10E+00					U							
Beta Sum	**1.95E+01**	**3.83E+00**						**1.66E+01**	**1.36E+01**					
Total Activity Sum	**2.53E+01**	**4.30E+00**						**2.24E+01**	**1.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.81E+00	9.60E-01						**0.43**	**(from gamma)**		**17.6**			
Gross Beta	4.18E+00	8.30E-01					J	**3.91**	**0.91**		**129**			
Total Activity	1.19E+01	4.00E+00					J	**2.27**	**0.73**		**71.9**			

0107029-19			TMF-0027					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	2.80E-01					U
Ra-226	8.90E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	1.70E-01												
Th-230	7.80E-01	1.40E-01												
Th-232	8.50E-01	1.50E-01												
U-234	7.20E-01	2.00E-01												
U-235	1.35E-01	8.00E-02						-2.10E-01	3.10E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.72E+00**	**3.15E-01**												
Alpha Sum	**4.18E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						1.20E+00	1.00E+00					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						7.40E+00	7.90E+00					
K-40	1.80E+01	3.40E+00												
Ra-228	7.90E-01	2.00E-01												
Pa-231	-1.10E+00	2.40E+00					U							
Beta Sum	**2.04E+01**	**3.43E+00**						**2.73E+01**	**8.67E+00**					
Total Activity Sum	**2.46E+01**	**4.08E+00**						**3.14E+01**	**8.94E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.10E+00						**0.58**	**(from gamma)**		**29.2**			
Gross Beta	4.26E+00	9.10E-01					J	**4.54**	**2.64**		**131**			
Total Activity	6.80E+00	3.90E+00					J	**3.14**	**2.52**		**113**			

0107029-20			TMF-0028					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.50E-01	3.50E-01					U
Ra-226	1.18E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.50E-01												
Th-230	8.60E-01	1.50E-01												
Th-232	8.70E-01	1.60E-01												
U-234	7.40E-01	2.00E-01												
U-235	8.90E-02	6.60E-02						7.00E-02	3.20E-01					U
U-238	8.00E-01	2.10E-01												
Total U Alpha	**1.63E+00**	**2.97E-01**												
Alpha Sum	**5.16E+00**	**1.61E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.10E-01						6.00E-02	8.50E-01					U
Pa-234m (Assumed from U-238)	8.00E-01	2.10E-01						1.00E+00	1.10E+01					U
K-40	1.71E+01	3.60E+00												
Ra-228	7.70E-01	2.40E-01												
Pa-231	-2.00E-01	1.70E+00					U							
Beta Sum	**1.94E+01**	**3.63E+00**						**1.89E+01**	**1.16E+01**					
Total Activity Sum	**2.46E+01**	**3.97E+00**						**2.41E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.02E+00	9.10E-01						**0.62**	**(from gamma)**		**24.8**			
Gross Beta	4.37E+00	8.70E-01					J	**4.04**	**1.25**		**127**			
Total Activity	9.60E+00	3.90E+00					J	**2.70**	**1.17**		**87.7**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107030

This sample delivery group (SDG) contained twenty (20) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 6, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0041	0107030-1
TMF-0042	0107030-2
TMF-0053	0107030-3
TMF-0054	0107030-4
TMF-0055	0107030-5
TMF-0056	0107030-6
TMF-0057	0107030-7
TMF-0058	0107030-8
TMF-0061	0107030-9
TMF-0062	0107030-10
TMF-0067	0107030-11
TMF-0068	0107030-12
TMF-0069	0107030-13
TMF-0070	0107030-14
TMF-0073	0107030-15
TMF-0074	0107030-16
TMF-0075	0107030-17
TMF-0076	0107030-18
TMF-0079	0107030-19
TMF-0080	0107030-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was reported by the laboratory in the EQ-1 and EQ-02 equipment rinsate blanks. However, ^{137}Cs peak was identified in gamma spectrometry report for equipment rinsate sample # EQ-1. All associated sample results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). There was ^{137}Cs activity reported for sample TMF-0055. The reported ^{137}Cs result is greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification of ^{137}Cs results in the sample is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits for the gamma spectrometry analysis.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Results for natural ^{40}K were also reported for all samples. There was ^{137}Cs activity reported for sample TMF-0055 at an activity concentration of (7.8E-02 ± 4.4E-02). There were no incidents of identified radionuclides being excluded from the laboratory reports.

In addition, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples. The $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl reported results are progeny from the ^{232}Th and ^{238}U series. These reported radionuclides may be due to near or total equilibrium with ^{232}Th and ^{238}U. The presence of $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl in the stated concentration is not out of the question for these samples considering the amount of ^{232}Th and ^{238}U present. **Inclusion of $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl in the database is recommended for information purposes only since any modeling will assume equilibrium with parent ^{232}Th and ^{238}U.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for the ^{231}Pa result for sample TMF-0061 (-2.5± 1.9). **It is recommended that the ^{231}Pa result for sample TMF-0061 be qualified as estimated (J).** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{230}Th results in method blank. Also there was an indication of blank contamination for ^{234}U result in method blank associated with sample TMF-0075. All associated samples results less than 5 times the blank value for ^{230}Th and ^{234}U analyses should be qualified as estimated (J). For sample TMF-0075 the ^{234}U results is greater than 5 times the ^{234}U concentrations identified in the method blank. No qualification of ^{234}U results for sample TMF-0075 is necessary. However, for all samples except sample TMF-0079, the ^{230}Th results are less than 5 times the ^{230}Th concentrations identified in the method blank. **Therefore, it is recommended that ^{230}Th results for samples TMF-0041, TMF-0042, TMF-0053, TMF-0054, TMF-0055, TMF-0056, TMF-0057, TMF-0058, TMF-0061, TMF-0062, TMF-0067, TMF-0068, TMF-0069, TMF-0070, TMF-0073, TMF-0074, TMF-0075, TMF-0076 and TMF-0080 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis. There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5

times the $^{228/230/232}$Th concentration identified in the rinsate blank. No further qualification of the alpha isotopic results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 16.48% for all samples for the alpha analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty. No qualification of is required.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination either in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analysis were within acceptable limits.

Duplicate Analysis:

One of the two duplicate DERs (1.69) is outside acceptable limits for the ^{226}Ra analysis. The RPD (72.7%) was also outside acceptable limits. **Therefore it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J).**

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses. Therefore, no qualification is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity analysis duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC. **It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.**

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (1.32, 1.46) for gross alpha to sum of alpha activities for samples TMF-0055 and TMF-0061 respectively are outside the acceptable limits as well as the RPD values (52.7%, 74.6%), indicating that the gross alpha analyses for these samples do not agree with the sum of the alpha emitters within a 99% confidence level. The gross alpha results for sample TMF-0055 and TMF-0061 were greater than sum of the alpha emitters. This may be due to heterogeneity or missing activity as analyzed for by individual analysis. Since the gross alpha analysis is an estimated value, no qualification of the gross alpha result for these samples is necessary.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.72 to 4.86) for all samples are outside the acceptable limits as well as the RPD (93.2% to 131%) values. The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the sample preparation as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the sum of the alpha and beta emitters, the DERs for samples TMF-0041 (2.79), TMF-0042 (3.57), TMF-0054 (2.57), TMF-0055 (2.19), TMF-0056 (3.16), TMF-0057 (2.30), TMF-0058 (2.57), TMF-0061 (1.73), TMF-0062 (2.98), TMF-0067 (3.11), TMF-0068 (2.94), TMF-0069 (2.00), TMF-0074 (2.11), TMF-0075 (1.8), TMF-0076 (2.41), TMF-0079 (1.99), and TMF-0080 (2.99) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (93.5%, 116%, 81.3%, 66.3%, 90%, 95.9%, 59.2%, 105%, 107%, 84.5%, 63.9%, 71.3%, 57.6% 69%, 60.2% and 84.8% respectively) are also outside acceptable limits. Samples TMF-0041, TMF-0042, TMF-0054, TMF-0055, TMF-0056, TMF-0057, TMF-0058, TMF-0061, TMF-0062, TMF-0067, TMF-0068, TMF-0069, TMF-0074, TMF-0075, TMF-0076, TMF-0079, and TMF-0080 have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 2.6 to 4. This is most likely due to a negative bias in the total activity results due to the sample preparation as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

0107030-1			TMF-0041					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	2.30E-01	-1.80E-01	5.00E-01	**0.02**	**5.41**	U
Ra-226	9.60E-01	2.50E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	1.50E-01												
Th-230	6.30E-01	1.40E-01					J							
Th-232	6.90E-01	1.50E-01												
U-234	8.70E-01	2.30E-01												
U-235	5.30E-02	5.00E-02						-1.00E-02	2.70E-01	6.00E-02	3.30E-01	**0.16**	**280**	U
U-238	7.90E-01	2.10E-01												
Total U Alpha	**1.71E+00**	**3.15E-01**												
Alpha Sum	**4.06E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.90E-01	2.10E-01						5.20E-01	7.40E-01	8.00E-01	9.80E-01	**0.23**	**42.4**	U
Pa-234m (Assumed from U-238)	7.90E-01	2.10E-01						3.10E+00	6.70E+00	-1.60E+00	9.50E+00	**0.40**	**627**	U
K-40	1.88E+01	3.40E+00	1.54E+01	3.20E+00	**0.73**	**19.9**								
Ra-228	7.30E-01	1.90E-01	9.00E-01	2.50E-01	**0.54**	**20.9**								
Pa-231	-7.00E-01	2.00E+00	-1.10E+00	1.80E+00	**0.15**	**44.4**	U							
Beta Sum	**2.10E+01**	**3.43E+00**						**2.31E+01**	**7.56E+00**	**1.54E+01**	**1.01E+01**			
Total Activity Sum	**2.51E+01**	**3.90E+00**						**2.71E+01**	**7.78E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.23E+00	1.00E+00	4.93E+00	9.80E-01	**0.21**	**5.91**		**0.55**	**(from gamma)**		**25.1**			
Gross Beta	4.68E+00	8.70E-01	4.78E+00	9.00E-01	**0.08**	**2.11**	J	**4.62**	**2.42**		**127**			
Total Activity	9.10E+00	4.20E+00	8.80E+00	4.20E+00	**0.05**	**3.35**	J	**2.79**	**2.04**		**93.5**			

0107030-2			TMF-0042					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	4.70E-01					U
Ra-226	1.10E+00	2.50E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.00E-01	1.01E+00	2.10E-01	**0.34**	**10.4**								
Th-230	7.80E-01	1.70E-01	8.40E-01	1.70E-01	**0.25**	**7.41**	J							
Th-232	9.30E-01	1.90E-01	8.70E-01	1.80E-01	**0.23**	**6.67**								
U-234	9.20E-01	2.20E-01												
U-235	8.90E-02	5.90E-02						-8.00E-02	3.20E-01					U
U-238	8.40E-01	2.10E-01												
Total U Alpha	**1.85E+00**	**3.10E-01**												
Alpha Sum	**6.20E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.10E-01						6.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	8.40E-01	2.10E-01						4.70E+00	8.30E+00					U
K-40	1.99E+01	3.90E+00												
Ra-228	7.00E-01	2.60E-01												
Pa-231	7.00E-01	1.60E+00					U							
Beta Sum	**2.24E+01**	**3.92E+00**						**2.60E+01**	**9.23E+00**					
Total Activity Sum	**2.86E+01**	**4.21E+00**						**3.22E+01**	**9.36E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.04E+00	9.70E-01						**0.64**	**(from gamma)**		**20.6**			
Gross Beta	4.56E+00	8.70E-01					J	**4.43**	**2.31**		**132**			
Total Activity	7.60E+00	4.10E+00					J	**3.57**	**2.41**		**116**			

0107030-3			TMF-0053					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.10E-01					U
Ra-226	7.80E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.70E-01	1.70E-01												
Th-230	9.40E-01	1.90E-01					J							
Th-232	6.30E-01	1.40E-01												
U-234	8.10E-01	2.10E-01												
U-235	1.05E-01	6.70E-02						0.00E+00	3.30E-01					U
U-238	9.20E-01	2.30E-01												
Total U Alpha	**1.84E+00**	**3.19E-01**												
Alpha Sum	**4.95E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E-01	2.30E-01						7.50E-01	9.00E-01					
Pa-234m (Assumed from U-238)	9.20E-01	2.30E-01						0.00E+00	1.20E+01					U
K-40	1.20E+01	3.20E+00												
Ra-228	5.90E-01	3.00E-01												
Pa-231	1.00E-01	2.00E+00					U							
Beta Sum	**1.44E+01**	**3.24E+00**						**1.34E+01**	**1.25E+01**					
Total Activity Sum	**1.94E+01**	**3.74E+00**						**1.83E+01**	**1.26E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.10E+00	1.30E+00						**0.95**	**(from gamma)**		**35.8**			
Gross Beta	5.26E+00	9.70E-01					J	**2.72**	**0.65**		**93.2**			
Total Activity	1.82E+01	5.80E+00					J	**0.17**	**0.01**		**6.32**			

0107030-4			TMF-0054					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.60E-02	9.60E-02					U
Ra-226	1.09E+00	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.20E-01												
Th-230	8.40E-01	1.80E-01					J							
Th-232	8.50E-01	1.80E-01												
U-234	8.10E-01	3.10E-01												
U-235	1.50E-01	1.20E-01						1.80E-01	2.60E-01					U
U-238	9.20E-01	3.30E-01												
Total U Alpha	**1.88E+00**	**4.68E-01**												
Alpha Sum	**5.16E+00**	**1.32E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E-01	3.30E-01						1.46E+00	9.30E-01					
Pa-234m (Assumed from U-238)	9.20E-01	3.30E-01						1.70E+00	8.40E+00					U
K-40	1.87E+01	3.80E+00												
Ra-228	6.70E-01	2.10E-01												
Pa-231	-5.00E-01	1.30E+00					U							
Beta Sum	**2.12E+01**	**3.84E+00**						**2.25E+01**	**9.27E+00**					
Total Activity Sum	**2.63E+01**	**4.06E+00**						**2.76E+01**	**9.36E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.00E+00						**0.14**	**(from gamma)**		**4.55**			
Gross Beta	4.92E+00	9.20E-01					J	**4.11**	**1.88**		**125**			
Total Activity	1.11E+01	4.30E+00					J	**2.57**	**1.60**		**81.3**			

0107030-5			TMF-0055					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	1.70E-01	7.00E-02	2.50E-01	**0.66**	**667**	U
Ra-226	8.70E-01	3.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.19E+00	2.50E-01												
Th-230	9.40E-01	2.00E-01					J							
Th-232	8.60E-01	1.90E-01												
U-234	8.00E-01	2.30E-01	8.10E-01	2.20E-01	**0.03**	**1.24**								
U-235	8.00E-02	6.60E-02	1.08E-01	7.00E-02	**0.29**	**29.8**		5.00E-02	2.70E-01	1.70E-01	2.90E-01	**0.30**	**109**	U
U-238	9.00E-01	2.50E-01	9.40E-01	2.40E-01	**0.12**	**4.35**								
Total U Alpha	**1.78E+00**	**3.46E-01**	**1.86E+00**	**3.33E-01**										
Alpha Sum	**4.02E+00**	**1.82E+00**	**-4.82E-01**	**1.83E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	7.80E-02	4.40E-02	8.90E-02	5.50E-02	**0.16**	**13.2**								
Th-234 (Assumed from U-238)	9.00E-01	2.50E-01	9.40E-01	2.40E-01	**0.12**	**4.35**		1.12E+00	9.20E-01	-2.00E-02	6.30E-01	**1.02**	**207**	
Pa-234m (Assumed from U-238)	9.00E-01	2.50E-01	9.40E-01	2.40E-01	**0.12**	**4.35**		-2.30E+00	7.60E+00	9.00E-01	7.10E+00	**0.31**	**457**	U
K-40	2.04E+01	3.70E+00	2.00E+01	3.60E+00	**0.08**	**1.98**								
Ra-228	8.00E-01	2.10E-01	8.60E-01	2.20E-01	**0.20**	**7.23**								
Pa-231	-1.80E+00	1.90E+00	-2.60E+00	2.00E+00	**0.29**	**36.4**	U							
Beta Sum	**2.29E+01**	**3.73E+00**	**2.25E+01**	**3.63E+00**				**1.99E+01**	**8.51E+00**	**2.15E+01**	**7.99E+00**			
Total Activity Sum	**2.69E+01**	**4.15E+00**	**2.20E+01**	**4.07E+00**				**2.39E+01**	**8.70E+00**	**2.10E+01**	**8.20E+00**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	1.20E+00						**1.32**	**(from gamma)**		**52.7**			
Gross Beta	5.90E+00	1.00E+00					J	**4.39**	**1.63**		**118**			
Total Activity	1.35E+01	4.50E+00					J	**2.19**	**1.06**		**66.3**			

0107030-6			TMF-0056					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	4.70E-01					U
Ra-226	9.00E-01	2.20E-01	4.20E-01	1.80E-01	**1.69**	**72.7**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	2.10E-01	7.90E-01	1.80E-01	**0.65**	**20.5**								
Th-230	8.30E-01	1.80E-01	9.10E-01	1.80E-01	**0.31**	**9.20**	J							
Th-232	8.70E-01	1.80E-01	9.40E-01	1.90E-01	**0.27**	**7.73**								
U-234	9.50E-01	2.40E-01												
U-235	1.25E-01	7.50E-02						7.00E-02	3.10E-01					U
U-238	1.01E+00	2.50E-01												
Total U Alpha	**2.09E+00**	**3.55E-01**												
Alpha Sum	**6.29E+00**	**1.88E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.01E+00	2.50E-01						9.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	1.01E+00	2.50E-01						2.00E+00	1.00E+01					U
K-40	1.80E+01	3.90E+00												
Ra-228	6.00E-01	2.60E-01												
Pa-231	7.00E-01	2.00E+00					U							
Beta Sum	**2.07E+01**	**3.93E+00**						**2.16E+01**	**1.08E+01**					
Total Activity Sum	**2.70E+01**	**4.36E+00**						**2.79E+01**	**1.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.37E+00	9.70E-01						**0.91**	**(from gamma)**		**35.9**			
Gross Beta	4.05E+00	8.50E-01					J	**4.14**	**1.62**		**135**			
Total Activity	8.10E+00	4.10E+00					J	**3.16**	**1.69**		**108**			

0107030-7			TMF-0057					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	2.90E-01					U
Ra-226	4.80E-01	1.70E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	1.80E-01												
Th-230	7.50E-01	1.60E-01					J							
Th-232	6.80E-01	1.50E-01												
U-234	6.70E-01	1.90E-01												
U-235	7.50E-02	5.70E-02						1.00E-02	2.70E-01					U
U-238	6.30E-01	1.80E-01												
Total U Alpha	**1.38E+00**	**2.68E-01**												
Alpha Sum	**2.99E+00**	**1.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.30E-01	1.80E-01						7.10E-01	7.10E-01					
Pa-234m (Assumed from U-238)	6.30E-01	1.80E-01						6.20E+00	7.90E+00					U
K-40	1.52E+01	3.20E+00												
Ra-228	7.30E-01	2.30E-01												
Pa-231	-1.20E+00	1.50E+00					U							
Beta Sum	**1.70E+01**	**3.22E+00**						**2.27E+01**	**8.56E+00**					
Total Activity Sum	**2.00E+01**	**3.52E+00**						**2.57E+01**	**8.67E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.86E+00	9.60E-01						**1.10**	**(from gamma)**		**47.8**			
Gross Beta	4.34E+00	8.50E-01					J	**3.81**	**2.13**		**119**			
Total Activity	7.60E+00	4.10E+00					J	**2.30**	**1.88**		**90.0**			

0107030-8			TMF-0058					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.20E-01	4.80E-01					U
Ra-226	9.20E-01	2.50E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.00E-01												
Th-230	7.40E-01	1.70E-01					J							
Th-232	7.50E-01	1.70E-01												
U-234	8.90E-01	2.40E-01												
U-235	6.10E-02	5.50E-02						4.00E-02	3.10E-01					U
U-238	8.20E-01	2.30E-01												
Total U Alpha	**1.77E+00**	**3.37E-01**												
Alpha Sum	**4.90E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.20E-01	2.30E-01						1.40E+00	1.00E+00					
Pa-234m (Assumed from U-238)	8.20E-01	2.30E-01						-6.00E+00	1.10E+01					U
K-40	1.59E+01	3.60E+00												
Ra-228	6.00E-01	2.40E-01												
Pa-231	-1.00E-01	1.80E+00					U							
Beta Sum	**1.81E+01**	**3.63E+00**						**1.19E+01**	**1.16E+01**					
Total Activity Sum	**2.30E+01**	**4.01E+00**						**1.68E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.63E+00	9.20E-01						**0.14**	**(from gamma)**		**5.69**			
Gross Beta	4.31E+00	8.40E-01					J	**3.71**	**0.65**		**123**			
Total Activity	8.10E+00	4.20E+00					J	**2.57**	**0.70**		**95.9**			

0107030-9			TMF-0061					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.60E-01	3.10E-01					U
Ra-226	8.60E-01	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	1.60E-01												
Th-230	7.70E-01	1.50E-01					J							
Th-232	7.80E-01	1.50E-01												
U-234	8.00E-01	2.10E-01												
U-235	1.27E-01	7.70E-02						-1.40E-01	2.70E-01					U
U-238	7.40E-01	2.00E-01												
Total U Alpha	**1.67E+00**	**3.00E-01**												
Alpha Sum	**2.56E+00**	**1.77E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.00E-01						9.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	7.40E-01	2.00E-01						-2.00E+00	9.20E+00					U
K-40	1.78E+01	3.60E+00												
Ra-228	7.50E-01	2.60E-01												
Pa-231	-2.50E+00	1.90E+00					UJ							
Beta Sum	**1.97E+01**	**3.63E+00**						**1.72E+01**	**9.95E+00**					
Total Activity Sum	**2.23E+01**	**4.04E+00**						**1.97E+01**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.10E+00						**1.46**	**(from gamma)**		**74.6**			
Gross Beta	4.94E+00	9.20E-01					J	**3.95**	**1.22**		**120**			
Total Activity	1.21E+01	4.30E+00					J	**1.73**	**0.69**		**59.2**			

0107030-10			TMF-0062					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-03	8.30E-02					U
Ra-226	1.23E+00	2.70E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	1.80E-01												
Th-230	6.70E-01	1.50E-01					J							
Th-232	8.20E-01	1.70E-01												
U-234	7.40E-01	2.00E-01	7.50E-01	2.10E-01	**0.03**	**1.34**								
U-235	9.60E-02	6.50E-02	8.70E-02	6.20E-02	**0.10**	**9.84**		1.50E-01	2.80E-01					U
U-238	1.00E+00	2.40E-01	8.10E-01	2.20E-01	**0.58**	**21.0**								
Total U Alpha	**1.84E+00**	**3.19E-01**	**1.65E+00**	**3.10E-01**										
Alpha Sum	**4.48E+00**	**1.36E+00**	**1.65E+00**	**3.10E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.00E+00	2.40E-01	8.10E-01	2.20E-01	**0.58**	**21.0**		5.60E-01	6.40E-01					
Pa-234m (Assumed from U-238)	1.00E+00	2.40E-01	8.10E-01	2.20E-01	**0.58**	**21.0**		0.00E+00	1.10E+01					U
K-40	1.80E+01	3.90E+00												
Ra-228	8.20E-01	2.70E-01												
Pa-231	-1.00E+00	1.40E+00					U							
Beta Sum	**2.07E+01**	**3.93E+00**	**1.62E+00**	**3.11E-01**				**1.93E+01**	**1.17E+01**					
Total Activity Sum	**2.52E+01**	**4.16E+00**	**3.27E+00**	**4.39E-01**				**2.37E+01**	**1.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.47E+00	9.50E-01						**0.00**	**(from gamma)**		**0.13**			
Gross Beta	4.47E+00	8.90E-01					J	**4.03**	**1.26**		**129**			
Total Activity	7.80E+00	4.10E+00					J	**2.98**	**1.28**		**105**			

0107030-11			TMF-0067					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01					U
Ra-226	7.80E-01	2.10E-01	8.50E-01	2.20E-01	**0.23**	**8.59**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.00E-01												
Th-230	9.10E-01	2.00E-01					J							
Th-232	8.50E-01	1.90E-01												
U-234	7.50E-01	2.10E-01												
U-235	4.70E-02	4.80E-02						1.20E-01	2.80E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.66E+00**	**3.15E-01**												
Alpha Sum	**5.25E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						8.40E-01	6.30E-01					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						2.90E+00	9.60E+00					U
K-40	1.85E+01	3.90E+00												
Ra-228	9.30E-01	2.90E-01												
Pa-231	2.00E-01	1.50E+00					U							
Beta Sum	**2.12E+01**	**3.93E+00**						**2.32E+01**	**1.04E+01**					
Total Activity Sum	**2.64E+01**	**4.19E+00**						**2.84E+01**	**1.05E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.10E+00	5.40E+00	1.00E+00	**0.47**	**12.2**		**0.47**	**(from gamma)**		**15.0**			
Gross Beta	4.82E+00	9.10E-01	4.25E+00	8.50E-01	**0.46**	**12.6**	J	**4.06**	**1.76**		**126**			
Total Activity	8.00E+00	4.20E+00	7.60E+00	4.20E+00	**0.07**	**5.13**	J	**3.11**	**1.81**		**107**			

0107030-12			TMF-0068					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	1.70E-01					U
Ra-226	1.03E+00	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.00E-01												
Th-230	9.20E-01	1.80E-01					J							
Th-232	8.90E-01	1.80E-01												
U-234	9.20E-01	2.50E-01												
U-235	8.30E-02	6.60E-02						-1.20E-01	2.60E-01					U
U-238	8.30E-01	2.30E-01												
Total U Alpha	**1.83E+00**	**3.46E-01**												
Alpha Sum	**6.15E+00**	**1.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.30E-01						1.20E-01	7.20E-01					U
Pa-234m (Assumed from U-238)	8.30E-01	2.30E-01						5.30E+00	7.60E+00					U
K-40	2.18E+01	3.90E+00												
Ra-228	8.50E-01	2.10E-01												
Pa-231	6.00E-01	1.90E+00					U							
Beta Sum	**2.44E+01**	**3.93E+00**						**2.81E+01**	**8.58E+00**					
Total Activity Sum	**3.05E+01**	**4.31E+00**						**3.43E+01**	**8.76E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.70E+00	1.20E+00						**0.25**	**(from gamma)**		**8.51**			
Gross Beta	5.10E+00	1.00E+00					J	**4.76**	**2.67**		**131**			
Total Activity	1.24E+01	4.40E+00					J	**2.94**	**2.23**		**84.5**			

0107030-13			TMF-0069					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	2.60E-01					U
Ra-226	7.70E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.10E-01	1.80E-01												
Th-230	9.80E-01	2.10E-01					J							
Th-232	7.40E-01	1.70E-01												
U-234	9.40E-01	2.40E-01												
U-235	1.01E-01	6.70E-02						3.00E-02	2.70E-01					U
U-238	9.70E-01	2.40E-01												
Total U Alpha	**2.01E+00**	**3.46E-01**												
Alpha Sum	**5.30E+00**	**1.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.70E-01	2.40E-01						1.17E+00	7.50E-01					
Pa-234m (Assumed from U-238)	9.70E-01	2.40E-01						1.20E+00	6.60E+00					U
K-40	1.49E+01	2.80E+00												
Ra-228	7.30E-01	1.90E-01												
Pa-231	1.00E-01	1.30E+00					U							
Beta Sum	**1.76E+01**	**2.83E+00**						**1.80E+01**	**7.21E+00**					
Total Activity Sum	**2.29E+01**	**3.11E+00**						**2.33E+01**	**7.33E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+00	1.10E+00						**0.47**	**(from gamma)**		**16.3**			
Gross Beta	3.93E+00	8.10E-01					J	**4.64**	**1.94**		**127**			
Total Activity	1.18E+01	4.60E+00					J	**2.00**	**1.33**		**63.9**			

0107030-14			TMF-0070					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.70E-01	3.20E-01	-6.00E-02	1.10E-01	**0.33**	**95.7**	U
Ra-226	7.10E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	5.70E-01	1.60E-01												
Th-230	7.30E-01	1.60E-01					J							
Th-232	5.40E-01	1.30E-01												
U-234	7.80E-01	2.40E-01												
U-235	8.90E-02	7.30E-02						-1.50E-01	4.30E-01	-2.70E-01	4.00E-01	**0.20**	**57.1**	U
U-238	7.50E-01	2.30E-01												
Total U Alpha	**1.62E+00**	**3.40E-01**												
Alpha Sum	**2.82E+00**	**2.03E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.30E-01						3.00E-01	1.20E+00	4.50E-01	7.80E-01	**0.10**	**40.0**	U
Pa-234m (Assumed from U-238)	7.50E-01	2.30E-01						8.00E+00	1.40E+01	1.30E+01	2.20E+01	**0.19**	**47.6**	U
K-40	1.12E+01	2.80E+00	1.02E+01	3.60E+00	**0.22**	**9.35**								
Ra-228	4.10E-01	2.30E-01	5.90E-01	5.20E-01	**0.32**	**36.0**								
Pa-231	-1.50E+00	2.20E+00	-9.00E-01	2.80E+00	**0.17**	**50.0**	U							
Beta Sum	**1.29E+01**	**2.84E+00**						**1.97E+01**	**1.43E+01**	**2.41E+01**	**2.23E+01**			
Total Activity Sum	**1.57E+01**	**3.49E+00**						**2.25E+01**	**1.45E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	1.30E+00						**1.15**	**(from gamma)**		**66.1**			
Gross Beta	3.41E+00	8.90E-01					J	**3.20**	**1.14**		**117**			
Total Activity	1.20E+01	4.60E+00					J	**0.65**	**0.69**		**27.0**			

0107030-15			TMF-0073					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.70E-01	4.90E-01					U
Ra-226	7.30E-01	3.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.90E-01												
Th-230	7.80E-01	1.70E-01					J							
Th-232	7.60E-01	1.70E-01												
U-234	7.30E-01	2.20E-01												
U-235	6.90E-02	6.30E-02						3.00E-02	3.00E-01					U
U-238	5.90E-01	2.00E-01												
Total U Alpha	**1.39E+00**	**3.04E-01**												
Alpha Sum	**3.02E+00**	**1.88E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.90E-01	2.00E-01						4.90E-01	7.50E-01					U
Pa-234m (Assumed from U-238)	5.90E-01	2.00E-01						0.00E+00	8.40E+00					U
K-40	1.64E+01	3.40E+00												
Ra-228	5.90E-01	2.20E-01												
Pa-231	-1.70E+00	2.00E+00					U							
Beta Sum	**1.80E+01**	**3.43E+00**						**1.73E+01**	**9.10E+00**					
Total Activity Sum	**2.10E+01**	**3.91E+00**						**2.03E+01**	**9.29E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.70E+00	1.10E+00						**0.77**	**(from gamma)**		**43.6**			
Gross Beta	5.20E+00	1.00E+00					J	**3.58**	**1.32**		**110**			
Total Activity	1.44E+01	4.60E+00					J	**1.09**	**0.57**		**37.2**			

0107030-16			TMF-0074					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	3.00E-01					U
Ra-226	8.40E-01	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	2.00E-01												
Th-230	1.01E+00	2.10E-01					J							
Th-232	1.05E+00	2.10E-01												
U-234	1.03E+00	2.80E-01												
U-235	7.10E-02	6.50E-02						-7.00E-02	3.00E-01					U
U-238	1.06E+00	2.90E-01												
Total U Alpha	**2.16E+00**	**4.08E-01**												
Alpha Sum	**4.47E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+00	2.90E-01						1.09E+00	8.90E-01					
Pa-234m (Assumed from U-238)	1.06E+00	2.90E-01						5.20E+00	8.30E+00					U
K-40	1.58E+01	3.30E+00												
Ra-228	7.70E-01	2.40E-01												
Pa-231	-1.60E+00	1.80E+00					U							
Beta Sum	**1.85E+01**	**3.34E+00**						**2.27E+01**	**8.98E+00**					
Total Activity Sum	**2.30E+01**	**3.76E+00**						**2.71E+01**	**9.15E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00						**0.82**	**(from gamma)**		**32.4**			
Gross Beta	4.93E+00	9.40E-01					J	**3.91**	**1.96**		**116**			
Total Activity	1.09E+01	4.30E+00					J	**2.11**	**1.61**		**71.3**			

0107030-17			TMF-0075					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.00E-01					U
Ra-226	1.01E+00	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	2.20E-01												
Th-230	9.90E-01	2.00E-01					J							
Th-232	7.90E-01	1.70E-01												
U-234	8.80E-01	2.40E-01	9.20E-01	2.40E-01	**0.12**	**4.44**								
U-235	1.21E-01	7.80E-02	1.07E-01	7.20E-02	**0.13**	**12.3**		3.00E-02	3.30E-01					U
U-238	9.90E-01	2.60E-01	1.05E+00	2.60E-01	**0.16**	**5.88**								
Total U Alpha	**1.99E+00**	**3.62E-01**	**2.08E+00**	**3.61E-01**										
Alpha Sum	**5.78E+00**	**1.80E+00**	**2.08E+00**	**3.61E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.90E-01	2.60E-01	1.05E+00	2.60E-01	**0.16**	**5.88**		1.40E+00	7.40E-01					
Pa-234m (Assumed from U-238)	9.90E-01	2.60E-01	1.05E+00	2.60E-01	**0.16**	**5.88**		6.70E+00	9.70E+00					U
K-40	1.61E+01	3.80E+00												
Ra-228	7.30E-01	2.80E-01												
Pa-231	0.00E+00	1.90E+00					U							
Beta Sum	**1.88E+01**	**3.83E+00**	**2.10E+00**	**3.68E-01**				**2.49E+01**	**1.05E+01**					
Total Activity Sum	**2.46E+01**	**4.24E+00**	**4.18E+00**	**5.15E-01**				**3.07E+01**	**1.06E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.20E+00						**0.15**	**(from gamma)**		**5.37**			
Gross Beta	4.89E+00	9.50E-01					J	**3.52**	**1.91**		**117**			
Total Activity	1.36E+01	4.40E+00					J	**1.80**	**1.49**		**57.6**			

0107030-18			TMF-0076					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.40E-01	5.90E-01					U
Ra-226	8.50E-01	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.20E+00	2.30E-01												
Th-230	9.30E-01	1.90E-01					J							
Th-232	1.05E+00	2.10E-01												
U-234	9.50E-01	2.40E-01												
U-235	8.50E-02	6.20E-02						1.70E-01	3.60E-01					U
U-238	1.03E+00	2.50E-01												
Total U Alpha	**2.07E+00**	**3.52E-01**												
Alpha Sum	**6.37E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.03E+00	2.50E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	1.03E+00	2.50E-01						1.00E+01	1.20E+01					
K-40	2.12E+01	4.50E+00												
Ra-228	1.15E+00	3.60E-01												
Pa-231	3.00E-01	1.90E+00					U							
Beta Sum	**2.44E+01**	**4.53E+00**						**3.32E+01**	**1.29E+01**					
Total Activity Sum	**3.08E+01**	**4.88E+00**						**3.96E+01**	**1.30E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.50E+00	1.30E+00						**0.51**	**(from gamma)**		**16.4**			
Gross Beta	6.20E+00	1.10E+00					J	**3.91**	**2.09**		**119**			
Total Activity	1.50E+01	4.40E+00					J	**2.41**	**1.79**		**69.0**			

0107030-19			TMF-0079					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.10E-01					U
Ra-226	1.11E+00	2.50E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.29E+00	2.70E-01												
Th-230	1.23E+00	2.50E-01												
Th-232	9.90E-01	2.10E-01												
U-234	9.60E-01	2.40E-01												
U-235	1.13E-01	7.20E-02						-4.00E-02	2.80E-01					U
U-238	9.90E-01	2.50E-01												
Total U Alpha	**2.06E+00**	**3.54E-01**												
Alpha Sum	**5.87E+00**	**1.81E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.90E-01	2.50E-01						1.30E+00	8.10E-01					
Pa-234m (Assumed from U-238)	9.90E-01	2.50E-01						1.00E+00	9.00E+00					U
K-40	1.85E+01	4.00E+00												
Ra-228	9.20E-01	3.40E-01												
Pa-231	-9.00E-01	1.90E+00					U							
Beta Sum	**2.13E+01**	**4.04E+00**						**2.16E+01**	**9.89E+00**					
Total Activity Sum	**2.72E+01**	**4.43E+00**						**2.75E+01**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.50E+00	1.30E+00						**0.73**	**(from gamma)**		**24.3**			
Gross Beta	5.80E+00	1.10E+00					J	**3.70**	**1.59**		**114**			
Total Activity	1.46E+01	4.50E+00					J	**1.99**	**1.17**		**60.2**			

0107030-20			TMF-0080					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.30E-01	1.60E-01					U
Ra-226	8.40E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	2.00E-01												
Th-230	8.60E-01	1.80E-01					J							
Th-232	8.30E-01	1.80E-01												
U-234	1.00E+00	2.70E-01												
U-235	9.50E-02	7.20E-02						4.00E-02	2.70E-01					U
U-238	9.70E-01	2.60E-01												
Total U Alpha	**2.07E+00**	**3.82E-01**												
Alpha Sum	**6.37E+00**	**1.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.70E-01	2.60E-01						8.40E-01	7.10E-01					
Pa-234m (Assumed from U-238)	9.70E-01	2.60E-01						9.00E-01	6.90E+00					U
K-40	1.94E+01	3.50E+00												
Ra-228	8.70E-01	2.20E-01												
Pa-231	9.00E-01	1.30E+00					U							
Beta Sum	**2.23E+01**	**3.53E+00**						**2.21E+01**	**7.77E+00**					
Total Activity Sum	**2.87E+01**	**3.76E+00**						**2.85E+01**	**7.88E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	1.20E+00						**0.30**	**(from gamma)**		**8.07**			
Gross Beta	4.62E+00	8.90E-01					J	**4.86**	**2.24**		**131**			
Total Activity	1.16E+01	4.30E+00					J	**2.99**	**1.88**		**84.8**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107095

This sample delivery group (SDG) contained twenty (20) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 13, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0131	0107095-1
TMF-0132	0107095-2
TMF-0121	0107095-3
TMF-0122	0107095-4
TMF-0127	0107095-5
TMF-0128	0107095-6
TMF-0175	0107095-7
TMF-0176	0107095-8
TMF-0178	0107095-9
TMF-0179	0107095-10
TMF-0181	0107095-11
TMF-0182	0107095-12
TMF-0187	0107095-13
TMF-0188	0107095-14
TMF-0184	0107095-15
TMF-0185	0107095-16
TMF-9199	0107095-17
TMF-9200	0107095-18
TMF-0166	0107095-19
TMF-0167	0107095-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was reported by the laboratory in the EQ-1 and EQ-02 equipment rinsate blanks. However, ^{137}Cs peak was identified in gamma spectrometry report for equipment rinsate sample # EQ-1. All associated sample results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). There was ^{137}Cs activity reported for samples TMF-0121, TMF-0127, TMF-0181 and TMF-0187. The reported ^{137}Cs results were greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification of ^{137}Cs results in the sample is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits for the gamma spectrometry analysis.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Results for natural ^{40}K were also reported for all samples. There was ^{137}Cs activity reported for samples TMF-0121 (1.44E-01±9.20E-02), TMF-0127 (7.6E-02±8.8E-02), TMF-0181 (1.37E-01±9.40E-02), and TMF-0187 (2.30E-01±1.20E-01). There were no incidents of identified radionuclides being excluded from the laboratory reports.

In addition, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples. The $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near or total equilibrium with ^{238}U and ^{232}Th. The presence of $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl in the stated concentration is not out of the question for these samples considering the amount of ^{232}Th and ^{238}U present. **Inclusion of $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl in the database is recommended for information purposes only since any modeling will assume equilibrium with parent ^{232}Th and ^{238}U.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for the ^{231}Pa result for sample TMF-0127. **It is recommended that the ^{231}Pa result for sample TMF-0127 be qualified as estimated (J).** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{230}Th results in method blank. All associated samples results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). For all samples the ^{230}Th results are greater than 5 times the ^{230}Th concentrations identified in the method blank. No qualification of ^{230}Th results for sample is necessary.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis. There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No further qualification of the alpha isotopic results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 20.99% for all samples for the alpha analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty. No qualification of is required.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination either in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analysis were within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate ^{226}Ra analysis.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity analysis duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC. **It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.**

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities are within acceptable limits indicating that the gross alpha analyses agree with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. DERs for samples TMF-0131 (4.51), TMF-0132 (4.21), TMF-0121 (3.65), TMF-0122 (4.36), TMF-0127 (3.49), TMF-0128 (4.06), TMF-0176 (4.37), TMF-0178 (3.48), TMF-0179 (3.56), TMF-0181 (2.75), TMF-0182 (4.48), TMF-0187 (3.29), TMF-0188 (3.72), TMF-0184 (4.39), TMF-9199 (3.00), TMF-9200 (4.27), TMF-0166 (3.18), and TMF-0167 (4.16) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (123%, 128%, 124%, 115%, 113%, 124%, 120%, 113%, 116%, 104%, 123%, 97.8%, 113% 123%, 127%, 108%, and 123% respectively) are also outside acceptable limits. The gross beta results are about 3-4 times smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the sample preparation as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the sum of the alpha and beta emitters, the DERs for samples TMF-0131 (3.45), TMF-0132 (3.79), TMF-0121 (2.54), TMF-0122 (2.76), TMF-0127 (2.01), TMF-0128 (2.95), TMF-0176 (3.46), TMF-0178 (1.42), TMF-0179 (2.48), TMF-0182 (3.51), TMF-0188 (3.13), TMF-0184 (3.04), TMF-9199 (1.88), TMF-9200 (2.68), TMF-0166 (2.02), and TMF-0167 (3.09) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (106%, 132%, 87.4%, 82.5%, 75.9%, 107%, 103%, 50.6%, 96.4%, 102%, 108%, 102%, 81.7% 89.9%, 74.8%, and 103% respectively) are also outside acceptable limits. Samples TMF-0131, TMF-0132, TMF-0121, TMF-0122, TMF-0127, TMF-0128, TMF-0176, TMF-0178, TMF-0179, TMF-0182, TMF-0188, TMF-0184, TMF-9199, TMF-9200, TMF-0166, and TMF-0167 have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 1.9 to 4.5. This is most likely due to a negative bias in the total activity results due to sample preparation as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

0107095-1			TMF-0131					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	2.60E-01	6.00E-02	3.40E-01	**0.33**	**1400**	U
Ra-226	8.90E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.13E+00	1.90E-01	1.05E+00	1.90E-01	**0.30**	**7.34**								
Th-230	1.04E+00	1.70E-01	9.60E-01	1.70E-01	**0.33**	**8.00**								
Th-232	9.90E-01	1.60E-01	8.70E-01	1.60E-01	**0.53**	**12.9**								
U-234	9.70E-01	2.40E-01												
U-235	6.30E-02	5.20E-02						2.40E-01	2.90E-01	1.00E-02	3.40E-01	**0.51**	**184**	
U-238	1.00E+00	2.40E-01												
Total U Alpha	**2.03E+00**	**3.43E-01**												
Alpha Sum	**6.80E+00**	**1.45E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.70E+01	3.20E+00	1.51E+01	3.30E+00	**0.41**	**11.8**								
Th-234 (Assumed from U-238)	1.00E+00	2.40E-01						1.68E+00	9.90E-01	1.20E+00	1.10E+00	**0.32**	**33.3**	
Pa-234m (Assumed from U-238)	1.00E+00	2.40E-01						8.40E+00	7.80E+00	8.00E+00	1.10E+01	**0.03**	**4.88**	
Ac-227														
Ra-228	7.50E-01	2.10E-01	8.90E-01	2.60E-01	**0.42**	**17.1**								
Pa-231	8.00E-01	1.50E+00	-1.40E+00	2.70E+00	**0.71**	**733**	U							
Beta Sum	**1.98E+01**	**3.23E+00**						**2.79E+01**	**8.49E+00**	**2.50E+01**	**1.15E+01**			
Total Activity Sum	**2.66E+01**	**3.54E+00**						**3.47E+01**	**8.62E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.10E+00						**0.33**	**(from gamma)**		**9.27**			
Gross Beta	4.74E+00	8.80E-01					J	**4.51**	**2.72**		**123**			
Total Activity	8.20E+00	4.00E+00					J	**3.45**	**2.79**		**106**			

0107095-2			TMF-0132					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.80E-01	3.30E-01					U
Ra-226	1.10E+00	4.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.60E-01												
Th-230	8.10E-01	1.50E-01												
Th-232	9.40E-01	1.60E-01												
U-234	7.90E-01	2.00E-01												
U-235	9.40E-02	6.10E-02						1.00E-02	3.10E-01					U
U-238	9.00E-01	2.20E-01												
Total U Alpha	**1.78E+00**	**3.04E-01**												
Alpha Sum	**5.08E+00**	**1.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.98E+01	4.00E+00												
Th-234 (Assumed from U-238)	9.00E-01	2.20E-01						7.90E-01	8.40E-01					
Pa-234m (Assumed from U-238)	9.00E-01	2.20E-01						4.40E+00	1.00E+01					U
Ac-227														
Ra-228	8.10E-01	2.80E-01												
Pa-231	-5.00E-01	1.90E+00					U							
Beta Sum	**2.24E+01**	**4.03E+00**						**2.57E+01**	**1.08E+01**					
Total Activity Sum	**2.74E+01**	**4.42E+00**						**3.08E+01**	**1.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00						**0.51**	**(from gamma)**		**19.8**			
Gross Beta	4.94E+00	9.20E-01					J	**4.21**	**1.92**		**128**			
Total Activity	5.60E+00	3.70E+00					J	**3.79**	**2.18**		**132**			

0107095-3			TMF-0121					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01					U
Ra-226	1.22E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.03E+00	1.80E-01												
Th-230	1.10E+00	1.80E-01												
Th-232	1.14E+00	1.90E-01												
U-234	1.08E+00	2.90E-01												
U-235	7.50E-02	6.70E-02						-1.30E-01	3.50E-01					U
U-238	9.90E-01	2.80E-01												
Total U Alpha	**2.15E+00**	**4.09E-01**												
Alpha Sum	**5.83E+00**	**2.06E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
K-40	1.90E+01	4.50E+00												
Cs-137	1.44E-01	9.20E-02												
Th-234 (Assumed from U-238)	9.90E-01	2.80E-01						1.11E+00	8.80E-01					
Pa-234m (Assumed from U-238)	9.90E-01	2.80E-01						2.00E+00	1.30E+01					U
Ac-227														
Ra-228	9.70E-01	4.10E-01												
Pa-231	-9.00E-01	2.20E+00					U							
Beta Sum	**2.20E+01**	**4.54E+00**						**2.31E+01**	**1.38E+01**					
Total Activity Sum	**2.78E+01**	**4.99E+00**						**2.89E+01**	**1.39E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	1.10E+00	5.46E+00	9.10E-01	**1.01**	**23.3**		**0.46**	**(from gamma)**		**16.9**			
Gross Beta	5.12E+00	8.10E-01	4.65E+00	7.60E-01	**0.42**	**9.62**	J	**3.65**	**1.30**		**124**			
Total Activity	1.09E+01	4.40E+00	9.10E+00	4.20E+00	**0.30**	**18.0**	J	**2.54**	**1.23**		**87.4**			

0107095-4			TMF-0122					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.60E-01					U
Ra-226	6.80E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.40E-01	1.60E-01												
Th-230	8.10E-01	1.50E-01												
Th-232	8.40E-01	1.50E-01												
U-234	7.40E-01	2.20E-01	8.00E-01	2.10E-01	**0.20**	**7.79**								
U-235	1.20E-01	8.10E-02	1.01E-01	6.80E-02	**0.18**	**17.2**		-4.00E-02	2.60E-01					U
U-238	7.80E-01	2.30E-01	9.10E-01	2.30E-01	**0.40**	**15.4**								
Total U Alpha	**1.64E+00**	**3.28E-01**	**1.81E+00**	**3.19E-01**										
Alpha Sum	**4.45E+00**	**1.18E+00**	**1.81E+00**	**3.19E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.77E+01	3.20E+00												
Th-234 (Assumed from U-238)	7.80E-01	2.30E-01	9.10E-01	2.30E-01	**0.40**	**15.4**		1.14E+00	8.60E-01					
Pa-234m (Assumed from U-238)	7.80E-01	2.30E-01	9.10E-01	2.30E-01	**0.40**	**15.4**		1.00E-01	7.30E+00					U
Ac-227														
Ra-228	8.60E-01	2.10E-01												
Pa-231	-4.00E-01	1.20E+00					U							
Beta Sum	**2.01E+01**	**3.23E+00**	**1.82E+00**	**3.25E-01**				**1.98E+01**	**8.02E+00**					
Total Activity Sum	**2.45E+01**	**3.43E+00**	**3.63E+00**	**4.55E-01**				**2.42E+01**	**8.11E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+00	1.10E+00						**0.65**	**(from gamma)**		**21.1**			
Gross Beta	5.39E+00	9.70E-01					J	**4.36**	**1.78**		**115**			
Total Activity	1.02E+01	3.90E+00					J	**2.76**	**1.56**		**82.5**			

0107095-5			TMF-0127					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.30E-01	1.40E-01	2.90E-01	**0.35**	**129**	U
Ra-226	1.01E+00	2.30E-01	1.00E+00	3.00E-01	**0.03**	**1.00**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.70E-01	1.04E+00	1.90E-01	**0.31**	**8.00**								
Th-230	9.60E-01	1.60E-01	8.90E-01	1.60E-01	**0.31**	**7.57**								
Th-232	9.60E-01	1.60E-01	1.06E+00	1.80E-01	**0.42**	**9.90**								
U-234	7.50E-01	2.30E-01												
U-235	5.50E-02	5.60E-02						-2.20E-01	3.00E-01	-9.00E-02	3.20E-01	**0.30**	**83.9**	U
U-238	9.00E-01	2.50E-01												
Total U Alpha	**1.71E+00**	**3.44E-01**												
Alpha Sum	**3.35E+00**	**1.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
K-40	1.56E+01	3.60E+00	1.53E+01	2.90E+00	**0.06**	**1.94**								
Cs-137	7.60E-02	8.80E-02	1.21E-01	6.40E-02	**0.41**	**45.7**								
Th-234 (Assumed from U-238)	9.00E-01	2.50E-01						1.03E+00	8.80E-01	7.00E-01	1.00E+00	**0.25**	**38.2**	
Pa-234m (Assumed from U-238)	9.00E-01	2.50E-01						1.00E+00	1.10E+01	4.60E+00	8.10E+00	**0.26**	**129**	U
Ac-227														
Ra-228	8.30E-01	3.00E-01	7.10E-01	2.10E-01	**0.33**	**15.6**								
Pa-231	-2.50E+00	1.90E+00	-1.60E+00	2.40E+00	**0.29**	**43.9**	UJ							
Beta Sum	**1.80E+01**	**3.64E+00**						**1.82E+01**	**1.16E+01**	**2.12E+01**	**8.67E+00**			
Total Activity Sum	**2.14E+01**	**4.05E+00**						**2.16E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.70E+00	1.10E+00						**1.60**	**(from gamma)**		**66.8**			
Gross Beta	5.00E+00	8.00E-01					J	**3.49**	**1.14**		**113**			
Total Activity	9.60E+00	4.20E+00					J	**2.01**	**0.96**		**75.9**			

**NOTE: Cs-137 original sample results were not listed on the Form 1, however they were listed on the QC form with the duplicate results

0107095-6			TMF-0128					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.60E-01	4.80E-01					
Ra-226	8.00E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.60E-01												
Th-230	7.70E-01	1.50E-01												
Th-232	8.00E-01	1.50E-01												
U-234	8.20E-01	2.10E-01												
U-235	7.30E-02	5.50E-02						-1.40E-01	3.20E-01					U
U-238	8.80E-01	2.20E-01												
Total U Alpha	**1.77E+00**	**3.09E-01**												
Alpha Sum	**3.86E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.74E+01	3.60E+00												
Th-234 (Assumed from U-238)	8.80E-01	2.20E-01						6.60E-01	9.80E-01					U
Pa-234m (Assumed from U-238)	8.80E-01	2.20E-01						5.20E+00	9.20E+00					U
Ac-227														
Ra-228	7.70E-01	2.30E-01												
Pa-231	-1.20E+00	2.00E+00					U							
Beta Sum	**1.98E+01**	**3.63E+00**						**2.39E+01**	**9.93E+00**					
Total Activity Sum	**2.36E+01**	**4.08E+00**						**2.77E+01**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.10E+00	5.50E+00	1.10E+00	**0.26**	**7.02**		**0.94**	**(from gamma)**		**41.7**			
Gross Beta	4.61E+00	9.10E-01	5.07E+00	9.30E-01	**0.35**	**9.50**	J	**4.06**	**1.93**		**124**			
Total Activity	7.20E+00	3.80E+00	9.20E+00	3.80E+00	**0.37**	**24.4**	J	**2.95**	**1.90**		**107**			

0107095-7			TMF-0175					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.80E-02	8.30E-02					U
Ra-226	5.00E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.70E-01	1.20E-01												
Th-230	5.00E-01	1.20E-01												
Th-232	2.27E-01	7.10E-02												
U-234	4.90E-01	1.60E-01												
U-235	5.90E-02	5.30E-02						-2.80E-01	2.50E-01					U
U-238	3.90E-01	1.50E-01												
Total U Alpha	**9.39E-01**	**2.26E-01**												
Alpha Sum	**2.80E+00**	**1.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	4.60E+00	1.80E+00												
Th-234 (Assumed from U-238)	3.90E-01	1.50E-01						3.00E-01	4.80E-01					U
Pa-234m (Assumed from U-238)	3.90E-01	1.50E-01						5.40E+00	8.60E+00					U
Ac-227														
Ra-228	3.80E-01	2.80E-01												
Pa-231	4.00E-01	1.50E+00					U							
Beta Sum	**5.81E+00**	**1.84E+00**						**1.07E+01**	**8.81E+00**					
Total Activity Sum	**8.60E+00**	**2.31E+00**						**1.35E+01**	**8.92E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.90E+00	1.30E+00						**0.05**	**(from gamma)**		**3.65**			
Gross Beta	3.00E+00	1.60E+00					J	**1.15**	**0.86**		**63.8**			
Total Activity	1.14E+01	4.70E+00					J	**0.53**	**0.21**		**28.0**			

0107095-8			TMF-0176					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.20E-01	1.60E-01					U
Ra-226	9.50E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	2.10E-01												
Th-230	1.02E+00	2.00E-01												
Th-232	1.10E+00	2.10E-01												
U-234	7.00E-01	2.00E-01												
U-235	5.60E-02	5.20E-02						-1.00E-02	2.60E-01					U
U-238	7.60E-01	2.10E-01												
Total U Alpha	**1.52E+00**	**2.95E-01**												
Alpha Sum	**5.48E+00**	**1.20E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.95E+01	3.60E+00												
Th-234 (Assumed from U-238)	7.60E-01	2.10E-01						4.00E-02	5.00E-01					U
Pa-234m (Assumed from U-238)	7.60E-01	2.10E-01						2.80E+00	7.00E+00					U
Ac-227														
Ra-228	8.30E-01	2.10E-01												
Pa-231	-1.00E-01	1.20E+00					U							
Beta Sum	**2.18E+01**	**3.62E+00**						**2.32E+01**	**7.89E+00**					
Total Activity Sum	**2.73E+01**	**3.82E+00**						**2.86E+01**	**7.98E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.20**	**(from gamma)**		**5.75**			
Gross Beta	5.44E+00	9.80E-01					J	**4.37**	**2.23**		**120**			
Total Activity	8.70E+00	3.80E+00					J	**3.46**	**2.25**		**103**			

0107095-9			TMF-0178					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.20E-01					U
Ra-226	8.20E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.80E-01												
Th-230	1.02E+00	1.80E-01												
Th-232	8.50E-01	1.50E-01												
U-234	7.10E-01	2.10E-01	9.20E-01	2.30E-01	**0.67**	**25.8**								
U-235	1.20E-02	3.50E-02	9.60E-02	6.60E-02	**1.12**	**156**	U	3.20E-01	3.00E-01					
U-238	1.09E+00	2.70E-01	8.50E-01	2.20E-01	**0.69**	**24.7**								
Total U Alpha	**1.81E+00**	**3.44E-01**	**1.87E+00**	**3.25E-01**										
Alpha Sum	**4.83E+00**	**1.78E+00**	**1.87E+00**	**3.25E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.18E+01	2.90E+00												
Th-234 (Assumed from U-238)	1.09E+00	2.70E-01	8.50E-01	2.20E-01	**0.69**	**24.7**		8.50E-01	7.40E-01					
Pa-234m (Assumed from U-238)	1.09E+00	2.70E-01	8.50E-01	2.20E-01	**0.69**	**24.7**		3.60E+00	9.80E+00					U
Ac-227														
Ra-228	7.20E-01	2.70E-01												
Pa-231	-7.00E-01	1.90E+00					U							
Beta Sum	**1.46E+01**	**2.95E+00**	**1.70E+00**	**3.11E-01**				**1.69E+01**	**1.03E+01**					
Total Activity Sum	**1.94E+01**	**3.44E+00**	**3.57E+00**	**4.50E-01**				**2.17E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.58E+00	9.30E-01						**0.37**	**(from gamma)**		**14.4**			
Gross Beta	4.09E+00	7.00E-01					J	**3.48**	**1.25**		**113**			
Total Activity	1.16E+01	4.30E+00					J	**1.42**	**0.90**		**50.6**			

0107095-10			TMF-0179					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.60E-01	5.30E-01					U
Ra-226	6.60E-01	2.00E-01	8.90E-01	2.30E-01	**0.75**	**29.7**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	1.60E-01												
Th-230	8.30E-01	1.50E-01												
Th-232	8.30E-01	1.50E-01												
U-234	6.10E-01	1.80E-01												
U-235	5.00E-03	2.30E-02					U	0.00E+00	2.90E-01					U
U-238	7.80E-01	2.10E-01												
Total U Alpha	**1.40E+00**	**2.78E-01**												
Alpha Sum	**3.76E+00**	**1.59E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.36E+01	3.10E+00												
Th-234 (Assumed from U-238)	7.80E-01	2.10E-01						7.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	7.80E-01	2.10E-01						-2.00E+00	1.20E+01					U
Ac-227														
Ra-228	6.40E-01	2.70E-01												
Pa-231	-8.00E-01	1.70E+00					U							
Beta Sum	**1.57E+01**	**3.13E+00**						**1.28E+01**	**1.24E+01**					
Total Activity Sum	**1.95E+01**	**3.51E+00**						**1.66E+01**	**1.25E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.51E+00	9.60E-01						**0.41**	**(from gamma)**		**18.3**			
Gross Beta	4.16E+00	8.40E-01					J	**3.56**	**0.70**		**116**			
Total Activity	6.80E+00	3.70E+00					J	**2.48**	**0.75**		**96.4**			

0107095-11			TMF-0181					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								9.00E-02	1.10E-01					U
Ra-226	3.70E-01	1.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.80E-01	1.30E-01												
Th-230	7.00E-01	1.30E-01												
Th-232	4.70E-01	1.00E-01												
U-234	5.30E-01	1.70E-01												
U-235	8.70E-02	6.40E-02						-2.30E-01	3.20E-01					U
U-238	5.80E-01	1.80E-01												
Total U Alpha	**1.20E+00**	**2.56E-01**												
Alpha Sum	**3.32E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
K-40	1.22E+01	3.30E+00												
Cs-137	1.37E-01	9.40E-02												
Th-234 (Assumed from U-238)	5.80E-01	1.80E-01						5.60E-01	6.50E-01					
Pa-234m (Assumed from U-238)	5.80E-01	1.80E-01						-5.00E+00	1.30E+01					U
Ac-227														
Ra-228	4.30E-01	3.10E-01												
Pa-231	0.00E+00	1.90E+00					U							
Beta Sum	**1.39E+01**	**3.33E+00**						**8.33E+00**	**1.34E+01**					
Total Activity Sum	**1.72E+01**	**3.77E+00**						**1.16E+01**	**1.35E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.10E+00						**0.91**	**(from gamma)**		**44.2**			
Gross Beta	4.38E+00	9.50E-01					J	**2.75**	**0.29**		**104**			
Total Activity	1.28E+01	6.30E+00					J	**0.61**	**0.08**		**29.6**			

0107095-12			TMF-0182					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	2.60E-01					U
Ra-226	6.50E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	1.80E-01												
Th-230	9.70E-01	1.70E-01												
Th-232	1.08E+00	1.80E-01												
U-234	6.60E-01	1.90E-01												
U-235	4.80E-02	4.90E-02						5.00E-02	2.60E-01					U
U-238	7.60E-01	2.10E-01												
Total U Alpha	**1.47E+00**	**2.87E-01**												
Alpha Sum	**5.93E+00**	**1.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	2.02E+01	3.70E+00												
Th-234 (Assumed from U-238)	7.60E-01	2.10E-01						1.16E+00	9.70E-01					
Pa-234m (Assumed from U-238)	7.60E-01	2.10E-01						-1.20E+00	7.20E+00					U
Ac-227														
Ra-228	8.40E-01	2.20E-01												
Pa-231	8.00E-01	1.40E+00					U							
Beta Sum	**2.27E+01**	**3.72E+00**						**2.11E+01**	**8.16E+00**					
Total Activity Sum	**2.86E+01**	**3.96E+00**						**2.70E+01**	**8.27E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.10E+00						**0.04**	**(from gamma)**		**1.21**			
Gross Beta	5.43E+00	9.70E-01					J	**4.48**	**1.91**		**123**			
Total Activity	9.30E+00	3.80E+00					J	**3.51**	**1.95**		**102**			

0107095-13			TMF-0187					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.30E-01					U
Ra-226	1.48E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.15E+00	2.00E-01												
Th-230	1.36E+00	2.20E-01												
Th-232	1.01E+00	1.70E-01												
U-234	1.19E+00	2.90E-01												
U-235	7.90E-02	6.50E-02						2.10E-01	3.30E-01					U
U-238	1.05E+00	2.70E-01												
Total U Alpha	**2.32E+00**	**4.02E-01**												
Alpha Sum	**6.78E+00**	**1.73E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
K-40	1.56E+01	3.60E+00												
Cs-137	2.30E-01	1.20E-01												
Th-234 (Assumed from U-238)	1.05E+00	2.70E-01						7.40E-01	6.80E-01					
Pa-234m (Assumed from U-238)	1.05E+00	2.70E-01						0.00E+00	1.40E+01					U
Ac-227														
Ra-228	1.08E+00	3.60E-01												
Pa-231	-6.00E-01	1.80E+00					U							
Beta Sum	**1.89E+01**	**3.65E+00**						**1.76E+01**	**1.45E+01**					
Total Activity Sum	**2.57E+01**	**4.04E+00**						**2.44E+01**	**1.46E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.70E+00	1.30E+00						**0.43**	**(from gamma)**		**12.7**			
Gross Beta	6.50E+00	1.00E+00					J	**3.29**	**0.76**		**97.8**			
Total Activity	1.86E+01	5.10E+00					J	**1.09**	**0.37**		**32.1**			

0107095-14			TMF-0188					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.70E-01	3.50E-01					U
Ra-226	8.50E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	1.80E-01												
Th-230	9.90E-01	1.70E-01												
Th-232	7.80E-01	1.40E-01												
U-234	6.50E-01	2.00E-01												
U-235	2.90E-02	4.30E-02					U	3.80E-01	3.00E-01					
U-238	7.00E-01	2.10E-01												
Total U Alpha	**1.38E+00**	**2.93E-01**												
Alpha Sum	**4.76E+00**	**1.60E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.80E+01	3.70E+00												
Th-234 (Assumed from U-238)	7.00E-01	2.10E-01						7.30E-01	7.70E-01					
Pa-234m (Assumed from U-238)	7.00E-01	2.10E-01						6.60E+00	7.80E+00					
Ac-227														
Ra-228	6.80E-01	2.50E-01												
Pa-231	-2.00E-01	1.70E+00					U							
Beta Sum	**2.01E+01**	**3.73E+00**						**2.60E+01**	**8.67E+00**					
Total Activity Sum	**2.48E+01**	**4.05E+00**						**3.07E+01**	**8.82E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.60E+00	1.10E+00						**0.08**	**(from gamma)**		**3.40**			
Gross Beta	5.60E+00	1.10E+00					J	**3.72**	**2.33**		**113**			
Total Activity	7.40E+00	3.80E+00					J	**3.13**	**2.43**		**108**			

0107095-15			TMF-0184					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.80E-01					U
Ra-226	1.01E+00	4.40E-01	8.10E-01	2.30E-01	**0.40**	**22**								
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.60E-01												
Th-230	8.70E-01	1.50E-01												
Th-232	8.50E-01	1.40E-01												
U-234	8.30E-01	2.50E-01												
U-235	1.32E-01	9.00E-02						1.50E-01	2.90E-01					U
U-238	8.10E-01	2.40E-01												
Total U Alpha	**1.77E+00**	**3.58E-01**												
Alpha Sum	**4.82E+00**	**1.41E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.74E+01	3.30E+00												
Th-234 (Assumed from U-238)	8.10E-01	2.40E-01						6.20E-01	7.80E-01					U
Pa-234m (Assumed from U-238)	8.10E-01	2.40E-01						-6.00E+00	8.70E+00					U
Ac-227														
Ra-228	7.20E-01	2.10E-01												
Pa-231	-6.00E-01	1.40E+00					U							
Beta Sum	**1.97E+01**	**3.33E+00**						**1.27E+01**	**9.34E+00**					
Total Activity Sum	**2.45E+01**	**3.61E+00**						**1.75E+01**	**9.45E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.87E+00	9.10E-01						**0.03**	**(from gamma)**		**0.99**			
Gross Beta	4.66E+00	7.90E-01					J	**4.39**	**0.85**		**123**			
Total Activity	7.90E+00	4.10E+00					J	**3.04**	**0.93**		**102**			

0107095-16			TMF-0185					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	2.10E-01					U
Ra-226	5.10E-01	1.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.40E-01	1.10E-01												
Th-230	5.80E-01	1.40E-01												
Th-232	1.62E-01	6.20E-02												
U-234	6.30E-01	2.00E-01												
U-235	4.60E-02	5.00E-02						-5.00E-02	2.50E-01					U
U-238	5.40E-01	1.80E-01												
Total U Alpha	**1.22E+00**	**2.74E-01**												
Alpha Sum	**1.89E+00**	**1.06E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	2.55E+00	9.00E-01												
Th-234 (Assumed from U-238)	5.40E-01	1.80E-01						2.80E-01	7.50E-01					U
Pa-234m (Assumed from U-238)	5.40E-01	1.80E-01						2.00E-01	5.80E+00					U
Ac-227														
Ra-228	1.40E-01	1.50E-01												
Pa-231	-8.00E-01	1.10E+00					U							
Beta Sum	**3.67E+00**	**9.56E-01**						**3.07E+00**	**5.92E+00**					
Total Activity Sum	**5.56E+00**	**1.43E+00**						**4.96E+00**	**6.01E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.80E+00						**1.59**	**(from gamma)**		**93.5**			
Gross Beta	2.40E+00	1.70E+00					J	**0.65**	**0.11**		**41.9**			
Total Activity	7.10E+00	3.80E+00					J	**0.38**	**0.30**		**24.3**			

0107095-17			TMF-9199					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.30E-01	9.00E-02	1.20E-01	**0.45**	**160**	U
Ra-226	5.80E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	1.80E-01												
Th-230	9.20E-01	1.80E-01												
Th-232	8.10E-01	1.60E-01												
U-234	1.00E+00	2.60E-01												
U-235	8.80E-02	6.70E-02						7.00E-02	4.50E-01	-4.00E-02	4.50E-01	**0.17**	**733**	U
U-238	9.00E-01	2.40E-01												
Total U Alpha	**1.99E+00**	**3.60E-01**												
Alpha Sum	**2.38E+00**	**3.19E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	2.29E+01	6.30E+00	1.94E+01	5.10E+00	**0.43**	**16.5**								
Th-234 (Assumed from U-238)	9.00E-01	2.40E-01						-2.00E-01	1.10E+00	7.00E-01	1.00E+00	**0.61**	**360**	U
Pa-234m (Assumed from U-238)	9.00E-01	2.40E-01						1.90E+01	2.10E+01	-1.50E+01	1.70E+01	**1.26**	**1700**	
Ac-227														
Ra-228	4.40E-01	6.30E-01	5.00E-01	5.30E-01	**0.07**	**12.8**	U							
Pa-231	-3.00E+00	3.50E+00	-9.00E-01	2.50E+00	**0.49**	**108**	U							
Beta Sum	**2.48E+01**	**6.35E+00**						**4.18E+01**	**2.20E+01**	**5.49E+00**	**1.78E+01**			
Total Activity Sum	**2.72E+01**	**7.11E+00**						**4.42E+01**	**2.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	1.30E+00						**1.31**	**(from gamma)**		**97.5**			
Gross Beta	5.50E+00	1.00E+00					J	**3.00**	**1.65**		**127**			
Total Activity	1.14E+01	4.40E+00					J	**1.88**	**1.45**		**81.7**			

0107095-18			TMF-9200					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.50E-01					U
Ra-226	4.70E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.80E-01												
Th-230	8.10E-01	1.60E-01												
Th-232	8.20E-01	1.60E-01												
U-234	7.40E-01	2.00E-01												
U-235	8.10E-02	6.20E-02						1.40E-01	2.30E-01					U
U-238	8.50E-01	2.20E-01												
Total U Alpha	**1.67E+00**	**3.04E-01**												
Alpha Sum	**3.04E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.88E+01	3.40E+00												
Th-234 (Assumed from U-238)	8.50E-01	2.20E-01						1.54E+00	8.10E-01					
Pa-234m (Assumed from U-238)	8.50E-01	2.20E-01						-8.00E-01	7.20E+00					U
Ac-227														
Ra-228	6.50E-01	1.80E-01												
Pa-231	-1.80E+00	2.10E+00					U							
Beta Sum	**2.09E+01**	**3.43E+00**						**2.00E+01**	**8.01E+00**					
Total Activity Sum	**2.40E+01**	**3.94E+00**						**2.30E+01**	**8.24E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.30E+00						**1.48**	**(from gamma)**		**72.5**			
Gross Beta	5.70E+00	1.00E+00					J	**4.27**	**1.77**		**114**			
Total Activity	9.10E+00	3.90E+00					J	**2.68**	**1.53**		**89.9**			

0107095-19			TMF-0166					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.00E-01					U
Ra-226	9.70E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	1.80E-01												
Th-230	8.70E-01	1.60E-01												
Th-232	7.60E-01	1.40E-01												
U-234	9.60E-01	2.60E-01												
U-235	5.00E-02	5.10E-02						-1.00E-02	2.90E-01					U
U-238	7.00E-01	2.10E-01												
Total U Alpha	**1.71E+00**	**3.38E-01**												
Alpha Sum	**3.74E+00**	**1.69E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.63E+01	3.80E+00												
Th-234 (Assumed from U-238)	7.00E-01	2.10E-01						9.30E-01	7.10E-01					
Pa-234m (Assumed from U-238)	7.00E-01	2.10E-01						3.00E+00	1.20E+01					U
Ac-227														
Ra-228	5.00E-01	3.20E-01												
Pa-231	-1.70E+00	1.80E+00					U							
Beta Sum	**1.80E+01**	**3.83E+00**						**2.05E+01**	**1.26E+01**					
Total Activity Sum	**2.17E+01**	**4.19E+00**						**2.43E+01**	**1.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.20E+00						**1.33**	**(from gamma)**		**53.9**			
Gross Beta	5.40E+00	1.00E+00					J	**3.18**	**1.20**		**108**			
Total Activity	9.90E+00	4.10E+00					J	**2.02**	**1.07**		**74.8**			

0107095-20			TMF-0167					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	5.00E-01					U
Ra-226	7.20E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.70E-01												
Th-230	8.30E-01	1.40E-01												
Th-232	9.80E-01	1.60E-01												
U-234	7.90E-01	2.20E-01												
U-235	1.10E-02	2.40E-02					U	-8.00E-02	3.40E-01					U
U-238	9.50E-01	2.50E-01												
Total U Alpha	**1.75E+00**	**3.34E-01**												
Alpha Sum	**4.35E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.89E+01	3.80E+00												
Th-234 (Assumed from U-238)	9.50E-01	2.50E-01						3.80E-01	7.70E-01					U
Pa-234m (Assumed from U-238)	9.50E-01	2.50E-01						-9.00E-01	8.50E+00					U
Ac-227														
Ra-228	9.30E-01	2.60E-01												
Pa-231	-1.00E+00	2.00E+00					U							
Beta Sum	**2.16E+01**	**3.83E+00**						**1.92E+01**	**9.35E+00**					
Total Activity Sum	**2.60E+01**	**4.26E+00**						**2.35E+01**	**9.53E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.67**	**(from gamma)**		**28.5**			
Gross Beta	5.19E+00	9.50E-01					J	**4.16**	**1.49**		**123**			
Total Activity	8.30E+00	3.80E+00					J	**3.09**	**1.49**		**103**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107096

This sample delivery group (SDG) contained twenty individual soil samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0133	0107096-1
TMF-0134	0107096-2
TMF-0135	0107096-3
TMF-0136	0107096-4
TMF-0137	0107096-5
TMF-0138	0107096-6
TMF-0129	0107096-7
TMF-0130	0107965-8
TMF-9139	0107096-9
TMF-9140	0107096-10
TMF-0151	0107096-11
TMF-0152	0107096-12
TMF-0154	0107096-13
TMF-0155	0107096-14
TMF-0157	0107096-15
TMF-0158	0107096-16
TMF-0160	0107096-17
TMF-0161	0107096-18
TMF-0163	0107096-19
TMF-0164	0107096-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in one of the method blanks for ^{234m}Pa. All associated sample results less than 5 times the blank value for ^{234m}Pa analyses should be qualified as estimated (J). **Therefore, it is recommended that the ^{234m}Pa results for samples TMF-0133, TMF-0133 (laboratory duplicate), TMF-0135, TMF-0136, TMF-0137, TMF-0129, TMF-9139, TMF-9140, TMF-0151, TMF-0154, TMF-0157, TMF-0160, and TMF-0163 be qualified as estimated (J).**

Equipment Rinsate Sample:

There was no indication of contamination of the equipment rinsate blank for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ac, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, ^{137}Cs, $^{212/214}$Bi, $^{212/214}$Pb, ^{228}Ra, and ^{208}Tl gamma emitting radionuclides were reported for most samples.

The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near total equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. Results for fission product ^{137}Cs were reported for two samples. **Inclusion of ^{212}Pb, ^{214}Pb, ^{214}Bi, and ^{208}Tl in the database is not recommended since any modeling would assume equilibrium with $^{235/238}$U or ^{232}Th.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{231}Pa result for samples TMF-0130 and TMF-0155 and the ^{235}U result for sample TMF-0160 (laboratory duplicate). **Therefore, it is recommended that the ^{231}Pa result for samples TMF-0130 and TMF-0155 and the ^{235}U result for sample TMF-0160 (laboratory duplicate) be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination in the $^{234/235/238}$U alpha spectrometry analyses. There was an indication of blank contamination in the method blank for ^{230}Th. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). All samples have results that are greater than 5 times the blank value for the ^{230}Th analyses. No qualification is required.

Equipment Rinsate Sample:

There was an indication of ^{228}Th and ^{230}Th contamination of equipment rinsate blank contamination for alpha spectrometry analyses. All associated sample results less than 5 times the blank value for ^{228}Th and ^{230}Th analyses should be qualified as estimated (J). All samples had ^{228}Th and ^{230}Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 30.07% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra all samples except TML-0129 and TML-0130 for isotopic thorium. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured blank activity is below the MDC (1.0 pCi/g). Only samples TMF-0135 and TMF-0160 have ^{230}Th results greater than the required MDC. **Therefore, it is recommended that the ^{230}Th results for samples TMF-0133, TMF-0133 (laboratory duplicate), TMF-0134, TMF-0135, TMF-0136, TMF-0137, TMF-0137 (laboratory duplicate), TMF-0138, TMF-130, TMF-9139, TMF-9140, TMF-0151, TMF-0152, TMF-0154, TMF-0155, TMF-0157, TMF-0158, TMF-0160, TMF-0163, and TMF-0164 be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least five extra peaks. These peaks are in the 5.8 MeV, 6.3 MeV, 6.7 MeV, 6.9 MeV, and 7.1 MeV regions. It is assumed that the peaks can be attributed to ^{216}Po, ^{217}At, ^{225}Ac and ^{221}Fr, which are progeny of ^{228}Th and the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was an indication of blank contamination in the method blank for ^{226}Ra analyses. All associated sample results less than 5 times the blank value for ^{226}Ra analyses should be qualified as estimated (J). Therefore, it is recommended that samples **TMF-0133, TMF-0136, TMF-0137, TMF-0138, TMF-0129, TMF-9139, TMF-9140, TMF-9140 (laboratory duplicate), TMF-0154, TMF-0155, TMF-0157, TMF-0161, TMF-0163, and TMF-0164 be qualified as estimated (J).**

Equipment Rinsate Sample:

There was no indication of ^{226}Ra contamination of equipment rinsate blank contamination for the radon emmination analyses.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the ^{226}Ra analyses were within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/g for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Sample:

There was no indication of gross alpha or gross beta contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample Analysis:

The MSS result was within acceptable limits for both gross alpha and gross beta analyses.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. The for the gross alpha analyses for samples TMF-0152, TMF-0155, and TMF-0157 exceeded the required MDL. The MDLs for the gross beta analyses for samples TMF-0152, TMF-0154, TMF-0155, and TMF-157 also exceeded the required MDL. The maximum MDL is 1.2 pCi/g. Since the gross alpha/beta analyses are activity estimates, no qualification is required.

5.0 TOTAL ACTIVITY

Method Blank:

There was no indication of blank contamination for the total activity analyses.

Equipment Rinsate Sample:

There was no indication of total activity contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity laboratory duplicate DER is within acceptable limits.

Matrix Spike Sample:

The MSS recovery was within acceptable limits for the total activity analysis.

Spectral Analysis:

Spectral plots of the total activity analyses were not included in the laboratory data package.

Method Detection Limit:

The required method detection limit (MDL) for the total activity analysis is 10 pCi/g. All samples met the required MDLs.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER for all samples indicates that the gross alpha analyses agree with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (from 2.25 to 4.75) for all samples are greater than or equal to 1.29 indicating that the gross beta analyses are in agreement with the sum of the beta emitters within a 99% confidence level. The corresponding RPDs (from 101% to 142%) are also outside acceptable limits. The gross beta activity for all samples was smaller than the beta sum values by approximately a factor of 4. This difference may be indicative of a negative bias in the gross beta sample results. **Therefore, it is recommended that the gross beta results from all samples be qualified as estimated (J).**

Total Activity to Sum of Alpha and Beta Emitters:

The DERs (2.36, 2.99, 2.82, 3.01, 1.61, 2.40, 2.92, 2.91, 3.53, 1.66, 2.99, 2.78, 2.06, 1.50, 3.72, 1.81, 3.25, and 3.69) for samples TMF-0133, TMF-0134, TMF-0135, TMF-0136, TMF-0137, TMF-0138, TMF-0129, TMF-0130, TMF-9139, TMF-9140, TMF-0152, TMF-0154, TML-0155, TMF-0157, TMF-0158, TMF-0160, TMF-0161, and TMF-0164 indicate that the total activity analysis does not agree with the sum of the alpha and beta emitters within a 99% confidence level. In addition, the corresponding RPDs (93.3%, 93.4%, 110%, 104%, 84.3%, 84.7%, 133%, 105%, 144%, 68%, 99.0%, 115%, 69.4%, 73.8%, 128%, 59.9%, 97.7%, and 107%) are also outside acceptable limits. The total activity results ranged from approximately a factor of 2 to 5 lower than the total activity sums. Again, this may be indicative of a negative bias in the total activity. **Therefore, it is recommended that the total activity results from samples TMF-0133, TMF-0134, TMF-0135, TMF-0136, TMF-0137, TMF-0138, TMF-0129, TMF-0130, TMF-9139, TMF-9140, TMF-0152, TMF-0154, TMF-0155, TMF-0157, TMF-0158, TMF-0160, TMF-0161, and TMF-0164 be qualified as estimated (J).**

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to ^{232}Th activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa gamma activity and ^{235}U alpha activity, it was assumed that the protactinium was in equilibrium. The ^{231}Pa and ^{235}U activities are within the measurement uncertainties for all samples except TMF-0130 and TMF-0155. Since the ^{231}Pa gamma activity results for samples TMF-0130 and TMF-0155 were previously qualified for improper background subtraction, no further qualification is necessary.

Summary:

For all samples, there was agreement within the measurement uncertainties between the total activity results and the sum of the gross alpha and gross beta results. However, there appears to be a negative bias on the gross alpha/beta and total activity results. **Therefore, it is recommended that the individual analysis results be used.**

0107096-1			TMF-0133					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	4.10E-01	2.00E-02	1.40E-01	**0.37**	**267**	U
Ra-226	6.70E-01	2.70E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	1.30E-01	8.20E-01	1.30E-01	**0.27**	**6.29**								
Th-230	8.00E-01	1.30E-01	8.00E-01	1.30E-01	**0.00**	**0.00**	J							
Th-232	7.10E-01	1.10E-01	7.50E-01	1.20E-01	**0.25**	**5.48**								
U-234	1.03E+00	2.50E-01												
U-235	1.49E-01	8.10E-02						-2.70E-01	5.20E-01	4.30E-01	5.80E-01	**0.90**	**875**	U
U-238	8.70E-01	2.20E-01												
Total U Alpha	**2.05E+00**	**3.43E-01**												
Alpha Sum	**4.64E+00**	**2.39E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	2.50E-01	1.20E-01	2.60E-01	1.70E-01	**0.05**	**3.92**								
Th-234 (Assumed from U-238)	8.70E-01	2.20E-01						6.00E-01	1.60E+00	1.30E+00	1.60E+00	**0.31**	**73.7**	U
Pa-234m (Assumed from U-238)	8.70E-01	2.20E-01						-3.00E+00	1.80E+01	3.40E+01	2.60E+01	**1.17**	**239**	UJ
K-40	1.44E+01	3.40E+00	1.07E+01	4.40E+00	**0.67**	**29.5**								
Ra-228	7.40E-01	3.60E-01	7.10E-01	5.30E-01	**0.05**	**4.14**								
Pa-231	-4.00E-01	2.60E+00	0.00E+00	3.30E+00	**0.10**	**200**	U							
Beta Sum	**1.71E+01**	**3.45E+00**						**1.29E+01**	**1.84E+01**	**4.70E+01**	**2.64E+01**			
Total Activity Sum	**2.17E+01**	**4.20E+00**						**1.76E+01**	**1.85E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+00	7.20E-01						**0.18**	**(from gamma)**		**9.93**			
Gross Beta	3.66E+00	6.20E-01					J	**3.83**	**0.50**		**129**			
Total Activity	7.90E+00	4.10E+00					J	**2.36**	**0.51**		**93.3**			

0107096-2			TMF-0134					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	2.40E-01	2.10E-01	5.10E-01	**0.25**	**100**	U
Ra-226	1.08E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	1.70E-01												
Th-230	8.80E-01	1.50E-01					J							
Th-232	1.08E+00	1.80E-01												
U-234	8.50E-01	2.20E-01	7.90E-01	2.10E-01	**0.20**	**7.32**								
U-235	1.54E-01	8.30E-02	6.20E-02	5.50E-02	**0.92**	**85.2**		3.00E-02	2.80E-01	1.00E-01	3.00E-01	**0.17**	**108**	U
U-238	7.50E-01	2.00E-01	8.30E-01	2.10E-01	**0.28**	**10.1**								
Total U Alpha	**1.75E+00**	**3.09E-01**	**1.68E+00**	**3.02E-01**										
Alpha Sum	**4.33E+00**	**1.95E+00**	**2.04E+00**	**1.38E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.00E-01	8.30E-01	2.10E-01	**0.28**	**10.1**		1.60E+00	9.30E-01	5.00E-01	1.10E+00	**0.76**	**105**	
Pa-234m (Assumed from U-238)	7.50E-01	2.00E-01	8.30E-01	2.10E-01	**0.28**	**10.1**		6.80E+00	7.20E+00	0.00E+00	8.00E+00	**0.63**	**200**	
K-40	2.08E+01	3.70E+00	1.83E+01	3.70E+00	**0.48**	**12.8**								
Ra-228	8.10E-01	2.00E-01	7.90E-01	2.40E-01	**0.06**	**2.50**								
Pa-231	-1.60E+00	2.10E+00	4.00E-01	1.50E+00	**0.77**	**333**	U							
Beta Sum	**2.29E+01**	**3.72E+00**	**2.08E+01**	**3.72E+00**				**2.98E+01**	**8.15E+00**	**1.96E+01**	**8.89E+00**			
Total Activity Sum	**2.73E+01**	**4.21E+00**	**2.28E+01**	**3.97E+00**				**3.42E+01**	**8.39E+00**	**2.17E+01**	**8.99E+00**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00						**0.81**	**(from gamma)**		**35.4**			
Gross Beta	5.31E+00	9.60E-01					J	**4.58**	**2.98**		**125**			
Total Activity	9.90E+00	4.00E+00					J	**2.99**	**2.61**		**93.4**			

0107096-3			TMF-0135					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.50E-01					U
Ra-226	1.05E+00	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.27E+00	2.00E-01												
Th-230	1.14E+00	1.80E-01					J							
Th-232	1.20E+00	1.90E-01												
U-234	8.50E-01	2.20E-01												
U-235	1.76E-01	8.80E-02						7.00E-02	4.70E-01					U
U-238	7.20E-01	2.00E-01												
Total U Alpha	**1.75E+00**	**3.10E-01**												
Alpha Sum	**6.41E+00**	**2.48E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.00E-01						1.20E+00	1.20E+00					
Pa-234m (Assumed from U-238)	7.20E-01	2.00E-01						-1.00E+01	2.80E+01					UJ
K-40	1.99E+01	5.40E+00												
Ra-228	7.40E-01	6.10E-01												
Pa-231	0.00E+00	2.70E+00					U							
Beta Sum	**2.21E+01**	**5.45E+00**						**1.18E+01**	**2.85E+01**					
Total Activity Sum	**2.85E+01**	**5.99E+00**						**1.82E+01**	**2.87E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	1.10E+00						**0.18**	**(from gamma)**		**7.43**			
Gross Beta	4.62E+00	7.50E-01					J	**3.17**	**0.25**		**131**			
Total Activity	8.30E+00	3.90E+00					J	**2.82**	**0.34**		**110**			

0107096-4			TMF-0136					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								9.00E-02	3.20E-01					U
Ra-226	6.80E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.40E-01												
Th-230	7.40E-01	1.20E-01					J							
Th-232	8.20E-01	1.30E-01												
U-234	7.50E-01	2.20E-01												
U-235	1.15E-01	7.70E-02						-2.30E-01	4.10E-01					U
U-238	7.30E-01	2.10E-01												
Total U Alpha	**1.60E+00**	**3.14E-01**												
Alpha Sum	**4.52E+00**	**2.03E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.10E-01						1.20E+00	1.10E+00					
Pa-234m (Assumed from U-238)	7.30E-01	2.10E-01						1.00E+01	1.30E+01					UJ
K-40	1.96E+01	4.00E+00												
Ra-228	6.80E-01	2.70E-01												
Pa-231	-2.00E-01	2.20E+00					U							
Beta Sum	**2.17E+01**	**4.03E+00**						**3.15E+01**	**1.37E+01**					
Total Activity Sum	**2.62E+01**	**4.51E+00**						**3.60E+01**	**1.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.00E+00	4.90E+00	9.80E-01	**0.07**	**2.02**		**0.21**	**(from gamma)**		**10.2**			
Gross Beta	4.13E+00	8.40E-01	4.70E+00	8.90E-01	**0.47**	**12.9**	J	**4.27**	**2.00**		**136**			
Total Activity	8.30E+00	3.90E+00	8.60E+00	3.90E+00	**0.05**	**3.55**	J	**3.01**	**1.93**		**104**			

0107096-5			TMF-0137					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	1.50E-01					U
Ra-226	9.10E-01	2.20E-01	1.18E+00	2.80E-01	**0.76**	**26**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.30E-01	8.90E-01	1.40E-01	**0.00**	**0.00**								
Th-230	9.30E-01	1.40E-01	8.90E-01	1.30E-01	**0.21**	**4.40**	J							
Th-232	9.20E-01	1.30E-01	8.70E-01	1.30E-01	**0.27**	**5.59**								
U-234	8.40E-01	2.40E-01												
U-235	1.35E-01	8.70E-02						3.70E-01	5.80E-01					U
U-238	8.30E-01	2.40E-01												
Total U Alpha	**1.81E+00**	**3.50E-01**												
Alpha Sum	**4.56E+00**	**3.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.40E-01						9.00E-01	1.40E+00					U
Pa-234m (Assumed from U-238)	8.30E-01	2.40E-01						1.20E+01	2.90E+01					UJ
K-40	1.43E+01	5.30E+00												
Ra-228	9.70E-01	7.60E-01												
Pa-231	-1.00E+00	4.10E+00					U							
Beta Sum	**1.68E+01**	**5.39E+00**						**2.81E+01**	**2.95E+01**					
Total Activity Sum	**2.14E+01**	**6.55E+00**						**3.26E+01**	**2.98E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.08E+00	9.80E-01						**0.40**	**(from gamma)**		**28.7**			
Gross Beta	4.51E+00	7.40E-01					J	**2.26**	**0.80**		**115**			
Total Activity	8.70E+00	4.40E+00					J	**1.61**	**0.79**		**84.3**			

0107096-6			TMF-0138					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.40E-01	5.00E-01					U
Ra-226	8.40E-01	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	1.40E-01												
Th-230	8.60E-01	1.40E-01					J							
Th-232	8.30E-01	1.40E-01												
U-234	7.40E-01	2.00E-01	8.70E-01	2.40E-01	**0.42**	**16.1**								
U-235	1.19E-01	7.20E-02	1.04E-01	7.50E-02	**0.14**	**13.5**		-3.00E-02	3.20E-01					U
U-238	7.30E-01	2.00E-01	8.40E-01	2.40E-01	**0.35**	**14.0**								
Total U Alpha	**1.59E+00**	**2.92E-01**	**1.81E+00**	**3.48E-01**										
Alpha Sum	**4.07E+00**	**2.29E+00**	**1.81E+00**	**3.48E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01	8.40E-01	2.40E-01	**0.35**	**14.0**		1.20E+00	1.10E+00					
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01	8.40E-01	2.40E-01	**0.35**	**14.0**		2.40E+00	8.10E+00					U
K-40	1.75E+01	3.60E+00												
Ra-228	8.00E-01	2.20E-01												
Pa-231	-1.00E+00	2.50E+00					U							
Beta Sum	**1.96E+01**	**3.63E+00**	**1.68E+00**	**3.39E-01**				**2.18E+01**	**8.94E+00**					
Total Activity Sum	**2.37E+01**	**4.29E+00**	**3.49E+00**	**4.86E-01**				**2.58E+01**	**9.23E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**0.75**	**(from gamma)**		**38.4**			
Gross Beta	4.01E+00	8.40E-01					J	**4.19**	**1.98**		**132**			
Total Activity	9.60E+00	4.00E+00					J	**2.40**	**1.62**		**84.7**			

0107096-7			TMF-0129					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.30E-01					U
Ra-226	7.30E-01	2.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.13E+00	1.70E-01												
Th-230	9.60E-01	1.40E-01												
Th-232	9.50E-01	1.40E-01												
U-234	9.50E-01	2.40E-01												
U-235	1.25E-01	7.60E-02						2.10E-01	4.40E-01					U
U-238	9.90E-01	2.50E-01												
Total U Alpha	**2.07E+00**	**3.55E-01**												
Alpha Sum	**6.20E+00**	**2.39E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.90E-01	2.50E-01						4.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	9.90E-01	2.50E-01						-1.00E+01	2.10E+01					UJ
K-40	1.64E+01	4.70E+00												
Ra-228	1.36E+00	6.70E-01												
Pa-231	4.00E-01	2.60E+00					U							
Beta Sum	**1.98E+01**	**4.77E+00**						**8.21E+00**	**2.16E+01**					
Total Activity Sum	**2.60E+01**	**5.34E+00**						**1.44E+01**	**2.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.79E+00	8.10E-01						**0.56**	**(from gamma)**		**25.6**			
Gross Beta	4.18E+00	7.00E-01					J	**3.24**	**0.19**		**130**			
Total Activity	6.50E+00	4.00E+00					J	**2.92**	**0.36**		**120**			

0107096-8			TMF-0130					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	3.60E-01					U
Ra-226	8.90E-01	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	1.50E-01												
Th-230	7.50E-01	1.20E-01					J							
Th-232	8.10E-01	1.30E-01												
U-234	1.08E+00	2.70E-01												
U-235	2.20E-01	1.10E-01						3.20E-01	3.50E-01					
U-238	9.00E-01	2.40E-01												
Total U Alpha	**2.20E+00**	**3.78E-01**												
Alpha Sum	**3.13E+00**	**1.87E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.40E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	9.00E-01	2.40E-01						3.00E+00	1.00E+01					U
K-40	1.98E+01	4.10E+00												
Ra-228	9.10E-01	3.00E-01												
Pa-231	-2.70E+00	2.00E+00					UJ							
Beta Sum	**2.22E+01**	**4.13E+00**						**2.42E+01**	**1.09E+01**					
Total Activity Sum	**2.53E+01**	**4.53E+00**						**2.73E+01**	**1.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.13E+00	9.90E-01	5.70E+00	1.10E+00	**0.39**	**10.5**		**0.95**	**(from gamma)**		**48.4**			
Gross Beta	4.63E+00	8.80E-01	4.52E+00	8.70E-01	**0.09**	**2.40**	J	**4.16**	**1.79**		**131**			
Total Activity	7.90E+00	3.90E+00	8.60E+00	3.90E+00	**0.13**	**8.48**	J	**2.91**	**1.66**		**105**			

0107096-9			TMF-9139					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	3.90E-01					U
Ra-226	1.12E+00	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	1.40E-01												
Th-230	9.30E-01	1.40E-01					J							
Th-232	9.20E-01	1.40E-01												
U-234	9.50E-01	2.50E-01												
U-235	1.44E-01	8.50E-02						-3.00E-01	5.10E-01					U
U-238	1.04E+00	2.60E-01												
Total U Alpha	**2.13E+00**	**3.71E-01**												
Alpha Sum	**4.45E+00**	**2.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.04E+00	2.60E-01						7.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	1.04E+00	2.60E-01						9.00E+00	1.60E+01					UJ
K-40	1.85E+01	4.00E+00												
Ra-228	8.60E-01	4.40E-01												
Pa-231	-1.80E+00	2.50E+00					U							
Beta Sum	**2.12E+01**	**4.05E+00**						**2.88E+01**	**1.65E+01**					
Total Activity Sum	**2.57E+01**	**4.66E+00**						**3.33E+01**	**1.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.14E+00	7.30E-01						**0.13**	**(from gamma)**		**7.31**			
Gross Beta	3.59E+00	6.30E-01					J	**4.30**	**1.53**		**142**			
Total Activity	4.20E+00	3.90E+00					J	**3.53**	**1.70**		**144**			

0107096-10			TMF-9140					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.20E-01					U
Ra-226	9.60E-01	2.20E-01	9.20E-01	2.10E-01	**0.13**	**4.26**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	1.60E-01												
Th-230	8.10E-01	1.30E-01					J							
Th-232	8.10E-01	1.40E-01												
U-234	7.90E-01	2.10E-01												
U-235	1.86E-01	9.30E-02						0.00E+00	4.60E-01					U
U-238	9.40E-01	2.40E-01												
Total U Alpha	**1.92E+00**	**3.32E-01**												
Alpha Sum	**5.25E+00**	**2.30E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.40E-01	2.40E-01						1.10E+00	1.20E+00					
Pa-234m (Assumed from U-238)	9.40E-01	2.40E-01						3.00E+00	1.70E+01					UJ
K-40	1.26E+01	4.10E+00												
Ra-228	6.00E-01	6.10E-01												
Pa-231	-2.00E-01	2.50E+00					U							
Beta Sum	**1.51E+01**	**4.17E+00**						**1.73E+01**	**1.75E+01**					
Total Activity Sum	**2.03E+01**	**4.76E+00**						**2.25E+01**	**1.77E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.89E+00	9.90E-01						**0.14**	**(from gamma)**		**7.02**			
Gross Beta	4.54E+00	8.80E-01					J	**2.47**	**0.73**		**107**			
Total Activity	1.00E+01	4.00E+00					J	**1.66**	**0.69**		**68.0**			

0107096-11			TMF-0151					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.20E-01					U
Ra-226	1.05E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.40E-01												
Th-230	8.60E-01	1.40E-01					J							
Th-232	7.60E-01	1.30E-01												
U-234	1.13E+00	2.70E-01												
U-235	4.30E-02	4.80E-02						-8.00E-02	4.20E-01					U
U-238	7.50E-01	2.00E-01												
Total U Alpha	**1.92E+00**	**3.39E-01**												
Alpha Sum	**3.86E+00**	**2.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.00E-01						9.00E-01	1.40E+00					U
Pa-234m (Assumed from U-238)	7.50E-01	2.00E-01						7.00E+00	2.10E+01					UJ
K-40	1.33E+01	4.10E+00												
Ra-228	6.70E-01	4.10E-01												
Pa-231	-1.70E+00	2.60E+00					U							
Beta Sum	**1.53E+01**	**4.14E+00**						**2.17E+01**	**2.14E+01**					
Total Activity Sum	**1.91E+01**	**4.78E+00**						**2.55E+01**	**2.16E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.95E+00	9.90E-01						**0.42**	**(from gamma)**		**24.7**			
Gross Beta	4.35E+00	8.60E-01					J	**2.58**	**0.81**		**111**			
Total Activity	1.46E+01	4.50E+00						**0.69**	**0.50**		**26.9**			

0107096-12			TMF-0152					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.90E-02	9.60E-02					U
Ra-226	1.09E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	1.60E-01												
Th-230	8.70E-01	1.40E-01					J							
Th-232	9.40E-01	1.50E-01												
U-234	8.10E-01	2.10E-01												
U-235	1.06E-01	6.60E-02						-6.00E-02	2.80E-01					U
U-238	8.20E-01	2.10E-01												
Total U Alpha	**1.74E+00**	**3.04E-01**												
Alpha Sum	**6.30E+00**	**1.60E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.20E-01	2.10E-01						4.90E-01	8.10E-01					U
Pa-234m (Assumed from U-238)	8.20E-01	2.10E-01						-1.00E+00	1.10E+01					U
K-40	1.74E+01	3.80E+00												
Ra-228	6.10E-01	2.40E-01												
Pa-231	8.00E-01	1.70E+00					U							
Beta Sum	**1.97E+01**	**3.82E+00**						**1.76E+01**	**1.17E+01**					
Total Activity Sum	**2.60E+01**	**4.15E+00**						**2.39E+01**	**1.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.00E+00						**0.58**	**(from gamma)**		**19.1**			
Gross Beta	4.50E+00	9.40E-01					J	**3.87**	**1.12**		**126**			
Total Activity	8.80E+00	4.00E+00					J	**2.99**	**1.21**		**99.0**			

0107096-13			TMF-0154					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-01	3.80E-01					U
Ra-226	9.90E-01	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	1.30E-01												
Th-230	8.00E-01	1.30E-01					J							
Th-232	7.60E-01	1.30E-01												
U-234	8.40E-01	2.20E-01												
U-235	1.00E-01	6.80E-02						-3.40E-01	4.50E-01					U
U-238	7.20E-01	2.00E-01												
Total U Alpha	**1.66E+00**	**3.05E-01**												
Alpha Sum	**4.73E+00**	**2.38E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.00E-01						3.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	7.20E-01	2.00E-01						7.00E+00	1.50E+01					UJ
K-40	1.54E+01	3.50E+00												
Ra-228	7.30E-01	3.50E-01												
Pa-231	-2.00E-01	2.60E+00					U							
Beta Sum	**1.75E+01**	**3.54E+00**						**2.34E+01**	**1.55E+01**					
Total Activity Sum	**2.23E+01**	**4.27E+00**						**2.81E+01**	**1.56E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**0.48**	**(from gamma)**		**23.7**			
Gross Beta	4.57E+00	9.80E-01					J	**3.53**	**1.22**		**117**			
Total Activity	6.00E+00	4.00E+00					J	**2.78**	**1.37**		**115**			

0107096-14			TMF-0155					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01					U
Ra-226	9.80E-01	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.40E-01												
Th-230	8.80E-01	1.40E-01					J							
Th-232	8.00E-01	1.30E-01												
U-234	9.10E-01	2.30E-01												
U-235	1.42E-01	8.20E-02						-2.00E-02	2.60E-01					U
U-238	6.90E-01	2.00E-01												
Total U Alpha	**1.74E+00**	**3.16E-01**												
Alpha Sum	**3.73E+00**	**1.43E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	2.00E-01						9.00E-01	7.90E-01					
Pa-234m (Assumed from U-238)	6.90E-01	2.00E-01						9.00E-01	9.40E+00					U
K-40	1.73E+01	3.60E+00												
Ra-228	6.90E-01	2.70E-01												
Pa-231	-1.70E+00	1.50E+00					UJ							
Beta Sum	**1.92E+01**	**3.63E+00**						**1.96E+01**	**1.01E+01**					
Total Activity Sum	**2.29E+01**	**3.90E+00**						**2.33E+01**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**1.21**	**(from gamma)**		**46.6**			
Gross Beta	4.61E+00	9.70E-01					J	**3.88**	**1.48**		**122**			
Total Activity	1.11E+01	4.20E+00					J	**2.06**	**1.11**		**69.4**			

0107096-15			TMF-0157					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.30E-01					U
Ra-226	7.40E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	1.40E-01												
Th-230	9.30E-01	1.50E-01					J							
Th-232	8.10E-01	1.30E-01												
U-234	8.80E-01	2.30E-01												
U-235	1.27E-01	7.80E-02						7.80E-01	5.90E-01					
U-238	1.00E+00	2.50E-01												
Total U Alpha	**2.01E+00**	**3.49E-01**												
Alpha Sum	**3.23E+00**	**2.83E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.00E+00	2.50E-01						1.30E+00	9.60E-01					
Pa-234m (Assumed from U-238)	1.00E+00	2.50E-01						2.00E+01	2.30E+01					J
K-40	1.39E+01	4.80E+00												
Ra-228	8.90E-01	7.40E-01												
Pa-231	-2.30E+00	3.10E+00					U							
Beta Sum	**1.65E+01**	**4.88E+00**						**3.58E+01**	**2.35E+01**					
Total Activity Sum	**1.97E+01**	**5.64E+00**						**3.90E+01**	**2.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.70E+00	1.40E+00						**1.10**	**(from gamma)**		**70.0**			
Gross Beta	5.30E+00	1.00E+00					J	**2.25**	**1.30**		**103**			
Total Activity	9.10E+00	4.30E+00					J	**1.50**	**1.24**		**73.8**			

0107096-16			TMF-0158					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.50E-01	5.20E-01					U
Ra-226	1.26E+00	3.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	1.80E-01												
Th-230	8.80E-01	1.60E-01					J							
Th-232	9.00E-01	1.60E-01												
U-234	9.60E-01	2.70E-01												
U-235	1.12E-01	8.60E-02						1.20E-01	3.20E-01					U
U-238	6.60E-01	2.20E-01												
Total U Alpha	**1.73E+00**	**3.59E-01**												
Alpha Sum	**6.42E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.60E-01	2.20E-01						9.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	6.60E-01	2.20E-01						4.00E+00	1.10E+01					U
K-40	1.95E+01	4.10E+00												
Ra-228	7.30E-01	2.50E-01												
Pa-231	8.00E-01	1.60E+00					U							
Beta Sum	**2.16E+01**	**4.12E+00**						**2.52E+01**	**1.18E+01**					
Total Activity Sum	**2.81E+01**	**4.40E+00**						**3.16E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+00	1.10E+00						**0.49**	**(from gamma)**		**15.5**			
Gross Beta	4.53E+00	8.90E-01					J	**4.06**	**1.75**		**131**			
Total Activity	6.20E+00	3.90E+00					J	**3.72**	**2.03**		**128**			

0107096-17			TMF-0160					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.30E-01	1.00E-01	3.70E-01	**0.36**	**467**	U
Ra-226	1.64E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.30E-01												
Th-230	1.24E+00	1.80E-01					J							
Th-232	8.40E-01	1.30E-01												
U-234	1.14E+00	2.80E-01												
U-235	8.80E-02	6.80E-02					J	1.50E-01	4.10E-01	-5.40E-01	4.40E-01	**1.15**	**354**	U
U-238	1.21E+00	2.90E-01												
Total U Alpha	**2.44E+00**	**4.09E-01**												
Alpha Sum	**7.20E+00**	**2.24E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.21E+00	2.90E-01						1.80E-01	9.60E-01	6.00E-01	1.50E+00	**0.24**	**108**	U
Pa-234m (Assumed from U-238)	1.21E+00	2.90E-01						9.00E+00	1.70E+01	1.70E+01	1.50E+01	**0.35**	**61.5**	UJ
K-40	1.59E+01	4.50E+00	1.66E+01	3.70E+00	**0.12**	**4.31**								
Ra-228	8.10E-01	3.80E-01	8.20E-01	3.30E-01	**0.02**	**1.23**								
Pa-231	2.00E-01	2.40E+00	-8.00E-01	2.60E+00	**0.28**	**333**	U							
Beta Sum	**1.92E+01**	**4.54E+00**						**2.59E+01**	**1.76E+01**	**3.49E+01**	**1.55E+01**			
Total Activity Sum	**2.64E+01**	**5.06E+00**						**3.31E+01**	**1.78E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	1.40E+00						**0.49**	**(from gamma)**		**16.6**			
Gross Beta	6.10E+00	1.10E+00					J	**2.79**	**1.12**		**103**			
Total Activity	1.42E+01	4.40E+00					J	**1.81**	**1.03**		**59.9**			

0107096-18			TMF-0161					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.60E-01					U
Ra-226	9.00E-01	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.40E-01												
Th-230	7.60E-01	1.30E-01												
Th-232	8.80E-01	1.40E-01												
U-234	8.00E-01	2.40E-01												
U-235	1.70E-01	1.00E-01						-3.00E-02	2.50E-01					U
U-238	9.90E-01	2.70E-01												
Total U Alpha	**1.96E+00**	**3.75E-01**												
Alpha Sum	**5.21E+00**	**1.19E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.90E-01	2.70E-01						4.70E-01	6.30E-01					U
Pa-234m (Assumed from U-238)	9.90E-01	2.70E-01						5.60E+00	7.20E+00					U
K-40	1.90E+01	3.40E+00												
Ra-228	5.80E-01	1.60E-01												
Pa-231	-1.00E-01	1.20E+00					U							
Beta Sum	**2.15E+01**	**3.43E+00**						**2.56E+01**	**7.99E+00**					
Total Activity Sum	**2.68E+01**	**3.63E+00**						**3.08E+01**	**8.08E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.70E+00	1.20E+00						**0.29**	**(from gamma)**		**8.98**			
Gross Beta	4.66E+00	9.40E-01					J	**4.75**	**2.61**		**129**			
Total Activity	9.20E+00	4.00E+00					J	**3.25**	**2.40**		**97.7**			

0107096-19			TMF-0163					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.30E-01					U
Ra-226	6.90E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	1.40E-01												
Th-230	8.40E-01	1.40E-01					J							
Th-232	8.50E-01	1.40E-01												
U-234	9.30E-01	2.40E-01												
U-235	6.50E-02	5.60E-02						-1.70E-01	5.60E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.73E+00**	**3.17E-01**												
Alpha Sum	**3.14E+00**	**2.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						6.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						0.00E+00	2.10E+01					UJ
K-40	1.31E+01	4.80E+00												
Ra-228	7.10E-01	7.10E-01												
Pa-231	-2.00E+00	3.10E+00					U							
Beta Sum	**1.50E+01**	**4.87E+00**						**1.42E+01**	**2.16E+01**					
Total Activity Sum	**1.82E+01**	**5.63E+00**						**1.73E+01**	**2.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.30E+00	1.20E+00						**1.03**	**(from gamma)**		**67.1**			
Gross Beta	4.92E+00	9.60E-01					J	**2.03**	**0.43**		**101**			
Total Activity	1.27E+01	4.60E+00						**0.75**	**0.21**		**35.4**			

0107096-20			TMF-0164					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	2.30E-01					U
Ra-226	7.50E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	1.60E-01												
Th-230	8.60E-01	1.30E-01					J							
Th-232	9.10E-01	1.40E-01												
U-234	7.90E-01	2.10E-01												
U-235	7.60E-02	5.80E-02						-8.00E-02	2.60E-01					U
U-238	8.40E-01	2.20E-01												
Total U Alpha	**1.71E+00**	**3.10E-01**												
Alpha Sum	**4.28E+00**	**1.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.20E-01						1.00E+00	9.40E-01					
Pa-234m (Assumed from U-238)	8.40E-01	2.20E-01						1.00E-01	6.70E+00					U
K-40	1.84E+01	3.30E+00												
Ra-228	7.70E-01	1.90E-01												
Pa-231	-1.10E+00	1.90E+00					U							
Beta Sum	**2.07E+01**	**3.33E+00**						**2.01E+01**	**7.53E+00**					
Total Activity Sum	**2.50E+01**	**3.77E+00**						**2.44E+01**	**7.74E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.61E+00	9.80E-01						**0.17**	**(from gamma)**		**7.52**			
Gross Beta	4.78E+00	9.20E-01					J	**4.62**	**2.02**		**125**			
Total Activity	5.00E+00	3.90E+00					J	**3.69**	**2.24**		**133**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107106

This sample delivery group (SDG) contained fifteen (15) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 14, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0190	0107106-1
TMF-0191	0107106-2
TMF-9196	0107106-3
TMF-9197	0107106-4
TMF-0272	0107106-5
TMF-0270	0107106-6
TMF-0271	0107106-7
TMF-0229	0107106-8
TMF-0228	0107106-9
TMF-0193	0107106-10
TMF-0282	0107106-11
TMF-0283	0107106-12
TMF-0284	0107106-13
TMF-0285	0107106-14
TMF-0194	0107106-15

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\mathrm{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was observed in the EQ-1 and EQ-2 equipment rinsate blanks. ^{137}Cs activity was observed in the equipment rinsate blank EQ-1, but it was not observed in all samples. However, ^{137}Cs activity was reported by the laboratory in samples TMF-0271 and TMF-0283 as the ^{137}Cs activity in the sample was higher than the required DL (1.65*TPU). All associated samples results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). ^{137}Cs activity value observed in samples TMF-0271 and TMF-0283 were greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification on ^{137}Cs results in those samples is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses except ^{231}Pa (DER 1.30, RPD 1533%) result. **Therefore, it is recommended that ^{231}Pa result for all samples qualified as estimated (J).**

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples. The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near total equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. Results for fission product ^{137}Cs was reported for samples TMF-0271 and TMF-0283. **Inclusion of ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl in the database is for information purposes only, since any modeling will assume equilibrium with parent ^{238}U or ^{232}Th.**

There were no incidents of identified radionuclides being excluded from the laboratory reports. The required method detection limit (MDL) for the gamma spectrometric analysis for target radionuclides is 1 pCi/g for ^{241}Am. Sample TMF-0285 ^{241}Am result exceeded the required MDL indicating that the laboratory may not have met the project DQOs. No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{230}Th analyses in the method blank. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). The ^{230}Th analyses results for all samples were greater than 5 times the blank therefore, no qualification of ^{230}Th analysis is necessary.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses. No qualification is required.

Sample-Specific Chemical Recovery:

The tracer recoveries are within acceptable limit. The tracer recoveries were greater than 14% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results of $^{234/235/238}$U and $^{228/230/232}$Th for all samples have less than 10% uncertainty, except for $^{228/230/232}$Th result for sample TMF-9196 (10.79%). Therefore it is recommended that the $^{228/230/232}$Th results for sample TMF-9196 be qualified as estimated (J).

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for $^{224/235/238}$U and $^{228/230/232}$Th analysis.

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 1.0 pCi/g for $^{224/235/238}$U and $^{228/230/232}$Th.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination in the method blank sample for ^{226}Ra analysis except for the method blank associated with sample TMF-0283. All associated samples result less than 5 times the blank value for ^{226}Ra analyses should be qualified as estimated (J). The ^{226}Ra result for sample TMF-0283 is less than 5 times the ^{226}Ra concentration identified in the method blank. **Therefore, it is recommended that the ^{226}Ra result for sample TMF-0283 qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all ^{226}Ra analyses.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis for all samples except samples TMF-0284 (237.37%) and TMF-0285 (127.05%) were within acceptable limits. However, results for samples TMF-0284 and TMF-0285 were calculated using 100% chemical recovery as directed by the SOW. This high recovery may be due to a matrix effect. **Therefore, it is recommended that the ^{226}Ra results for samples TMF-0284 and TMF-0285 be qualified as estimated (J).**

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Quantitation and Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. The results for samples TMF-0190, TMF-9196, TMF-0270, TMF-0228, TMF-0103, TMF-0282, TMF-0282 (laboratory duplicate), TMF-0283, and TMF-0285 did not meet the required MDL limits of both gross alpha and gross beta analyses indicating that the laboratory may not have met the project DQOs for these samples.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses. Therefore, no qualification is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis by liquid scintillation counting.

Duplicate Analysis:

The total activity by LCS duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC.

It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have

been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities are within acceptable limits for all samples indicating that the gross alpha analyses for all samples agree with the sum of the alpha emitters within a 99% confidence level. No qualification of the gross alpha result is necessary.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (1.91 – 4.62) for all samples, except sample TMF-0285 (0.07), the sums of the beta emitters activity and gross beta activity are outside the acceptable limits as well as the RPD values (84.1% - 130%). The gross beta results are smaller than the sum of the beta emitters by an approximate factor ranging from 2.4 to 4.7 for all samples. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts or the sample preparation method, as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the total activity sum i.e., the sums of the beta emitters and the sum of alpha, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs for samples TMF-0191 (3.19), TMF-9197 (2.39), TMF-0272 (2.63), TMF-0270 (1.72), TMF-0271 (2.08), TMF-0229 (2.34), TMF-0193 (1.96), TMF-0282 (1.68), TMF-0283 (2.25), TMF-0284 (2.93), TMF-0285 (1.88) and TMF-0194 (2.28) are out side the acceptable limits as well as the RPD values TMF-0191 (106%), TMF-9197 (81.3%), TMF-0272 (88.1%), TMF-0270 (54.5%), TMF-0271 (56.6%), TMF-0229 (84.4%), TMF-0193 (83.4%), TMF-0282 (65.1%), TMF-0283 (62.3%), TMF-0284 (98.7%), TMF-0285 (24.3%) and TMF-0194 (72.1%). The total activity results for these samples are smaller than the sums of the alpha and beta emitters by an approximate factor ranging from 1.7

to 3.2. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides, radionuclide salts, and/or the sample preparation method as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

0107106-1			TMF-0190					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.40E-01	1.00E-02	1.40E-01	**0.22**	**300**	U
Ra-226	6.10E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.30E-01	1.20E-01	2.40E-01	1.00E-01	**0.58**	**31.6**								
Th-230	6.10E-01	1.30E-01	6.20E-01	1.40E-01	**0.05**	**1.63**								
Th-232	3.11E-01	8.90E-02	3.51E-01	9.40E-02	**0.31**	**12.1**								
U-234	5.20E-01	1.80E-01												
U-235	5.10E-02	5.20E-02						1.00E-02	2.50E-01	-8.00E-02	2.50E-01	**0.25**	**257**	U
U-238	5.60E-01	1.80E-01												
Total U Alpha	**1.13E+00**	**2.60E-01**												
Alpha Sum	**3.89E+00**	**1.24E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	6.60E+00	1.50E+00	6.20E+00	1.40E+00	**0.19**	**6.25**								
Th-234 (Assumed from U-238)	5.60E-01	1.80E-01						6.70E-01	7.50E-01	5.80E-01	7.30E-01	**0.09**	**14.4**	
Pa-234m (Assumed from U-238)	5.60E-01	1.80E-01						-1.00E+00	6.80E+00	1.70E+00	7.10E+00	**0.27**	**771**	U
Ac-227														
Ra-228	2.30E-01	1.30E-01	2.50E-01	1.30E-01	**0.11**	**8.33**								
Pa-231	1.00E+00	1.30E+00	-1.30E+00	1.20E+00	**1.30**	**1533**	UJ							
Beta Sum	**8.07E+00**	**1.53E+00**						**6.62E+00**	**7.01E+00**	**8.57E+00**	**7.28E+00**			
Total Activity Sum	**1.20E+01**	**1.97E+00**						**1.05E+01**	**7.11E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+00	1.10E+00						**0.37**	**(from gamma)**		**14.5**			
Gross Beta	3.17E+00	9.20E-01					J	**2.74**	**0.49**		**87.2**			
Total Activity	8.40E+00	4.00E+00					J	**0.80**	**0.26**		**35.0**			

0107106-2			TMF-0191					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-01	4.70E-01					U
Ra-226	1.80E-01	1.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	1.90E-01												
Th-230	7.60E-01	1.50E-01												
Th-232	8.10E-01	1.60E-01												
U-234	7.70E-01	2.10E-01	9.50E-01	2.50E-01	**0.55**	**20.9**								
U-235	1.24E-01	7.50E-02	1.33E-01	8.20E-02	**0.08**	**7.00**		-1.40E-01	3.50E-01					U
U-238	7.10E-01	2.00E-01	9.30E-01	2.50E-01	**0.69**	**26.8**								
Total U Alpha	**1.60E+00**	**3.00E-01**	**2.01E+00**	**3.63E-01**										
Alpha Sum	**4.78E+00**	**1.59E+00**	**2.01E+00**	**3.63E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.97E+01	4.00E+00												
Th-234 (Assumed from U-238)	7.10E-01	2.00E-01	9.30E-01	2.50E-01	**0.69**	**26.8**		6.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	7.10E-01	2.00E-01	9.30E-01	2.50E-01	**0.69**	**26.8**		-1.70E+00	9.30E+00					U
Ac-227														
Ra-228	6.20E-01	2.10E-01												
Pa-231	5.00E-01	1.70E+00					UJ							
Beta Sum	**2.18E+01**	**4.02E+00**	**1.86E+00**	**3.54E-01**				**1.93E+01**	**1.02E+01**					
Total Activity Sum	**2.66E+01**	**4.32E+00**	**3.87E+00**	**5.07E-01**				**2.41E+01**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.10E+00						**0.68**	**(from gamma)**		**24.2**			
Gross Beta	5.35E+00	9.70E-01					J	**3.98**	**1.36**		**121**			
Total Activity	8.20E+00	3.80E+00					J	**3.19**	**1.44**		**106**			

0107106-3			TMF-9196					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.70E-01					U
Ra-226	7.00E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.90E-01	1.80E-01												
Th-230	5.80E-01	1.60E-01												
Th-232	3.20E-01	1.10E-01												
U-234	5.90E-01	1.90E-01												
U-235	1.20E-01	8.00E-02						-1.10E-01	2.70E-01					U
U-238	5.20E-01	1.70E-01												
Total U Alpha	**1.23E+00**	**2.67E-01**												
Alpha Sum	**3.66E+00**	**1.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	6.70E+00	1.90E+00												
Th-234 (Assumed from U-238)	5.20E-01	1.70E-01						5.40E-01	8.80E-01					U
Pa-234m (Assumed from U-238)	5.20E-01	1.70E-01						3.40E+00	9.00E+00					U
Ac-227														
Ra-228	2.80E-01	2.40E-01												
Pa-231	6.00E-01	1.40E+00					UJ							
Beta Sum	**8.09E+00**	**1.94E+00**						**1.10E+01**	**9.25E+00**					
Total Activity Sum	**1.18E+01**	**2.35E+00**						**1.47E+01**	**9.34E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.80E+00	1.30E+00						**0.08**	**(from gamma)**		**3.8**			
Gross Beta	3.30E+00	1.60E+00					J	**1.91**	**0.82**		**84.1**			
Total Activity	8.20E+00	3.90E+00					J	**0.78**	**0.64**		**35.6**			

0107106-4			TMF-9197					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.20E-02	9.60E-02					U
Ra-226	9.20E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.70E-01												
Th-230	9.20E-01	1.70E-01												
Th-232	6.90E-01	1.30E-01												
U-234	6.70E-01	1.90E-01												
U-235	6.10E-02	5.30E-02						1.90E-01	2.80E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.46E+00**	**2.81E-01**												
Alpha Sum	**3.86E+00**	**1.51E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.75E+01	3.80E+00												
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						1.12E+00	6.10E-01					
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						0.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.80E-01	2.90E-01												
Pa-231	-1.10E+00	1.60E+00					UJ							
Beta Sum	**1.96E+01**	**3.83E+00**						**1.93E+01**	**1.17E+01**					
Total Activity Sum	**2.35E+01**	**4.11E+00**						**2.31E+01**	**1.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.00E+00	7.10E+00	1.30E+00	**1.10**	**29.0**		**0.79**	**(from gamma)**		**31.4**			
Gross Beta	5.25E+00	9.60E-01	5.36E+00	9.70E-01	**0.08**	**2.07**	J	**3.64**	**1.20**		**116**			
Total Activity	9.90E+00	3.90E+00	7.50E+00	3.80E+00	**0.44**	**27.6**	J	**2.39**	**1.07**		**81.3**			

0107106-5			TMF-0272					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.70E-02	9.60E-02	2.30E-01	4.90E-01	**0.39**	**145**	U
Ra-226	6.60E-01	2.60E-01	9.50E-01	2.50E-01	**0.80**	**36**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	2.10E-01	8.40E-01	1.70E-01	**0.67**	**19.4**								
Th-230	9.20E-01	1.80E-01	7.70E-01	1.40E-01	**0.66**	**17.8**								
Th-232	9.60E-01	1.80E-01	7.90E-01	1.50E-01	**0.73**	**19.4**								
U-234	9.20E-01	2.30E-01												
U-235	1.36E-01	8.00E-02						7.00E-02	2.60E-01	-9.00E-02	3.20E-01	**0.39**	**1600**	U
U-238	9.10E-01	2.30E-01												
Total U Alpha	**1.97E+00**	**3.35E-01**												
Alpha Sum	**5.62E+00**	**1.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.52E+01	3.30E+00	1.91E+01	3.80E+00	**0.77**	**22.7**								
Th-234 (Assumed from U-238)	9.10E-01	2.30E-01						1.20E+00	8.50E-01	1.20E+00	1.00E+00	**0.00**	**0.00**	
Pa-234m (Assumed from U-238)	9.10E-01	2.30E-01						9.80E+00	9.70E+00	0.00E+00	9.10E+00	**0.74**	**200**	
Ac-227														
Ra-228	7.70E-01	2.40E-01	6.00E-01	2.20E-01	**0.52**	**24.8**								
Pa-231	1.00E-01	1.90E+00	-5.00E-01	1.80E+00	**0.23**	**300**	UJ							
Beta Sum	**1.78E+01**	**3.33E+00**						**2.70E+01**	**1.03E+01**	**2.08E+01**	**9.92E+00**			
Total Activity Sum	**2.34E+01**	**3.78E+00**						**3.26E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.09**	**(from gamma)**		**3.2**			
Gross Beta	5.57E+00	9.90E-01					J	**3.52**	**2.07**		**105**			
Total Activity	9.10E+00	3.90E+00					J	**2.63**	**2.11**		**88.1**			

0107106-6			TMF-0270					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.70E-01	2.90E-01					U
Ra-226	1.06E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	2.10E-01												
Th-230	1.00E+00	1.90E-01												
Th-232	1.00E+00	1.90E-01												
U-234	1.08E+00	2.80E-01	9.90E-01	2.50E-01	**0.24**	**8.70**								
U-235	1.90E-01	1.00E-01	7.60E-02	6.20E-02	**0.97**	**85.7**		-4.00E-02	3.10E-01					U
U-238	1.05E+00	2.70E-01	8.70E-01	2.30E-01	**0.51**	**18.8**								
Total U Alpha	**2.32E+00**	**4.02E-01**	**1.94E+00**	**3.45E-01**										
Alpha Sum	**4.85E+00**	**2.33E+00**	**1.94E+00**	**3.45E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.56E+01	3.00E+00												
Th-234 (Assumed from U-238)	1.05E+00	2.70E-01	8.70E-01	2.30E-01	**0.51**	**18.8**		5.00E-01	5.80E-01					
Pa-234m (Assumed from U-238)	1.05E+00	2.70E-01	8.70E-01	2.30E-01	**0.51**	**18.8**		-1.00E+00	8.30E+00					U
Ac-227														
Ra-228	5.70E-01	1.70E-01												
Pa-231	-1.80E+00	2.50E+00					UJ							
Beta Sum	**1.81E+01**	**3.04E+00**	**1.74E+00**	**3.25E-01**				**1.55E+01**	**8.85E+00**					
Total Activity Sum	**2.29E+01**	**3.83E+00**	**3.68E+00**	**4.74E-01**				**2.03E+01**	**9.15E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.70E+00	1.40E+00						**0.68**	**(from gamma)**		**32.0**			
Gross Beta	4.70E+00	1.10E+00					J	**4.13**	**1.21**		**117**			
Total Activity	1.31E+01	4.20E+00					J	**1.72**	**0.72**		**54.5**			

0107106-7			TMF-0271					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.70E-01					U
Ra-226	7.20E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	1.60E-01												
Th-230	6.60E-01	1.30E-01												
Th-232	7.20E-01	1.40E-01												
U-234	1.22E+00	3.00E-01												
U-235	5.00E-02	5.10E-02						-2.10E-01	2.80E-01					U
U-238	1.15E+00	2.90E-01												
Total U Alpha	**2.42E+00**	**4.20E-01**												
Alpha Sum	**5.12E+00**	**1.37E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	1.46E-01	7.10E-02												
K-40	1.84E+01	3.50E+00												
Th-234 (Assumed from U-238)	1.15E+00	2.90E-01						8.10E-01	8.10E-01					
Pa-234m (Assumed from U-238)	1.15E+00	2.90E-01						2.10E+00	7.50E+00					U
Ac-227														
Ra-228	7.10E-01	2.10E-01												
Pa-231	-1.00E-01	1.40E+00					UJ							
Beta Sum	**2.15E+01**	**3.53E+00**						**2.22E+01**	**8.32E+00**					
Total Activity Sum	**2.67E+01**	**3.79E+00**						**2.73E+01**	**8.43E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.69E+00	8.90E-01						**0.88**	**(from gamma)**		**32.5**			
Gross Beta	5.30E+00	9.60E-01					J	**4.43**	**2.01**		**121**			
Total Activity	1.49E+01	4.20E+00					J	**2.08**	**1.31**		**56.6**			

0107106-8			TMF-0229					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	5.50E-01					U
Ra-226	4.50E-01	3.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	2.00E-01												
Th-230	8.10E-01	1.70E-01												
Th-232	8.70E-01	1.80E-01												
U-234	7.80E-01	2.20E-01												
U-235	4.10E-02	5.00E-02					U	-3.00E-02	3.10E-01					U
U-238	8.80E-01	2.40E-01												
Total U Alpha	**1.70E+00**	**3.29E-01**												
Alpha Sum	**3.51E+00**	**2.15E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.75E+01	3.90E+00												
Th-234 (Assumed from U-238)	8.80E-01	2.40E-01						-4.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.80E-01	2.40E-01						7.00E+00	1.30E+01					U
Ac-227														
Ra-228	7.70E-01	2.60E-01												
Pa-231	-1.30E+00	2.30E+00					UJ							
Beta Sum	**1.99E+01**	**3.93E+00**						**2.47E+01**	**1.36E+01**					
Total Activity Sum	**2.34E+01**	**4.48E+00**						**2.82E+01**	**1.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.08E+00	9.90E-01	5.40E+00	1.10E+00	**0.22**	**6.11**		**0.66**	**(from gamma)**		**36.5**			
Gross Beta	4.49E+00	8.70E-01	4.80E+00	9.10E-01	**0.25**	**6.67**	J	**3.82**	**1.48**		**126**			
Total Activity	9.50E+00	3.90E+00	9.90E+00	3.90E+00	**0.07**	**4.12**	J	**2.34**	**1.31**		**84.4**			

0107106-9			TMF-0228					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	2.90E-01					U
Ra-226	7.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.90E-01	1.80E-01												
Th-230	6.80E-01	1.60E-01												
Th-232	4.40E-01	1.20E-01												
U-234	8.40E-01	2.50E-01												
U-235	1.01E-01	7.80E-02						2.80E-01	2.80E-01					
U-238	8.00E-01	2.40E-01												
Total U Alpha	**1.74E+00**	**3.55E-01**												
Alpha Sum	**3.37E+00**	**1.52E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	8.80E+00	2.20E+00												
Th-234 (Assumed from U-238)	8.00E-01	2.40E-01						5.50E-01	8.10E-01					U
Pa-234m (Assumed from U-238)	8.00E-01	2.40E-01						3.70E+00	8.90E+00					U
Ac-227														
Ra-228	4.30E-01	2.10E-01												
Pa-231	-8.00E-01	1.60E+00					UJ							
Beta Sum	**1.07E+01**	**2.24E+00**						**1.34E+01**	**9.21E+00**					
Total Activity Sum	**1.41E+01**	**2.71E+00**						**1.68E+01**	**9.33E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.40E+00	1.00E+00						**0.02**	**(from gamma)**		**0.9**			
Gross Beta	2.54E+00	9.40E-01					J	**3.37**	**1.17**		**123**			
Total Activity	9.20E+00	3.90E+00					J	**1.03**	**0.75**		**42.1**			

0107106-10			TMF-0193					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-03	8.40E-02					U
Ra-226	6.70E-01	2.10E-01	7.20E-01	2.00E-01	**0.17**	**7**								
Np-237														
Pu-238														
Pu-239														
Th-228	4.40E-01	1.60E-01												
Th-230	7.40E-01	1.60E-01												
Th-232	3.70E-01	1.00E-01												
U-234	6.90E-01	2.10E-01												
U-235	9.00E-03	2.70E-02					U	1.30E-01	2.30E-01					U
U-238	7.30E-01	2.20E-01												
Total U Alpha	**1.43E+00**	**3.05E-01**												
Alpha Sum	**4.37E+00**	**1.34E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	9.30E+00	2.30E+00												
Th-234 (Assumed from U-238)	7.30E-01	2.20E-01						5.60E-01	5.20E-01					
Pa-234m (Assumed from U-238)	7.30E-01	2.20E-01						-2.00E+00	7.90E+00					U
Ac-227														
Ra-228	5.80E-01	2.40E-01												
Pa-231	8.00E-01	1.40E+00					UJ							
Beta Sum	**1.14E+01**	**2.34E+00**						**8.54E+00**	**8.25E+00**					
Total Activity Sum	**1.58E+01**	**2.69E+00**						**1.29E+01**	**8.36E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.80E+00	1.00E+00						**0.34**	**(from gamma)**		**13.93**			
Gross Beta	2.94E+00	9.30E-01					J	**3.37**	**0.67**		**118**			
Total Activity	6.50E+00	3.90E+00					J	**1.96**	**0.69**		**83.4**			

0107106-11			TMF-0282					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.60E-01	8.00E-03	9.50E-02	**0.61**	**221**	U
Ra-226	5.00E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.90E-01	1.40E-01	5.00E-01	1.50E-01	**0.44**	**16.5**								
Th-230	6.20E-01	1.30E-01	6.90E-01	1.50E-01	**0.35**	**10.7**								
Th-232	4.60E-01	1.10E-01	5.80E-01	1.40E-01	**0.67**	**23.1**								
U-234	8.90E-01	2.60E-01												
U-235	4.50E-02	5.40E-02						0.00E+00	2.80E-01	-8.00E-02	2.90E-01	**0.20**	**200**	U
U-238	9.80E-01	2.80E-01												
Total U Alpha	**1.92E+00**	**3.86E-01**												
Alpha Sum	**3.37E+00**	**1.35E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.07E+01	2.10E+00	1.07E+01	2.80E+00	**0.00**	**0.00**								
Th-234 (Assumed from U-238)	9.80E-01	2.80E-01						6.00E-02	8.00E-01	5.60E-01	7.10E-01	**0.47**	**161**	U
Pa-234m (Assumed from U-238)	9.80E-01	2.80E-01						-5.00E+00	7.90E+00	1.30E+00	7.70E+00	**0.57**	**341**	U
Ac-227														
Ra-228	5.80E-01	1.90E-01	3.80E-01	2.50E-01	**0.64**	**41.7**								
Pa-231	-8.00E-01	1.40E+00	-6.00E-01	1.60E+00	**0.09**	**28.6**	UJ							
Beta Sum	**1.31E+01**	**2.15E+00**						**6.24E+00**	**8.22E+00**	**1.29E+01**	**8.23E+00**			
Total Activity Sum	**1.65E+01**	**2.54E+00**						**9.61E+00**	**8.33E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+00	1.10E+00	3.10E+00	1.10E+00	**0.90**	**36.8**		**0.65**	**(from gamma)**		**28.9**			
Gross Beta	2.81E+00	9.30E-01	2.90E+00	1.00E+00	**0.07**	**3.15**	J	**4.41**	**0.42**		**130**			
Total Activity	8.40E+00	4.10E+00					J	**1.68**	**0.13**		**65.1**			

0107106-12			TMF-0283					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.60E-01					UJ
Ra-226	9.80E-01	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.50E-01	1.60E-01												
Th-230	1.06E+00	1.90E-01												
Th-232	6.50E-01	1.30E-01												
U-234	1.46E+00	3.40E-01												
U-235	7.90E-02	6.50E-02						0.00E+00	2.60E-01					U
U-238	1.37E+00	3.30E-01												
Total U Alpha	**2.91E+00**	**4.78E-01**												
Alpha Sum	**6.07E+00**	**1.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	9.10E-02	5.10E-02												
K-40	1.59E+01	3.00E+00												
Th-234 (Assumed from U-238)	1.37E+00	3.30E-01						1.13E+00	8.20E-01					
Pa-234m (Assumed from U-238)	1.37E+00	3.30E-01						3.20E+00	7.70E+00					U
Ac-227														
Ra-228	5.50E-01	1.80E-01												
Pa-231	-2.00E-01	1.30E+00					UJ							
Beta Sum	**1.93E+01**	**3.05E+00**						**2.08E+01**	**8.31E+00**					
Total Activity Sum	**2.53E+01**	**3.32E+00**						**2.69E+01**	**8.41E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.20E+00						**0.02**	**(from gamma)**		**0.5**			
Gross Beta	4.30E+00	1.10E+00					J	**4.62**	**1.97**		**127**			
Total Activity	1.33E+01	4.20E+00					J	**2.25**	**1.45**		**62.3**			

0107106-13			TMF-0284					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.70E-01	4.70E-01					
Ra-226	9.90E-01	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	1.60E-01												
Th-230	7.80E-01	1.40E-01												
Th-232	8.20E-01	1.40E-01												
U-234	9.10E-01	2.40E-01	8.20E-01	2.20E-01	**0.28**	**10.4**								
U-235	4.10E-02	4.50E-02	4.00E-03	2.30E-02	**0.73**	**164**		-4.00E-02	3.10E-01					U
U-238	8.30E-01	2.20E-01	8.70E-01	2.30E-01	**0.13**	**4.71**								
Total U Alpha	**1.78E+00**	**3.29E-01**	**1.69E+00**	**3.19E-01**										
Alpha Sum	**4.11E+00**	**1.44E+00**	**1.69E+00**	**3.19E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.79E+01	3.60E+00												
Th-234 (Assumed from U-238)	8.30E-01	2.20E-01	8.70E-01	2.30E-01	**0.13**	**4.71**		-9.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.30E-01	2.20E-01	8.70E-01	2.30E-01	**0.13**	**4.71**		-4.90E+00	9.00E+00					U
Ac-227														
Ra-228	6.60E-01	2.10E-01												
Pa-231	-1.30E+00	1.50E+00					UJ							
Beta Sum	**2.01E+01**	**3.62E+00**	**1.74E+00**	**3.25E-01**				**1.26E+01**	**9.76E+00**					
Total Activity Sum	**2.42E+01**	**3.90E+00**	**3.43E+00**	**4.56E-01**				**1.67E+01**	**9.86E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.61E+00	9.00E-01						**0.29**	**(from gamma)**		**11.4**			
Gross Beta	4.24E+00	7.30E-01					J	**4.28**	**0.85**		**130**			
Total Activity	8.20E+00	3.80E+00					J	**2.93**	**0.81**		**98.7**			

0107106-14			TMF-0285					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	6.60E-01					U
Ra-226	2.26E+01	2.40E+00					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.60E-01												
Th-230	3.15E+01	4.40E+00												
Th-232	9.10E-01	1.60E-01												
U-234	2.90E+01	4.60E+00												
U-235	1.72E+00	4.50E-01						1.65E+00	7.20E-01					
U-238	2.79E+01	4.50E+00												
Total U Alpha	**5.86E+01**	**6.45E+00**												
Alpha Sum	**1.16E+02**	**8.50E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.29E+01	2.90E+00												
Th-234 (Assumed from U-238)	2.79E+01	4.50E+00						1.82E+01	3.70E+00					
Pa-234m (Assumed from U-238)	2.79E+01	4.50E+00						3.10E+01	2.00E+01					
Ac-227														
Ra-228	7.40E-01	3.20E-01												
Pa-231	1.70E+00	2.60E+00					UJ							
Beta Sum	**6.96E+01**	**7.01E+00**						**6.30E+01**	**2.05E+01**					
Total Activity Sum	**1.86E+02**	**1.10E+01**						**1.79E+02**	**2.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.27E+02	1.80E+01						**0.55**	**(from gamma)**		**9.0**			
Gross Beta	7.05E+01	9.80E+00					J	**0.07**	**0.33**		**1.22**			
Total Activity	2.37E+02	2.50E+01					J	**1.88**	**1.73**		**24.3**			

0107106-15			TMF-0194					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.30E-02	9.30E-02					U
Ra-226	1.02E+00	2.60E-01	8.10E-01	2.30E-01	**0.60**	**23**								
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.60E-01												
Th-230	7.70E-01	1.50E-01												
Th-232	9.00E-01	1.70E-01												
U-234	9.70E-01	2.60E-01												
U-235	6.60E-02	6.00E-02						1.50E-01	2.40E-01					U
U-238	7.40E-01	2.20E-01												
Total U Alpha	**1.78E+00**	**3.46E-01**												
Alpha Sum	**5.54E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.66E+01	3.70E+00												
Th-234 (Assumed from U-238)	7.40E-01	2.20E-01						5.20E-01	7.50E-01					U
Pa-234m (Assumed from U-238)	7.40E-01	2.20E-01						1.00E+01	1.10E+01					
Ac-227														
Ra-228	6.10E-01	2.10E-01												
Pa-231	3.00E-01	1.50E+00					UJ							
Beta Sum	**1.87E+01**	**3.72E+00**						**2.78E+01**	**1.16E+01**					
Total Activity Sum	**2.43E+01**	**3.99E+00**						**3.33E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.25E+00	8.90E-01						**0.76**	**(from gamma)**		**26.28**			
Gross Beta	4.52E+00	8.00E-01					J	**3.73**	**1.99**		**122**			
Total Activity	1.14E+01	4.00E+00					J	**2.28**	**1.77**		**72.1**			

Chemical Analytical Data Verification Comments on Data for Tonawanda Landfill, SDG 0107106

Data for three soil samples were reported in these data packages. The soil samples were analyzed by Paragon Analytics Inc. laboratory for polychlorinated biphenyls (PCBs), pesticides, volatile organics analysis (VOAs), base neutral/acid extractables (BNAs), total metals, total cyanide, and percent moisture as requested in the SAP. The analytical data were evaluated according to the guidance provided in the referenced methods from SW-846[1], ASTM[2], and the sampling and analysis plan (SAP)[3]. The groundwater samples have the following ID numbers:

Client Sample ID	Laboratory Sample ID
TMF-0282	0107106-11
TMF-0283	0107106-12
TMF-0284	0107106-13

Total PCBs

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total PCBs.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met. No qualification of data is necessary.

Blanks

No blank contamination was detected. No qualification of data is necessary.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

---

1 "EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition.

2 "American Society of Testing and Materials Standard Methods".

3 "Statement of Work for Radiological and Chemical Analytical Laboratory Services, Town of Tonawanda Landfill, Vicinity FUSRAP Property, Tonawanda, NY," April 2001.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS recoveries for Aroclor 1016 (61%, 69%, QC limits 72-116%), and Aroclor 1260 (54%, 65%, QC limits 66-116%) were outside the QC limits. **The Aroclor 1260 results for samples TMF-0282 and TMF-0283 should be qualified as estimated (J), and the remaining Aroclor results for samples TMF-0282, TMF-0283, and TMF-0284 should be qualified as undetected at an estimated detection limit (UJ) due to low MS recoveries.**

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

GC column percent difference (%D)

The GC column %D for Aroclor 1260 for samples TMF-0282 (34.2%) and TMF-0283 (27.5%) were greater than the QC limit of 25%. **The Aroclor 1260 results for samples TMF-0282 and TMF-0283 should be qualified as estimated (J) due to high GC column %D.**

Total Pesticides

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total pesticides.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met except for the continuing calibration percent differences (%Ds) for 4,4'-DDT (53%, 66%), methoxychlor (53%, 57%), and endrin ketone (21%, 23%) associated with samples TMF-0282, TMF-0283, and TMF-0284, which were greater than the QC limit of 15%. **The 4,4'-DDT result for sample TMF-0282 should be qualified as estimated (J), and the methoxychlor and endrin ketone results for sample TMF-0282, and the 4,4'-DDT, methoxychlor, and endrin ketone results for samples TMF-0283 and TMF-0284 should be qualified as undetected at an estimated detection limit (UJ) due to high continuing calibration %D.**

Blanks

No blank contamination was detected. No qualification of data is necessary.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS/MSD recoveries and RPDs were acceptable except for the MS/MSD RPDs for aldrin (24%), dieldrin (22%), and 4,4'-DDT (25%), which were greater than the QC limit of 20%. **The aldrin result for sample TMF-0282, the aldrin and 4,4'-DDT results for sample TMF-0283, and the aldrin, dieldrin, and 4,4'-DDT results for sample TMF-0284 should be qualified as undetected at an estimated detection limit (UJ), and the dieldrin and 4,4'-DDT**

results for sample TMF-0282, and the dieldrin result for sample TMF-0283 should be qualified as estimated (J) due to high MS/MSD RPD.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

GC column percent difference (%D)

The GC column %Ds were acceptable except for the heptachlor epoxide (25.6%), gamma-chlordane (76.5%), alpha-chlordane (27.8%), and dieldrin (105.3%) %Ds for sample TMF-0282, and the gamma-chlordane (180.0%), alpha-chlordane (64.7%), 4,4'-DDE (109.9%), 4,4'-DDD (36.6%), and endosulfan sulfate (617.9%) %Ds for sample TMF-0283, which were greater than the QC limit of 25%. **The heptachlor epoxide, gamma-chlordane, alpha-chlordane, and dieldrin results for sample TMF-0282, and the gamma-chlordane, alpha-chlordane, 4,4'-DDE, 4,4'-DDD, and endosulfan sulfate results for sample TMF-0283 should be qualified as estimated (J) due to high GC column %D.**

Endrin and 4,4'-DDT Breakdown

The endrin and 4,4'-DDT percent breakdown results were acceptable. No qualification of data is necessary.

Total VOAs

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total VOAs.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

GC/MS Tune

The GC/MS tuning requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration results were acceptable except for the initial calibration relative standard deviation (RSD) for methylene chloride (40.2%) associated with samples TMF-0282, TMF-0283, and TMF-0284, which was greater than the QC limit of 30%, and the continuing calibration percent difference (%D) for methylene chloride (55.8%) associated with sample TMF-0282, which was greater than the acceptability limit for non-detected results of 40%. **The methylene chloride results for samples TMF-0283 and TMF-0284 should be qualified as estimated (J) due to initial calibration RSD greater than the QC limit, and the methylene chloride result for sample TMF-0282 should be qualified as rejected (R) due to continuing calibration %D greater than the acceptability limit for non-detected results.**

Blanks

The method blanks were contaminated with methylene chloride, at concentrations requiring qualification of data. Based on professional judgment for VOAs analysis, if the sample to blank concentration ratio is less than 2.5 (5 for common laboratory contaminants), the sample result should be qualified as undetected at an estimated detection limit (UJ), and if the sample to blank concentration ratio is between 2.5 and 5 (between 5 and 10 for common laboratory contaminants), the sample result should be qualified as estimated (J). The compound methylene chloride is considered to be a common laboratory contaminant for VOAs analysis. **The methylene chloride results for samples TMF-0283 and TMF-0284 should be qualified as undetected at an estimated detection limit (UJ) due to blank contamination.**

Internal Standard (IS) Area

The IS percent recoveries and retention times were acceptable. No qualification of data is necessary.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS samples were prepared from a sample from another project. Since the LCS recoveries were acceptable, no qualification of data is recommended.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

Total BNAs

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total BNAs. Samples TMF-0282 and TMF-0283 were reanalyzed at higher detection limits due to high surrogate recovery and low internal standard recovery in the original analyses. **It is recommended that the project use the original analysis results for samples TMF-0282 and TMF-0283 since these analyses were reported at lower detection limits with no rejection of data.**

Holding Times

The holding time requirements were met. No qualification of data is necessary.

GC/MS Tune

The GC/MS tuning requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration results were acceptable. No qualification of data is necessary.

Blanks

Method blank contamination was not detected. No qualification of data is necessary.

Internal Standard (IS) Areas

The IS percent recoveries and retention times were acceptable except for the IS5 (18.8%) and IS6 (12.3%) recoveries for sample TMF-282, and the IS5 (38.5%) and IS6 (24.0%) recoveries for sample TMF-283, which were outside the QC limits of 50-200%. **The benzidine, pyrene, butylbenzylphthalate, benzo(a)anthracene, 3,3'-dichlorobenzidine, chrysene, bis(2-ethylhexyl)phthalate, di-n-octyl phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene results for samples TMF-282 and TMF-283 should be qualified as undetected at an estimated detection limit (UJ) for non-detected results and as estimated (J) for detected results due to low IS recovery.**

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS samples were prepared from a sample from another project. Since the LCS recoveries were acceptable, no qualification of data is recommended.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

Total Metals

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total metals.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met. No qualification of data is necessary.

Blanks

No blank contamination requiring qualification of data was detected. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The matrix spike samples were prepared from a sample from another project. Therefore, an evaluation of the MS recoveries could not be performed. Since the LCS recoveries were acceptable, no qualification of data is recommended.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

Laboratory Duplicate Relative Percent Difference (RPD)

The laboratory duplicate was performed on a sample from another project. Therefore, an evaluation of the laboratory duplicate RPD could not be performed. Based on professional judgment and the intended use of the data, no qualification of data is recommended.

Serial Dilution Percent Difference (%D)

The serial dilution was performed on a sample from another project. Therefore, an evaluation of the serial dilution %D could not be performed. Based on professional judgment and the intended use of the data, no qualification of data is recommended.

Interference Check Standard

The interference check standard results were acceptable. No qualification of data is necessary.

Wet Chemistry

Samples TMF-0282, TMF-0283, and TMF-0284 were analyzed for total cyanide and percent moisture. The results were evaluated for holding times, calibration, blank contamination, matrix spike recovery, laboratory control sample recovery, and duplicate RPD where applicable. The matrix spike sample for total cyanide was prepared from a sample from another project and therefore the matrix spike recovery for total cyanide could not be evaluated. However, since the total cyanide LCS recovery was acceptable, no qualification of results is recommended. The other QC results were acceptable. No qualification of data is necessary.

Radiological Analytical Data Verification
Comments on Data for SDG 0107107

This sample delivery group (SDG) contained twenty (20) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on July 14, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0169	0107107-1
TMF-0170	0107107-2
TMF-0172	0107107-3
TMF-0173	0107107-4
TMF-0210	0107107-5
TMF-0211	0107107-6
TMF-9246	0107107-7
TMF-9247	0107107-8
TMF-0212	0107107-9
TMF-0213	0107107-10
TMF-0214	0107107-11
TMF-021	0107107-12
TMF-0216	0107107-13
TMF-0217	0107107-14
TMF-0218	0107107-15
TMF-0219	0107107-16
TMF-0220	0107107-17
TMF-0221	0107107-18
TMF-0222	0107107-19
TMF-0223	0107107-20

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was reported by the laboratory in the EQ-1 and EQ-02 equipment rinsate blanks. However, ^{137}Cs peak was identified in gamma spectrometry report for equipment rinsate sample EQ-1. All associated sample results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). The ^{137}Cs activity was reported for samples TMF-0218 and TMF-0223. The reported ^{137}Cs results were greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification of ^{137}Cs results in the sample is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

In addition, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples. The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near or total equilibrium with ^{238}U and ^{232}Th. **Therefore, it is recommended that they remain in the data base for information purposes only.** Results for natural ^{40}K were reported for all samples. Results for the fission product ^{137}Cs activity was also reported for samples TMF-0218 and TMF-0223.

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for ^{235}U result for sample TMF-0211, ^{241}Am result for samples TMF-0219 and ^{231}Pa results for samples TMF-9246, TMF-0214, TMF-0215 and TMF-0223. **It is recommended that the ^{235}U result for sample TMF-0211, ^{241}Am result for TMF-0219 and ^{231}Pa results for samples TMF-9246, TMF-0214, TMF0215 and TMF-0223 be qualified as estimated (J).** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{238}U result in method blank. All associated samples results less than 5 times the blank value for ^{238}U analyses should be qualified as estimated (J). For all samples the ^{238}U results are greater than 5 times the ^{238}U concentrations identified in the method blank. No qualification of ^{238}U results is necessary.

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis. There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the $^{228/230/232}$Th results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses. No qualification is required.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 47.99% for all samples for the alpha analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty. No qualification of is required.

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for the isotopic uranium and thorium.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination either in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analysis were within acceptable limits.

Duplicate Analysis:

The DER (1.32) as well as RPD (52.1%) are outside the acceptable limits for the duplicate ^{226}Ra analysis. **Therefore, it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J).**

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the gross alpha/beta analyses is within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity analysis duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC.

It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities for samples TMF-0170 (1.32) and TMF-9246 (1.64) outside acceptable limits indicating that the gross alpha analysis for these samples did not agree with the sum of alpha activities within a 99% confidence level. The RPDs (51.7% and 166% respectively) are also outside acceptable limits. The gross alpha results are greater than the sum of the alpha emitters for both samples by approximate factors of 1.7 and 10.8 respectively. This maybe an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TMF-0170 and TMF-9246 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.34 to 4.63) for all samples are outside the acceptable limits indicating that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (84.8% to 144%) are also outside acceptable limits. The gross beta results are smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the loss of volatile radionuclides, volatile radionuclide salts, or the sample preparation method, as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the sum of the alpha and beta emitters, the DERs for samples TMF-0169 (3.25), TMF-0170 (3.11), TMF-0173 (3.01), TMF-0210 (2.56), TMF-0211 (3.25), TMF-9246 (3.11), TMF-0212 (4.21), TMF-0213 (3.51), TMF-0214 (2.03), TMF-0215 (3.27), TMF-0216 (1.83), TMF-0217 (2.43), TMF-0218 (2.09), TMF-0219 (3.25), TMF-0220 (3.37), TMF-0221 (3.46) and TMF-0223 (1.81) indicates that the total activity analysis did not agree with the sum of the alpha and beta emitters with a 99% confidence level. The RPDs (95.6%, 112%, 113%, 102%, 99.1%, 88.1%, 143%, 121%, 91.4%, 124%, 64.6%, 77.2%, 83.1% 112%, 101.7%, 1105% and 42.6% respectively) are also outside acceptable limits. These samples have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor ranging from approximately 1.5 to 5.5. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides, radionuclide salts, or sample preparation method, as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

0107107-1			TMF-0169					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	2.60E-01	2.00E-01	3.20E-01	**0.41**	**148**	U
Ra-226	8.00E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	3.60E-01												
Th-230	9.90E-01	3.00E-01												
Th-232	9.40E-01	2.90E-01												
U-234	8.30E-01	2.30E-01												
U-235	8.70E-02	6.70E-02						1.20E-01	2.80E-01	-1.00E-01	3.00E-01	**0.54**	**2200**	U
U-238	6.70E-01	2.00E-01												
Total U Alpha	**1.59E+00**	**3.12E-01**												
Alpha Sum	**6.32E+00**	**1.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.95E+01	3.60E+00	1.55E+01	3.30E+00	**0.82**	**22.9**								
Th-234 (Assumed from U-238)	6.70E-01	2.00E-01						5.00E-01	8.10E-01	6.00E-01	1.10E+00	**0.07**	**18.2**	U
Pa-234m (Assumed from U-238)	6.70E-01	2.00E-01						-6.00E-01	7.50E+00	4.00E+00	1.10E+01	**0.35**	**271**	U
Ac-227														
Ra-228	7.10E-01	1.90E-01	6.00E-01	2.30E-01	**0.37**	**16.8**								
Pa-231	1.30E+00	1.40E+00	-3.00E-01	1.70E+00	**0.73**	**320**								
Beta Sum	**2.17E+01**	**3.62E+00**						**2.03E+01**	**8.36E+00**	**2.07E+01**	**1.15E+01**			
Total Activity Sum	**2.80E+01**	**3.89E+00**						**2.66E+01**	**8.48E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.10E+00						**0.18**	**(from gamma)**		**5.15**			
Gross Beta	5.27E+00	9.40E-01					J	**4.39**	**1.78**		**122**			
Total Activity	9.90E+00	4.00E+00					J	**3.25**	**1.78**		**95.6**			

0107107-2			TMF-0170					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.80E-01	3.00E-01					U
Ra-226	9.50E-01	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	3.10E-01												
Th-230	7.60E-01	2.50E-01												
Th-232	8.00E-01	2.50E-01												
U-234	7.10E-01	1.90E-01	7.10E-01	1.90E-01	**0.00**	**0.00**								
U-235	3.80E-02	4.10E-02	1.45E-01	7.90E-02	**1.20**	**117**		7.00E-02	2.90E-01					U
U-238	5.90E-01	1.70E-01	7.30E-01	1.90E-01	**0.55**	**21.2**								
Total U Alpha	**1.34E+00**	**2.58E-01**	**1.59E+00**	**2.80E-01**										
Alpha Sum	**3.83E+00**	**1.64E+00**	**1.59E+00**	**2.80E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.80E+01	3.60E+00												
Th-234 (Assumed from U-238)	5.90E-01	1.70E-01	7.30E-01	1.90E-01	**0.55**	**21.2**		1.10E+00	1.10E+00					
Pa-234m (Assumed from U-238)	5.90E-01	1.70E-01	7.30E-01	1.90E-01	**0.55**	**21.2**		-5.00E-01	9.80E+00					U
Ac-227														
Ra-228	9.20E-01	2.60E-01												
Pa-231	-9.00E-01	1.70E+00					U							
Beta Sum	**2.00E+01**	**3.62E+00**	**1.46E+00**	**2.69E-01**				**1.94E+01**	**1.05E+01**					
Total Activity Sum	**2.38E+01**	**3.98E+00**	**3.05E+00**	**3.88E-01**				**2.32E+01**	**1.06E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.20E+00					J	**1.32**	**(from gamma)**		**51.7**			
Gross Beta	4.70E+00	9.00E-01					J	**4.10**	**1.40**		**124**			
Total Activity	6.70E+00	3.80E+00					J	**3.11**	**1.47**		**112**			

0107107-3			TMF-0172					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-01	2.80E-01	4.00E-02	1.10E-01	**0.20**	**85.7**	U
Ra-226	1.10E+00	3.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	2.50E-01	2.30E-01	4.60E-01	2.20E-01	**0.66**	**59.2**								
Th-230	7.70E-01	2.60E-01	5.50E-01	2.30E-01	**0.63**	**33.3**								
Th-232	3.20E-01	1.70E-01	3.00E-01	1.70E-01	**0.08**	**6.45**								
U-234	6.80E-01	1.90E-01												
U-235	9.50E-02	6.40E-02						1.00E-02	3.90E-01	5.00E-02	3.80E-01	**0.07**	**133**	U
U-238	9.00E-01	2.30E-01												
Total U Alpha	**1.68E+00**	**3.05E-01**												
Alpha Sum	**5.11E+00**	**1.98E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	9.50E+00	2.40E+00	6.30E+00	2.70E+00	**0.89**	**40.5**								
Th-234 (Assumed from U-238)	9.00E-01	2.30E-01						1.00E+00	1.10E+00	7.80E-01	9.50E-01	**0.15**	**24.7**	
Pa-234m (Assumed from U-238)	9.00E-01	2.30E-01						-2.00E+00	1.40E+01	5.00E+00	1.40E+01	**0.35**	**467**	U
Ac-227														
Ra-228	3.70E-01	2.50E-01	3.80E-01	4.50E-01	**0.02**	**2.7**								
Pa-231	1.10E+00	2.10E+00	-1.30E+00	2.80E+00	**0.69**	**2400**	U							
Beta Sum	**1.18E+01**	**2.45E+00**						**9.00E+00**	**1.43E+01**	**1.23E+01**	**1.43E+01**			
Total Activity Sum	**1.69E+01**	**3.15E+00**						**1.41E+01**	**1.44E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.90E+00	1.40E+00						**0.08**	**(from gamma)**		**4.10**			
Gross Beta	2.40E+00	1.50E+00					J	**3.27**	**0.46**		**132**			
Total Activity	1.14E+01	4.00E+00					J	**1.08**	**0.18**		**38.9**			

0107107-4			TMF-0173					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.90E-02	9.30E-02					
Ra-226	1.11E+00	2.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.80E-01												
Th-230	1.17E+00	3.00E-01												
Th-232	1.00E+00	2.70E-01												
U-234	9.10E-01	2.30E-01												
U-235	2.20E-01	1.00E-01						-1.10E-01	3.20E-01					U
U-238	9.10E-01	2.30E-01												
Total U Alpha	**2.04E+00**	**3.40E-01**												
Alpha Sum	**5.10E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.59E+01	3.70E+00												
Th-234 (Assumed from U-238)	9.10E-01	2.30E-01						1.19E+00	9.10E-01					
Pa-234m (Assumed from U-238)	9.10E-01	2.30E-01						6.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.00E-01	2.80E-01												
Pa-231	-1.30E+00	1.80E+00					U							
Beta Sum	**1.83E+01**	**3.73E+00**						**2.36E+01**	**1.16E+01**					
Total Activity Sum	**2.34E+01**	**4.12E+00**						**2.87E+01**	**1.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.75E+00	6.90E-01						**0.72**	**(from gamma)**		**30.5**			
Gross Beta	2.97E+00	5.60E-01					J	**4.05**	**1.77**		**144**			
Total Activity	6.50E+00	3.80E+00					J	**3.01**	**1.80**		**113**			

0107107-5			TMF-0210					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01					U
Ra-226	8.80E-01	2.30E-01	9.30E-01	2.20E-01	**0.16**	**5.52**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	3.50E-01												
Th-230	9.00E-01	2.60E-01												
Th-232	9.20E-01	2.70E-01												
U-234	7.10E-01	2.00E-01												
U-235	1.89E-01	9.50E-02						-2.60E-01	4.50E-01					U
U-238	9.60E-01	2.40E-01												
Total U Alpha	**1.86E+00**	**3.27E-01**												
Alpha Sum	**5.83E+00**	**2.52E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.74E+01	5.00E+00												
Th-234 (Assumed from U-238)	9.60E-01	2.40E-01						3.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	9.60E-01	2.40E-01						-5.00E+00	1.80E+01					U
Ac-227														
Ra-228	6.40E-01	4.20E-01												
Pa-231	2.00E-01	2.70E+00					U							
Beta Sum	**2.00E+01**	**5.04E+00**						**1.34E+01**	**1.87E+01**					
Total Activity Sum	**2.58E+01**	**5.63E+00**						**1.92E+01**	**1.89E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	1.50E+00	6.70E+00	1.20E+00	**0.94**	**23.7**		**0.91**	**(from gamma)**		**37.3**			
Gross Beta	6.60E+00	1.10E+00	5.47E+00	9.80E-01	**0.77**	**18.7**	J	**2.59**	**0.36**		**101**			
Total Activity	8.40E+00	3.80E+00	1.16E+01	4.00E+00	**0.58**	**32.0**	J	**2.56**	**0.56**		**102**			

0107107-6			TMF-0211					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.70E-01	3.90E-01					U
Ra-226	8.10E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	3.00E-01												
Th-230	8.20E-01	2.40E-01												
Th-232	7.90E-01	2.40E-01												
U-234	8.60E-01	2.20E-01	7.50E-01	2.20E-01	**0.35**	**13.7**								
U-235	1.10E-01	6.80E-02	1.65E-01	9.30E-02	**0.48**	**40.0**		-6.10E-01	4.70E-01					UJ
U-238	8.70E-01	2.20E-01	8.40E-01	2.30E-01	**0.09**	**3.51**								
Total U Alpha	**1.84E+00**	**3.18E-01**	**1.76E+00**	**3.32E-01**										
Alpha Sum	**6.90E+00**	**2.41E+00**	**1.76E+00**	**3.32E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	2.29E+01	4.70E+00												
Th-234 (Assumed from U-238)	8.70E-01	2.20E-01	8.40E-01	2.30E-01	**0.09**	**3.51**		-5.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	8.70E-01	2.20E-01	8.40E-01	2.30E-01	**0.09**	**3.51**		-8.00E+00	1.70E+01					U
Ac-227														
Ra-228	5.50E-01	3.20E-01												
Pa-231	1.90E+00	2.60E+00					U							
Beta Sum	**2.54E+01**	**4.73E+00**	**1.68E+00**	**3.25E-01**				**1.52E+01**	**1.77E+01**					
Total Activity Sum	**3.23E+01**	**5.31E+00**	**3.44E+00**	**4.64E-01**				**2.21E+01**	**1.78E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.10E+00						**0.64**	**(from gamma)**		**28.1**			
Gross Beta	4.75E+00	9.20E-01					J	**4.29**	**0.59**		**137**			
Total Activity	1.09E+01	3.90E+00					J	**3.25**	**0.61**		**99.1**			

0107107-7			TMF-9246					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.20E-01					U
Ra-226	7.40E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	2.70E-01	8.60E-01	3.00E-01	**0.25**	**12.3**								
Th-230	8.40E-01	2.60E-01	1.03E+00	2.90E-01	**0.49**	**20.3**								
Th-232	7.50E-01	2.40E-01	8.40E-01	2.60E-01	**0.25**	**11.3**								
U-234	6.20E-01	2.70E-01												
U-235	2.30E-02	5.20E-02					U	-3.00E-01	4.70E-01					U
U-238	8.90E-01	3.20E-01												
Total U Alpha	**1.53E+00**	**4.22E-01**												
Alpha Sum	**5.73E-01**	**3.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.58E+01	5.00E+00												
Th-234 (Assumed from U-238)	8.90E-01	3.20E-01						4.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	8.90E-01	3.20E-01						9.00E+00	2.30E+01					U
Ac-227														
Ra-228	1.08E+00	6.90E-01												
Pa-231	-4.50E+00	3.50E+00					UJ							
Beta Sum	**1.81E+01**	**5.09E+00**						**2.57E+01**	**2.36E+01**					
Total Activity Sum	**1.87E+01**	**6.02E+00**						**2.63E+01**	**2.38E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00					J	**1.64**	**(from gamma)**		**166**			
Gross Beta	6.00E+00	1.00E+00					J	**2.34**	**0.84**		**100**			
Total Activity	1.00E+01	4.00E+00					J	**1.20**	**0.68**		**60.6**			

0107107-8			TMF-9247					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.50E-01					U
Ra-226	8.00E-01	2.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	2.70E-01												
Th-230	7.30E-01	2.20E-01												
Th-232	1.00E+00	2.60E-01												
U-234	9.00E-01	2.30E-01												
U-235	8.30E-02	6.30E-02						-8.00E-02	2.50E-01					U
U-238	9.90E-01	2.40E-01												
Total U Alpha	**1.97E+00**	**3.38E-01**												
Alpha Sum	**5.33E+00**	**1.07E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.94E+01	3.50E+00												
Th-234 (Assumed from U-238)	9.90E-01	2.40E-01						2.60E-01	4.70E-01					U
Pa-234m (Assumed from U-238)	9.90E-01	2.40E-01						2.30E+00	6.90E+00					U
Ac-227														
Ra-228	5.80E-01	1.80E-01												
Pa-231	5.00E-02	1.00E+00					U							
Beta Sum	**2.20E+01**	**3.52E+00**						**2.25E+01**	**7.75E+00**					
Total Activity Sum	**2.73E+01**	**3.68E+00**						**2.79E+01**	**7.83E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.00E+00						**0.22**	**(from gamma)**		**6.35**			
Gross Beta	5.09E+00	9.30E-01					J	**4.63**	**2.24**		**125**			
Total Activity	1.06E+01	3.90E+00					J	**3.11**	**1.98**		**88.1**			

0107107-9			TMF-0212					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	2.50E-01					U
Ra-226	1.08E+00	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	3.10E-01												
Th-230	9.20E-01	2.60E-01												
Th-232	8.80E-01	2.50E-01												
U-234	6.90E-01	2.20E-01												
U-235	5.50E-02	5.60E-02						-1.10E-01	2.80E-01					U
U-238	7.10E-01	2.20E-01												
Total U Alpha	**1.46E+00**	**3.16E-01**												
Alpha Sum	**5.56E+00**	**1.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.88E+01	3.40E+00												
Th-234 (Assumed from U-238)	7.10E-01	2.20E-01						1.05E+00	7.40E-01					
Pa-234m (Assumed from U-238)	7.10E-01	2.20E-01						7.40E+00	7.20E+00					
Ac-227														
Ra-228	5.90E-01	1.80E-01												
Pa-231	3.00E-01	1.40E+00					U							
Beta Sum	**2.08E+01**	**3.42E+00**						**2.79E+01**	**8.00E+00**					
Total Activity Sum	**2.64E+01**	**3.70E+00**						**3.34E+01**	**8.12E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.30E+00	1.20E+00						**0.40**	**(from gamma)**		**12.6**			
Gross Beta	5.80E+00	1.00E+00					J	**4.22**	**2.74**		**113**			
Total Activity	4.40E+00	3.70E+00					J	**4.21**	**3.25**		**143**			

0107107-10			TMF-0213					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	3.00E-01	1.10E-01	2.20E-01	**0.11**	**44.4**	U
Ra-226	1.04E+00	2.80E-01	6.10E-01	1.70E-01	**1.31**	**52.1**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.18E+00	3.60E-01												
Th-230	1.18E+00	3.10E-01												
Th-232	1.29E+00	3.30E-01												
U-234	7.50E-01	2.10E-01												
U-235	4.30E-02	4.30E-02						2.30E-01	2.90E-01	-2.80E-01	2.80E-01	**1.27**	**2040**	U
U-238	1.00E+00	2.50E-01												
Total U Alpha	**1.79E+00**	**3.29E-01**												
Alpha Sum	**6.03E+00**	**2.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.83E+01	3.70E+00	1.95E+01	3.50E+00	**0.24**	**6.35**								
Th-234 (Assumed from U-238)	1.00E+00	2.50E-01						3.00E-02	8.40E-01	5.80E-01	9.10E-01	**0.44**	**180**	U
Pa-234m (Assumed from U-238)	1.00E+00	2.50E-01						4.50E+00	9.90E+00	3.60E+00	6.60E+00	**0.08**	**22.2**	U
Ac-227														
Ra-228	6.70E-01	2.30E-01	7.50E-01	1.90E-01	**0.27**	**11.3**								
Pa-231	-5.00E-01	2.40E+00	-4.00E-01	1.80E+00	**0.03**	**22.2**	U							
Beta Sum	**2.09E+01**	**3.74E+00**						**2.34E+01**	**1.06E+01**	**2.44E+01**	**7.53E+00**			
Total Activity Sum	**2.69E+01**	**4.37E+00**						**2.95E+01**	**1.09E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.00E+00	4.68E+00	9.60E-01	**0.23**	**6.61**		**0.42**	**(from gamma)**		**18.7**			
Gross Beta	4.83E+00	9.30E-01	4.75E+00	9.00E-01	**0.06**	**1.67**	J	**4.18**	**1.75**		**125**			
Total Activity	6.60E+00	3.80E+00	9.40E+00	3.90E+00	**0.51**	**35.0**	J	**3.51**	**1.99**		**121**			

0107107-11			TMF-0214					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.02E-01	9.30E-02					
Ra-226	9.10E-01	2.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	2.80E-01												
Th-230	9.70E-01	3.00E-01												
Th-232	5.80E-01	2.20E-01												
U-234	7.40E-01	2.10E-01												
U-235	1.35E-01	8.20E-02						-1.60E-01	2.60E-01					U
U-238	7.80E-01	2.20E-01												
Total U Alpha	**1.66E+00**	**3.15E-01**												
Alpha Sum	**3.34E+00**	**1.48E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.09E+01	2.80E+00												
Th-234 (Assumed from U-238)	7.80E-01	2.20E-01						9.50E-01	5.30E-01					
Pa-234m (Assumed from U-238)	7.80E-01	2.20E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	4.90E-01	3.30E-01												
Pa-231	-1.60E+00	1.50E+00					UJ							
Beta Sum	**1.28E+01**	**2.84E+00**						**1.31E+01**	**1.14E+01**					
Total Activity Sum	**1.61E+01**	**3.20E+00**						**1.65E+01**	**1.15E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.70E+00	9.30E-01						**0.21**	**(from gamma)**		**10.4**			
Gross Beta	3.56E+00	7.90E-01					J	**3.12**	**0.84**		**113**			
Total Activity	6.00E+00	3.80E+00					J	**2.03**	**0.87**		**91.4**			

0107107-12			TMF-0215					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.10E-01					U
Ra-226	9.30E-01	2.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.90E-01												
Th-230	9.30E-01	2.40E-01												
Th-232	8.50E-01	2.30E-01												
U-234	8.80E-01	2.30E-01												
U-235	8.70E-02	6.30E-02						2.00E-01	2.40E-01					
U-238	8.90E-01	2.30E-01												
Total U Alpha	**1.86E+00**	**3.31E-01**												
Alpha Sum	**3.89E+00**	**1.39E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.70E+01	3.60E+00												
Th-234 (Assumed from U-238)	8.90E-01	2.30E-01						9.30E-01	8.30E-01					
Pa-234m (Assumed from U-238)	8.90E-01	2.30E-01						-2.80E+00	9.60E+00					U
Ac-227														
Ra-228	8.40E-01	2.60E-01												
Pa-231	-1.80E+00	1.40E+00					UJ							
Beta Sum	**1.94E+01**	**3.63E+00**						**1.58E+01**	**1.03E+01**					
Total Activity Sum	**2.33E+01**	**3.89E+00**						**1.96E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.20E+00						**0.61**	**(from gamma)**		**25.0**			
Gross Beta	3.20E+00	1.10E+00					J	**4.27**	**1.21**		**143**			
Total Activity	5.50E+00	3.80E+00					J	**3.27**	**1.28**		**124**			

0107107-13			TMF-0216					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.80E-01					U
Ra-226	7.50E-01	2.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	2.60E-01												
Th-230	9.20E-01	2.80E-01												
Th-232	5.80E-01	2.10E-01												
U-234	9.30E-01	2.40E-01												
U-235	1.20E-02	3.30E-02					U	2.50E-01	2.80E-01					
U-238	5.80E-01	1.80E-01												
Total U Alpha	**1.52E+00**	**3.02E-01**												
Alpha Sum	**3.74E+00**	**1.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.45E+01	2.90E+00												
Th-234 (Assumed from U-238)	5.80E-01	1.80E-01						9.10E-01	8.50E-01					
Pa-234m (Assumed from U-238)	5.80E-01	1.80E-01						-5.00E+00	8.60E+00					U
Ac-227														
Ra-228	6.30E-01	2.10E-01												
Pa-231	-8.00E-01	1.50E+00					U							
Beta Sum	**1.62E+01**	**2.92E+00**						**1.09E+01**	**9.12E+00**					
Total Activity Sum	**1.99E+01**	**3.27E+00**						**1.47E+01**	**9.24E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.10E+00						**0.85**	**(from gamma)**		**34.5**			
Gross Beta	4.53E+00	8.80E-01					J	**3.82**	**0.70**		**113**			
Total Activity	1.02E+01	4.20E+00					J	**1.83**	**0.44**		**64.6**			

0107107-14			TMF-0217					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-02	8.30E-02					U
Ra-226	1.04E+00	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	3.30E-01												
Th-230	1.17E+00	3.10E-01												
Th-232	8.50E-01	2.60E-01												
U-234	8.10E-01	2.10E-01												
U-235	1.40E-01	7.70E-02						4.00E-02	2.80E-01					U
U-238	8.70E-01	2.20E-01												
Total U Alpha	**1.82E+00**	**3.14E-01**												
Alpha Sum	**5.20E+00**	**1.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.71E+01	3.80E+00												
Th-234 (Assumed from U-238)	8.70E-01	2.20E-01						9.70E-01	5.60E-01					
Pa-234m (Assumed from U-238)	8.70E-01	2.20E-01						-4.00E+00	1.10E+01					U
Ac-227														
Ra-228	6.60E-01	2.60E-01												
Pa-231	-8.00E-01	1.40E+00					U							
Beta Sum	**1.94E+01**	**3.83E+00**						**1.46E+01**	**1.17E+01**					
Total Activity Sum	**2.46E+01**	**4.08E+00**						**1.98E+01**	**1.17E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.40E+00	1.30E+00						**0.62**	**(from gamma)**		**20.7**			
Gross Beta	5.10E+00	1.00E+00					J	**3.62**	**0.81**		**117**			
Total Activity	1.09E+01	3.90E+00					J	**2.43**	**0.72**		**77.2**			

0107107-15			TMF-0218					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.60E-01					U
Ra-226	7.50E-01	2.00E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	2.60E-01												
Th-230	1.24E+00	3.30E-01												
Th-232	9.40E-01	2.80E-01												
U-234	8.40E-01	2.30E-01												
U-235	1.72E-01	9.40E-02						3.00E-01	4.60E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.87E+00**	**3.39E-01**												
Alpha Sum	**5.64E+00**	**3.13E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	3.20E-01	1.90E-01												
K-40	1.76E+01	5.00E+00												
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						1.30E+00	1.40E+00					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						-3.00E+00	2.60E+01					U
Ac-227														
Ra-228	6.20E-01	6.40E-01												
Pa-231	2.00E-01	3.40E+00					U							
Beta Sum	**2.03E+01**	**5.07E+00**						**1.69E+01**	**2.65E+01**					
Total Activity Sum	**2.59E+01**	**5.96E+00**						**2.25E+01**	**2.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.60E+00	1.10E+00						**0.31**	**(from gamma)**		**20.3**			
Gross Beta	5.60E+00	1.10E+00					J	**2.83**	**0.42**		**113**			
Total Activity	1.07E+01	4.20E+00					J	**2.09**	**0.44**		**83.1**			

0107107-16			TMF-0219					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.34E-01	9.90E-02					UJ
Ra-226	7.00E-01	1.70E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	3.00E-01												
Th-230	1.06E+00	3.00E-01												
Th-232	7.20E-01	2.40E-01												
U-234	9.20E-01	2.50E-01												
U-235	1.55E-01	9.00E-02						-3.00E-02	2.60E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.94E+00**	**3.51E-01**												
Alpha Sum	**4.37E+00**	**1.49E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.88E+01	3.80E+00												
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						1.32E+00	8.10E-01					
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						-7.00E+00	1.10E+01					U
Ac-227														
Ra-228	6.30E-01	2.20E-01												
Pa-231	-1.00E+00	1.50E+00					U							
Beta Sum	**2.10E+01**	**3.82E+00**						**1.36E+01**	**1.17E+01**					
Total Activity Sum	**2.54E+01**	**4.10E+00**						**1.80E+01**	**1.18E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.10E+00	1.20E+00						**0.91**	**(from gamma)**		**33.2**			
Gross Beta	5.60E+00	1.00E+00					J	**3.90**	**0.69**		**116**			
Total Activity	7.20E+00	3.80E+00					J	**3.25**	**0.87**		**112**			

0107107-17			TMF-0220					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	1.50E-01					U
Ra-226	8.60E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.90E-01												
Th-230	8.50E-01	2.50E-01												
Th-232	1.02E+00	2.80E-01												
U-234	9.80E-01	2.60E-01												
U-235	1.45E-01	8.90E-02						2.00E-01	2.50E-01					U
U-238	1.06E+00	2.70E-01												
Total U Alpha	**2.19E+00**	**3.85E-01**												
Alpha Sum	**5.10E+00**	**1.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.90E+01	3.40E+00												
Th-234 (Assumed from U-238)	1.06E+00	2.70E-01						7.10E-01	6.80E-01					
Pa-234m (Assumed from U-238)	1.06E+00	2.70E-01						2.80E+00	6.30E+00					U
Ac-227														
Ra-228	6.10E-01	1.70E-01												
Pa-231	-9.00E-01	1.20E+00					U							
Beta Sum	**2.16E+01**	**3.43E+00**						**2.30E+01**	**7.19E+00**					
Total Activity Sum	**2.67E+01**	**3.65E+00**						**2.81E+01**	**7.30E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.10E+00						**0.12**	**(from gamma)**		**3.94**			
Gross Beta	5.50E+00	1.00E+00					J	**4.51**	**2.41**		**119**			
Total Activity	8.70E+00	3.90E+00					J	**3.37**	**2.34**		**101.7**			

0107107-18			TMF-0221					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	2.40E-01					U
Ra-226	7.30E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	3.20E-01												
Th-230	8.80E-01	2.50E-01												
Th-232	9.90E-01	2.70E-01												
U-234	6.20E-01	1.90E-01												
U-235	1.22E-01	7.80E-02						-1.80E-01	2.70E-01					U
U-238	6.50E-01	1.90E-01												
Total U Alpha	**1.39E+00**	**2.80E-01**												
Alpha Sum	**5.46E+00**	**1.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.92E+01	3.50E+00												
Th-234 (Assumed from U-238)	6.50E-01	1.90E-01						6.70E-01	6.50E-01					
Pa-234m (Assumed from U-238)	6.50E-01	1.90E-01						7.00E+00	6.40E+00					
Ac-227														
Ra-228	7.50E-01	1.90E-01												
Pa-231	5.00E-01	1.30E+00					U							
Beta Sum	**2.13E+01**	**3.52E+00**						**2.77E+01**	**7.33E+00**					
Total Activity Sum	**2.68E+01**	**3.75E+00**						**3.31E+01**	**7.44E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**0.30**	**(from gamma)**		**9.4**			
Gross Beta	5.60E+00	1.00E+00					J	**4.29**	**2.99**		**117**			
Total Activity	8.30E+00	3.80E+00					J	**3.46**	**2.97**		**105**			

0107107-19			TMF-0222					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-01	3.20E-01					U
Ra-226	1.32E+00	2.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	3.50E-01	2.30E-01												
Th-230	1.79E+00	4.30E-01												
Th-232	3.10E-01	1.50E-01												
U-234	2.67E+00	5.10E-01												
U-235	1.04E-01	7.60E-02						3.00E-01	4.20E-01					U
U-238	2.73E+00	5.20E-01												
Total U Alpha	**5.50E+00**	**7.32E-01**												
Alpha Sum	**9.81E+00**	**2.35E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	5.80E+00	1.90E+00												
Th-234 (Assumed from U-238)	2.73E+00	5.20E-01						1.00E+00	1.10E+00					
Pa-234m (Assumed from U-238)	2.73E+00	5.20E-01						5.00E+00	1.30E+01					U
Ac-227														
Ra-228	2.90E-01	3.10E-01												
Pa-231	6.00E-01	2.40E+00					U							
Beta Sum	**1.16E+01**	**2.08E+00**						**1.22E+01**	**1.32E+01**					
Total Activity Sum	**2.14E+01**	**3.14E+00**						**2.20E+01**	**1.34E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.90E+00	1.70E+00						**0.66**	**(from gamma)**		**21.6**			
Gross Beta	4.70E+00	1.20E+00					J	**2.88**	**0.56**		**84.8**			
Total Activity	1.83E+01	4.30E+00					J	**0.59**	**0.26**		**15.8**			

0107107-20			TMF-0223					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.30E-01	3.50E-01					U
Ra-226	4.20E-01	1.10E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.08E+00	3.00E-01												
Th-230	1.06E+00	2.70E-01												
Th-232	9.90E-01	2.60E-01												
U-234	2.92E+00	5.90E-01												
U-235	5.00E-01	1.90E-01						1.40E-01	3.10E-01					U
U-238	3.04E+00	6.10E-01												
Total U Alpha	**6.46E+00**	**8.70E-01**												
Alpha Sum	**8.03E+00**	**1.98E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	2.36E-01	9.20E-02												
K-40	1.82E+01	3.80E+00												
Th-234 (Assumed from U-238)	3.04E+00	6.10E-01						2.80E+00	1.30E+00					
Pa-234m (Assumed from U-238)	3.04E+00	6.10E-01						7.70E+00	9.80E+00					U
Ac-227														
Ra-228	8.60E-01	2.70E-01												
Pa-231	-2.20E+00	1.90E+00					UJ							
Beta Sum	**2.51E+01**	**3.91E+00**						**2.95E+01**	**1.06E+01**					
Total Activity Sum	**3.31E+01**	**4.39E+00**						**3.76E+01**	**1.08E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.01E+01	1.60E+00						**0.81**	**(from gamma)**		**22.8**			
Gross Beta	8.50E+00	1.30E+00					J	**4.03**	**1.97**		**98.8**			
Total Activity	2.15E+01	4.70E+00					J	**1.81**	**1.37**		**42.6**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107108

This sample delivery group (SDG) contained six individual soil samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0224	0107108-1
TMF-0225	0107108-2
TMF-0226	0107108-3
TMF-0227	0107108-4
TMF-0230	0107108-5
TMF-0231	0107108-6

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in one of the method blanks for ^{235}U. All associated sample results less than 5 times the blank value for ^{235}U analyses should be qualified as estimated (J). **Therefore, it is recommended that the ^{235}U results for samples TMF-0224, TMF-0224 (laboratory duplicate), TMF-0225, TMF-0226, TMF-0227, TMF-0230, and TMF-0231 be qualified as estimated (J).**

Equipment Rinsate Sample:

There was no indication of contamination of the equipment rinsate blank for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}Pa$, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, ^{137}Cs, $^{212/214}Bi$, $^{212/214}Pb$, ^{228}Ra, and ^{208}Tl gamma emitting radionuclides were reported for most samples.

The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near total equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. A result for fission product ^{137}Cs was reported for one sample. **Inclusion of ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl in the database is not recommended since any modeling will assume equilibrium with parents $^{235/238}U$ or ^{232}Th.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{231}Pa result for samples

TMF-0230 and the ^{241}Am result for sample TMF-0231. **Therefore, it is recommended that the ^{231}Pa result for sample TMF-0230 and the ^{241}Am result for sample TMF-0231 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination in the $^{234/235/238}$U alpha spectrometry analyses. There was an indication of blank contamination in the method blank for ^{230}Th. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). **Therefore, it is recommended that for the ^{230}Th results for all samples be qualified as estimated (J).**

Equipment Rinsate Sample:

There was an indication of ^{228}Th and ^{230}Th contamination of equipment rinsate blank contamination for alpha spectrometry analyses. All associated sample results less than 5 times the blank value for ^{228}Th and ^{230}Th analyses should be qualified as estimated (J). All samples had ^{228}Th and ^{230}Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 58.91% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra all samples for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 1.09 " 0.32 to 1.36 " 0.35 pCi/g. Spectral interference observed is also observed in the isotopic uranium analyses for all

samples. The ^{234}U peaks tail into the ^{235}U peak region. **Therefore, it is recommended that the ^{235}U and ^{230}Th results for all samples be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least five extra peaks. These peaks are in the 5.8 MeV, 6.3 MeV, 6.7 MeV, 6.9 MeV, and 7.1 MeV regions. It is assumed that the peaks can be attributed to ^{216}Po, ^{217}At, ^{225}Ac and ^{221}Fr, which are progeny of ^{228}Th and the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the method blank for ^{226}Ra analyses.

Equipment Rinsate Sample:

There was no indication of ^{226}Ra contamination of equipment rinsate blank contamination for the radon emmination analyses.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the ^{226}Ra analyses were within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recovery (197.40%) for the ^{226}Ra analysis of sample TMF-0225 was outside acceptable limits. The reported ^{226}Ra result was calculated using 100% recovery. **Therefore, it is recommended that the ^{226}Ra result for sample TMF-0225 be estimated (J).**

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/g for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Sample:

There was no indication of gross alpha or gross beta contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample Analysis:

There was no MSS analysis for the gross alpha and gross beta analyses as specified by the SOW.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. All gross alpha and beta analysis MDLs were below the required MDL

5.0 TOTAL ACTIVITY

Method Blank:

There was no indication of blank contamination for the total activity analyses.

Equipment Rinsate Sample:

There was no indication of total activity contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity laboratory duplicate DER is within acceptable limits.

Matrix Spike Sample:

The MSS recovery was within acceptable limits for the total activity analysis.

Spectral Analysis:

Spectral plots of the total activity analyses were not included in the laboratory data package.

Method Detection Limit:

The required method detection limit (MDL) for the total activity analysis is 10 pCi/g. All samples met the required MDLs.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER for all samples indicates that the gross alpha analyses agree with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (ranging from 3.57 to 4.36) for all samples are greater than or equal to 1.29 indicating that the gross beta analyses are in agreement with the sum of the beta emitters within a 99% confidence level. The corresponding RPDs (ranging from104% to 116%) are also outside acceptable limits. The gross beta activity for all samples was smaller than the beta sum values by approximately a factor of 3. This difference may be indicative of a negative bias in the gross beta sample results. **Therefore, it is recommended that the gross beta results from all samples be qualified as estimated (J).**

Total Activity to Sum of Alpha and Beta Emitters:

The DERs (ranging from 1.90 to 3.10) for all samples indicate that the total activity analysis agrees with the sum of the alpha and beta emitters within a 99% confidence level. In addition, the corresponding RPDs (ranging from 58.3% to 91.7%) are also outside acceptable limits. The total activity results ranged from approximately a factor of 2 to 5 lower than the beta sums. Again, this may be indicative of a negative bias in the total activity. **Therefore, it is recommended that the total activity results from all samples be qualified as estimated (J).**

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa gamma activity and ^{235}U alpha activity, it was assumed that the protactinium was in equilibrium. The ^{231}Pa and ^{235}U activities are within the measurement uncertainties for all samples except TMF-0230. Since the ^{231}Pa gamma activity result for samples TMF-0230 was previously qualified for improper background subtraction, no further qualification is necessary.

Summary:

For all samples, there was agreement within the measurement uncertainties between the total activity results and the sum of the gross alpha and gross beta results. However, there appears to be a negative bias on the gross alpha/beta and total activity results. **Therefore it is recommended that individual analysis results be used.**

0107108-1			TMF-0224					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.80E-01	2.60E-01	1.00E-01	5.20E-01	**0.31**	**94.7**	
Ra-226	1.37E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.03E+00	3.40E-01	1.02E+00	3.30E-01	**0.02**	**0.98**								
Th-230	1.28E+00	3.40E-01	1.36E+00	3.50E-01	**0.16**	**6.06**	J							
Th-232	9.20E-01	2.70E-01	9.10E-01	2.70E-01	**0.03**	**1.09**								
U-234	1.96E+00	4.20E-01												
U-235	4.80E-01	1.70E-01					J	2.50E-01	2.80E-01	6.00E-02	3.20E-01	**0.45**	**123**	J
U-238	1.30E+00	3.10E-01												
Total U Alpha	**3.74E+00**	**5.49E-01**												
Alpha Sum	**9.24E+00**	**1.50E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.30E+00	3.10E-01						1.48E+00	8.00E-01	2.10E+00	1.20E+00	**0.43**	**34.6**	
Pa-234m (Assumed from U-238)	1.30E+00	3.10E-01						2.70E+00	7.00E+00	-8.00E-01	9.10E+00	**0.30**	**368**	U
K-40	1.89E+01	3.40E+00	1.78E+01	3.60E+00	**0.22**	**5.99**								
Ra-228	8.20E-01	2.00E-01	9.10E-01	2.70E-01	**0.27**	**10.4**								
Pa-231	1.00E+00	1.40E+00	-1.10E+00	1.90E+00	**0.89**	**4200**	U							
Beta Sum	**2.24E+01**	**3.44E+00**						**2.40E+01**	**7.83E+00**	**1.99E+01**	**9.87E+00**			
Total Activity Sum	**3.17E+01**	**3.75E+00**						**3.33E+01**	**7.97E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.20E+00	1.40E+00	8.00E+00	1.40E+00	**0.10**	**2.47**		**0.51**	**(from gamma)**		**11.9**			
Gross Beta	6.70E+00	1.10E+00	7.20E+00	1.20E+00	**0.31**	**7.19**	J	**4.36**	**2.19**		**108**			
Total Activity	1.50E+01	4.20E+00	1.49E+01	4.20E+00	**0.02**	**0.67**	J	**2.96**	**2.03**		**71.5**			

0107108-2			TMF-0225					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	5.20E-01					U
Ra-226	1.34E+00	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.07E+00	3.50E-01												
Th-230	1.29E+00	3.40E-01					J							
Th-232	1.24E+00	3.40E-01												
U-234	1.28E+00	3.00E-01	1.02E+00	2.60E-01	**0.65**	**22.6**								
U-235	2.70E-01	1.20E-01	4.10E-01	1.50E-01	**0.73**	**41.2**	J	3.70E-01	3.40E-01					J
U-238	9.50E-01	2.50E-01	9.30E-01	2.40E-01	**0.06**	**2.13**								
Total U Alpha	**2.50E+00**	**4.09E-01**	**2.36E+00**	**3.84E-01**										
Alpha Sum	**6.99E+00**	**1.79E+00**	**2.36E+00**	**3.84E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.50E-01	2.50E-01	9.30E-01	2.40E-01	**0.06**	**2.13**		1.10E+00	1.10E+00					
Pa-234m (Assumed from U-238)	9.50E-01	2.50E-01	9.30E-01	2.40E-01	**0.06**	**2.13**		0.00E+00	9.30E+00					U
K-40	1.60E+01	3.40E+00												
Ra-228	8.30E-01	2.40E-01												
Pa-231	-5.00E-01	1.80E+00					U							
Beta Sum	**1.87E+01**	**3.43E+00**	**1.86E+00**	**3.39E-01**				**1.79E+01**	**9.97E+00**					
Total Activity Sum	**2.57E+01**	**3.87E+00**	**4.22E+00**	**5.13E-01**				**2.49E+01**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.10E+00	1.40E+00						**0.49**	**(from gamma)**		**14.7**			
Gross Beta	5.90E+00	1.00E+00					J	**3.57**	**1.19**		**104**			
Total Activity	1.06E+01	4.00E+00					J	**2.71**	**1.31**		**83.1**			

0107108-3			TMF-0226					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	3.00E-01					U
Ra-226	1.07E+00	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.05E+00	3.40E-01												
Th-230	1.36E+00	3.50E-01					J							
Th-232	1.22E+00	3.30E-01												
U-234	1.11E+00	2.60E-01												
U-235	1.73E-01	8.90E-02					J	-4.00E-02	3.20E-01					UJ
U-238	1.08E+00	2.60E-01												
Total U Alpha	**2.36E+00**	**3.78E-01**												
Alpha Sum	**6.52E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Cs-137	1.21E-01	7.10E-02												
Th-234 (Assumed from U-238)	1.08E+00	2.60E-01						-1.00E-02	8.40E-01					U
Pa-234m (Assumed from U-238)	1.08E+00	2.60E-01						7.90E+00	9.60E+00					U
K-40	1.44E+01	3.10E+00												
Ra-228	7.60E-01	2.50E-01												
Pa-231	-6.00E-01	1.70E+00					U							
Beta Sum	**1.74E+01**	**3.14E+00**						**2.31E+01**	**1.01E+01**					
Total Activity Sum	**2.39E+01**	**3.57E+00**						**2.96E+01**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.10E+00						**0.16**	**(from gamma)**		**5.08**			
Gross Beta	5.60E+00	1.00E+00					J	**3.57**	**1.72**		**102**			
Total Activity	1.31E+01	4.40E+00					J	**1.90**	**1.48**		**58.3**			

0107108-4			TMF-0227					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-03	9.50E-02					U
Ra-226	9.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.42E+00	3.90E-01												
Th-230	1.16E+00	3.10E-01					J							
Th-232	1.05E+00	2.90E-01												
U-234	1.22E+00	2.90E-01												
U-235	3.70E-01	1.40E-01					J	3.00E-02	3.00E-01					UJ
U-238	1.06E+00	2.70E-01												
Total U Alpha	**2.65E+00**	**4.20E-01**												
Alpha Sum	**8.75E+00**	**2.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+00	2.70E-01						1.20E+00	8.50E-01					
Pa-234m (Assumed from U-238)	1.06E+00	2.70E-01						-1.00E+00	1.00E+01					U
K-40	1.68E+01	3.70E+00												
Ra-228	8.60E-01	2.70E-01												
Pa-231	1.70E+00	2.40E+00					U							
Beta Sum	**2.00E+01**	**3.74E+00**						**1.81E+01**	**1.07E+01**					
Total Activity Sum	**2.87E+01**	**4.38E+00**						**2.68E+01**	**1.09E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.50E+00	1.10E+00						**0.89**	**(from gamma)**		**29.5**			
Gross Beta	5.70E+00	1.00E+00					J	**3.69**	**1.15**		**111**			
Total Activity	1.53E+01	4.50E+00					J	**2.14**	**0.97**		**61.0**			

0107108-5			TMF-0230					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-03	9.90E-02					U
Ra-226	8.80E-01	2.20E-01	8.30E-01	1.90E-01	**0.17**	**5.85**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.11E+00	3.90E-01												
Th-230	1.16E+00	3.30E-01					J							
Th-232	9.10E-01	2.90E-01												
U-234	7.60E-01	2.10E-01												
U-235	1.66E-01	8.90E-02					J	-7.00E-02	2.40E-01					UJ
U-238	9.90E-01	2.50E-01												
Total U Alpha	**1.92E+00**	**3.38E-01**												
Alpha Sum	**3.55E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.90E-01	2.50E-01						3.30E-01	6.80E-01					U
Pa-234m (Assumed from U-238)	9.90E-01	2.50E-01						2.00E+00	1.10E+01					U
K-40	1.60E+01	3.40E+00												
Ra-228	7.10E-01	2.50E-01												
Pa-231	-2.70E+00	1.50E+00					UJ							
Beta Sum	**1.84E+01**	**3.43E+00**						**1.87E+01**	**1.15E+01**					
Total Activity Sum	**2.19E+01**	**3.76E+00**						**2.23E+01**	**1.16E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.70E+00	1.10E+00						**1.14**	**(from gamma)**		**46.6**			
Gross Beta	4.91E+00	9.20E-01					J	**3.79**	**1.19**		**116**			
Total Activity	9.40E+00	3.90E+00					J	**2.31**	**1.05**		**79.9**			

0107108-6			TMF-0231					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.10E-01	1.50E-01					UJ
Ra-226	3.30E-01	1.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.70E-01	2.90E-01												
Th-230	1.09E+00	3.20E-01					J							
Th-232	8.50E-01	2.80E-01												
U-234	1.15E+00	2.70E-01												
U-235	2.70E-01	1.10E-01					J	-1.00E-01	2.50E-01					UJ
U-238	8.00E-01	2.10E-01												
Total U Alpha	**2.22E+00**	**3.59E-01**												
Alpha Sum	**5.27E+00**	**1.09E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.10E-01						1.80E-01	6.30E-01					U
Pa-234m (Assumed from U-238)	8.00E-01	2.10E-01						3.60E+00	6.20E+00					U
K-40	1.86E+01	3.40E+00												
Ra-228	6.40E-01	1.80E-01												
Pa-231	2.30E-01	9.70E-01					U							
Beta Sum	**2.09E+01**	**3.42E+00**						**2.30E+01**	**7.10E+00**					
Total Activity Sum	**2.61E+01**	**3.59E+00**						**2.83E+01**	**7.18E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+00	1.10E+00						**0.34**	**(from gamma)**		**9.6**			
Gross Beta	6.40E+00	1.10E+00					J	**4.03**	**2.32**		**106**			
Total Activity	9.70E+00	3.90E+00					J	**3.10**	**2.28**		**91.7**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107115

This sample delivery group (SDG) contained twelve individual soil samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0232	0107115-1
TMF-0233	0107115-2
TMF-0234	0107115-3
TMF-0235	0107115-4
TMF-9248	0107115-5
TMF-9249	0107115-6
TMF-0236	0107115-7
TMF-0237	0107115-8
TMF-0238	0107115-9
TMF-0239	0107115-10
TMF-0240	0107115-11
TMF-0241	0107115-12

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty

$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in one of the method blanks for ^{231}Pa. All associated sample results less than 5 times the blank value for ^{235}U analyses should be qualified as estimated (J). **Therefore, it is recommended that the ^{231}Pa results for all samples be qualified as estimated (J).**

Equipment Rinsate Sample:

There was no indication of contamination of the equipment rinsate blank for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, ^{137}Cs, $^{212/214}$Bi, $^{212/214}$Pb, ^{228}Ra, and ^{208}Tl gamma emitting radionuclides were reported for most samples.

The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near total equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. A result for fission product ^{137}Cs was reported for one sample. **Inclusion of ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl in the database is not recommended since any modeling will assume equilibrium with parents $^{235/238}$U or ^{232}Th.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{241}Am result for sample TMF-0236. **Therefore, it is recommended that the ^{241}Am result for sample TMF-0236 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination in the $^{234/235/238}$U and $^{228/230/232}$Th alpha spectrometry analyses.

Equipment Rinsate Sample:

There was an indication of ^{228}Th and ^{230}Th contamination of equipment rinsate blank contamination for alpha spectrometry analyses. All associated sample results less than 5 times the blank value for ^{228}Th and ^{230}Th analyses should be qualified as estimated (J). All samples had ^{228}Th and ^{230}Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 41.01% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TMF-232, TMF-9248, TMF-0237, TMF-0239, and TMF-0241 for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.69 " 0.23 to 1.05 " 0.42 pCi/g. Spectral interference observed is also observed in the isotopic uranium analyses for samples TMF-0239 and TMF-0240. The ^{234}U peaks tail into the ^{235}U peak region. **Therefore, it is recommended that the ^{235}U results for samples TMF-0239 and TMF-0240 and ^{230}Th results for samples TMF-232, TMF-9248, TMF-0237, TMF-0239, and TMF-0241 be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least five extra peaks. These peaks are in the 5.8 MeV, 6.3 MeV, 6.7 MeV, 6.9 MeV, and 7.1 MeV regions. It is assumed that the peaks can be attributed to ^{216}Po, ^{217}At, ^{225}Ac and ^{221}Fr, which are progeny of ^{228}Th and the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the method blank for ^{226}Ra analyses.

Equipment Rinsate Sample:

There was no indication of ^{226}Ra contamination of equipment rinsate blank contamination for the radon emmination analyses.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the ^{226}Ra analyses were within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recovery was within acceptable limits for the ^{226}Ra analyses.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/g for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Sample:

There was no indication of gross alpha or gross beta contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample Analysis:

There was no MSS analysis for the gross alpha and gross beta analyses as specified by the SOW.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}KCl, and ^{40}KF). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. Samples TMF-0237, TMF-0238, TMF-0239, and TMF-0240 gross alpha analyses exceeded the required MDL. Samples TMF-9249, TMF-0236, TMF-0237, TMF-0238, TMF-0239, and TMF-0240 gross beta analyses exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY

Method Blank:

There was no indication of blank contamination for the total activity analyses.

Equipment Rinsate Sample:

There was no indication of total activity contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity laboratory duplicate DER is within acceptable limits.

Matrix Spike Sample:

The MSS analysis result was within acceptable limits for the total activity analysis.

Spectral Analysis:

Spectral plots of the total activity analyses were not included in the laboratory data package.

Method Detection Limit:

The required method detection limit (MDL) for the total activity analysis is 10 pCi/g. All samples met the required MDLs.

Quantification:

It is recommended that the total activity analysis results for samples TMF-0232, TMF-0233, TMF-0235, TMF-9248, TMF-9249, TMF-0236, TMF-0237, TMF-0238, TMF-0239, TMF-0240, and TMF-0241 be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}KCl, and ^{40}KF). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER for all samples indicates that the gross alpha analyses agree with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (ranging from 1.89 to 4.94) for all samples are greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The corresponding RPDs (ranging from 92% to 146%) are also outside acceptable limits. The gross beta activity for all samples was smaller than the beta sum values by approximately a factor ranging from 3 to 5. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sum of Alpha and Beta Emitters:

The DERs (ranging from 1.46 to 3.10) for all samples, except TMF-0234, indicate that the total activity analyses are not in agreement with the sum of the alpha and beta emitters within a 99% confidence level. In addition, the corresponding RPDs (ranging from 46.1% to 94.6%) are also outside acceptable limits. Samples TMF-0232, TMF-0233, TMF-0235, TMF-9248, TMF-9249, TMF-0236, TMF-0237, TMF-0238, TMF-0239, TMF-0240, and TMF-0241 have total activity results that is less than the sum of the alpha and beta emitters by an approximate factor of approximately 2. This is most likely due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa gamma activity and ^{235}U alpha activity, it was assumed that the protactinium was in equilibrium. The ^{231}Pa and ^{235}U activities are within the measurement uncertainties for all samples.

Summary:

For all samples, there was agreement within the measurement uncertainties between the total activity results and the sum of the gross alpha and gross beta results. However, there appears to be a negative bias on the gross beta and total activity results. (According to laboratory procedure, the gross alpha/beta and total activity samples are heated to dryness prior to counting. The loss of volatile radionuclides is likely. **Therefore it is recommended that individual analysis results be used.)**

0107115-1			TMF-0232					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-01	2.40E-01	2.00E-02	4.70E-01	**0.15**	**133**	U
Ra-226	9.50E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.06E+00	3.80E-01	1.15E+00	3.80E-01	**0.17**	**8.14**								
Th-230	1.03E+00	3.20E-01	1.05E+00	3.10E-01	**0.04**	**1.92**	J							
Th-232	1.00E+00	3.10E-01	1.02E+00	3.00E-01	**0.05**	**1.98**								
U-234	9.70E-01	2.50E-01												
U-235	6.40E-02	5.90E-02						6.00E-02	2.70E-01	2.40E-01	2.50E-01	**0.49**	**120**	U
U-238	7.40E-01	2.10E-01												
Total U Alpha	**1.77E+00**	**3.32E-01**												
Alpha Sum	**4.82E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137			8.50E-02	5.80E-02										
K-40	1.76E+01	3.20E+00	1.83E+01	3.70E+00	**0.14**	**3.90**								
Th-234 (Assumed from U-238)	7.40E-01	2.10E-01						4.50E-01	8.40E-01	1.10E+00	1.20E+00	**0.44**	**83.9**	U
Pa-234m (Assumed from U-238)	7.40E-01	2.10E-01						6.20E+00	6.50E+00	1.60E+00	7.70E+00	**0.46**	**118**	
Ac-227														
Ra-228	6.40E-01	1.70E-01	6.40E-01	2.10E-01	**0.00**	**0.00**	J							
Pa-231	-1.10E+00	1.40E+00	-4.00E-01	1.60E+00	**0.33**	**93.3**	UJ							
Beta Sum	**1.96E+01**	**3.22E+00**						**2.48E+01**	**7.30E+00**	**2.17E+01**	**8.63E+00**			
Total Activity Sum	**2.44E+01**	**3.53E+00**						**2.96E+01**	**7.44E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.30E+00	1.30E+00	7.20E+00	1.20E+00	**0.06**	**1.38**		**1.28**	**(from gamma)**		**40.8**			
Gross Beta	6.10E+00	1.10E+00	5.80E+00	1.00E+00	**0.20**	**5.04**	J	**3.96**	**2.53**		**105**			
Total Activity	1.07E+01	4.10E+00	1.04E+01	4.00E+00	**0.05**	**2.84**	J	**2.53**	**2.22**		**78.1**			

0107115-2			TMF-0233					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.70E-01	4.60E-01					U
Ra-226	7.00E-02	1.20E-01					U							
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	3.80E-01												
Th-230	1.02E+00	3.30E-01												
Th-232	9.40E-01	3.10E-01												
U-234	7.60E-01	2.20E-01	8.80E-01	2.40E-01	**0.37**	**14.6**								
U-235	7.40E-02	6.10E-02	1.12E-01	7.60E-02	**0.39**	**40.9**		1.00E-01	2.80E-01					U
U-238	7.50E-01	2.20E-01	9.10E-01	2.40E-01	**0.49**	**19.3**								
Total U Alpha	**1.58E+00**	**3.17E-01**	**1.90E+00**	**3.48E-01**										
Alpha Sum	**3.60E+00**	**1.67E+00**	**1.90E+00**	**3.48E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.72E+01	3.50E+00												
Th-234 (Assumed from U-238)	7.50E-01	2.20E-01	9.10E-01	2.40E-01	**0.49**	**19.3**		6.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	7.50E-01	2.20E-01	9.10E-01	2.40E-01	**0.49**	**19.3**		-2.30E+00	8.70E+00					U
Ac-227														
Ra-228	6.20E-01	2.10E-01												
Pa-231	-1.10E+00	1.70E+00					UJ							
Beta Sum	**1.92E+01**	**3.53E+00**	**1.82E+00**	**3.39E-01**				**1.60E+01**	**9.45E+00**					
Total Activity Sum	**2.28E+01**	**3.90E+00**	**3.72E+00**	**4.86E-01**				**1.96E+01**	**9.59E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.00E+00						**0.87**	**(from gamma)**		**38.1**			
Gross Beta	5.36E+00	9.70E-01					J	**3.78**	**1.12**		**113**			
Total Activity	1.24E+01	4.10E+00						**1.84**	**0.69**		**59.1**			

0107115-3			TMF-0234					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	3.30E-01					U
Ra-226	4.70E-01	1.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.20E-01	3.10E-01												
Th-230	6.90E-01	2.70E-01												
Th-232	4.20E-01	2.00E-01												
U-234	5.10E-01	1.60E-01												
U-235	7.20E-02	5.70E-02						-1.30E-01	2.80E-01					U
U-238	4.80E-01	1.60E-01												
Total U Alpha	**1.06E+00**	**2.33E-01**												
Alpha Sum	**2.07E+00**	**1.45E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	6.10E+00	1.90E+00												
Th-234 (Assumed from U-238)	4.80E-01	1.60E-01						1.02E+00	8.30E-01					
Pa-234m (Assumed from U-238)	4.80E-01	1.60E-01						7.30E+00	8.90E+00					U
Ac-227														
Ra-228	4.00E-01	1.90E-01												
Pa-231	-1.10E+00	1.50E+00					UJ							
Beta Sum	**7.33E+00**	**1.93E+00**						**1.47E+01**	**9.14E+00**					
Total Activity Sum	**9.40E+00**	**2.42E+00**						**1.68E+01**	**9.26E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.20E+00	1.50E+00						**0.54**	**(from gamma)**		**42.8**			
Gross Beta	1.50E+00	1.60E+00					J	**2.32**	**1.42**		**132**			
Total Activity	8.50E+00	4.30E+00						**0.18**	**0.81**		**10.1**			

0107115-4			TMF-0235					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.40E-02	8.80E-02					U
Ra-226	1.05E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.10E+00	4.00E-01												
Th-230	6.90E-01	2.70E-01												
Th-232	8.90E-01	3.00E-01												
U-234	7.90E-01	2.10E-01												
U-235	8.30E-02	6.30E-02						1.60E-01	2.40E-01					U
U-238	7.80E-01	2.10E-01												
Total U Alpha	**1.65E+00**	**3.04E-01**												
Alpha Sum	**4.03E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.48E+01	3.30E+00												
Th-234 (Assumed from U-238)	7.80E-01	2.10E-01						1.43E+00	9.20E-01					
Pa-234m (Assumed from U-238)	7.80E-01	2.10E-01						2.00E+00	1.10E+01					U
Ac-227														
Ra-228	5.50E-01	2.00E-01												
Pa-231	-1.50E+00	1.50E+00					UJ							
Beta Sum	**1.67E+01**	**3.32E+00**						**1.86E+01**	**1.15E+01**					
Total Activity Sum	**2.08E+01**	**3.66E+00**						**2.26E+01**	**1.16E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.00E+00						**0.75**	**(from gamma)**		**29.0**			
Gross Beta	5.24E+00	9.60E-01					J	**3.32**	**1.16**		**105**			
Total Activity	8.20E+00	3.90E+00					J	**2.35**	**1.18**		**86.8**			

0107115-5			TMF-9248					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.50E-02	9.80E-02					U
Ra-226	9.80E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.05E+00	4.20E-01	8.40E-01	3.30E-01	**0.39**	**22.2**								
Th-230	8.10E-01	3.00E-01	1.08E+00	3.20E-01	**0.62**	**28.6**	J							
Th-232	7.40E-01	2.80E-01	9.70E-01	3.00E-01	**0.56**	**26.9**								
U-234	8.70E-01	2.30E-01												
U-235	9.10E-02	6.50E-02						-3.00E-02	2.60E-01					U
U-238	7.80E-01	2.20E-01												
Total U Alpha	**1.74E+00**	**3.25E-01**												
Alpha Sum	**5.77E+00**	**2.10E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.68E+01	3.50E+00												
Th-234 (Assumed from U-238)	7.80E-01	2.20E-01						1.09E+00	8.90E-01					
Pa-234m (Assumed from U-238)	7.80E-01	2.20E-01						1.80E+00	9.50E+00					U
Ac-227														
Ra-228	6.80E-01	2.30E-01												
Pa-231	5.00E-01	2.20E+00					UJ							
Beta Sum	**1.91E+01**	**3.53E+00**						**2.04E+01**	**1.02E+01**					
Total Activity Sum	**2.49E+01**	**4.11E+00**						**2.62E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.83E+00	9.80E-01						**0.41**	**(from gamma)**		**17.8**			
Gross Beta	5.48E+00	9.90E-01					J	**3.71**	**1.46**		**111**			
Total Activity	1.04E+01	4.00E+00					J	**2.52**	**1.42**		**82.1**			

0107115-6			TMF-9249					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.40E-01					U
Ra-226	1.05E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	3.00E-01												
Th-230	8.60E-01	2.70E-01												
Th-232	8.90E-01	2.80E-01												
U-234	9.60E-01	2.40E-01	7.70E-01	2.10E-01	**0.60**	**22.0**								
U-235	1.52E-01	8.20E-02	4.60E-02	5.00E-02	**1.10**	**107**		6.00E-02	2.40E-01					U
U-238	8.70E-01	2.20E-01	8.40E-01	2.20E-01	**0.10**	**3.51**								
Total U Alpha	**1.98E+00**	**3.36E-01**	**1.66E+00**	**3.08E-01**										
Alpha Sum	**5.23E+00**	**1.18E+00**	**1.66E+00**	**3.08E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.77E+01	3.20E+00												
Th-234 (Assumed from U-238)	8.70E-01	2.20E-01	8.40E-01	2.20E-01	**0.10**	**3.51**		2.00E-01	5.70E-01					U
Pa-234m (Assumed from U-238)	8.70E-01	2.20E-01	8.40E-01	2.20E-01	**0.10**	**3.51**		3.70E+00	6.30E+00					U
Ac-227														
Ra-228	7.80E-01	1.90E-01												
Pa-231	-2.00E-01	1.10E+00					UJ							
Beta Sum	**2.02E+01**	**3.22E+00**	**1.68E+00**	**3.11E-01**				**2.24E+01**	**7.09E+00**					
Total Activity Sum	**2.54E+01**	**3.43E+00**	**3.34E+00**	**4.38E-01**				**2.76E+01**	**7.19E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.00E+00	1.20E+00						**0.46**	**(from gamma)**		**13.7**			
Gross Beta	5.10E+00	1.00E+00					J	**4.47**	**2.41**		**119**			
Total Activity	9.10E+00	4.00E+00					J	**3.10**	**2.25**		**94.6**			

0107115-7			TMF-0236					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	1.50E-01					UJ
Ra-226	9.60E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.70E-01	2.70E-01												
Th-230	9.90E-01	3.10E-01					J							
Th-232	7.00E-01	2.60E-01												
U-234	1.05E+00	2.50E-01												
U-235	1.67E-01	8.60E-02						-1.00E-01	2.50E-01					U
U-238	1.03E+00	2.50E-01												
Total U Alpha	**2.25E+00**	**3.64E-01**												
Alpha Sum	**5.02E+00**	**1.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	1.08E-01	5.30E-02												
K-40	1.24E+01	2.40E+00												
Th-234 (Assumed from U-238)	1.03E+00	2.50E-01						1.20E+00	1.00E+00					
Pa-234m (Assumed from U-238)	1.03E+00	2.50E-01						-1.70E+00	7.20E+00					U
Ac-227														
Ra-228	6.20E-01	2.00E-01												
Pa-231	-5.00E-01	1.20E+00					UJ							
Beta Sum	**1.51E+01**	**2.44E+00**						**1.26E+01**	**7.66E+00**					
Total Activity Sum	**2.01E+01**	**2.74E+00**						**1.76E+01**	**7.76E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.46E+00	8.80E-01						**1.01**	**(from gamma)**		**36.7**			
Gross Beta	2.36E+00	8.60E-01					J	**4.94**	**1.32**		**146**			
Total Activity	1.26E+01	4.40E+00					J	**1.46**	**0.56**		**46.1**			

0107115-8			TMF-0237					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	2.40E-01					U
Ra-226	1.02E+00	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	3.10E-01												
Th-230	1.04E+00	3.20E-01					J							
Th-232	7.90E-01	2.70E-01												
U-234	8.30E-01	2.40E-01												
U-235	5.60E-02	5.60E-02						-4.00E-02	2.60E-01					U
U-238	6.90E-01	2.20E-01												
Total U Alpha	**1.58E+00**	**3.30E-01**												
Alpha Sum	**5.22E+00**	**1.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.76E+01	3.20E+00												
Th-234 (Assumed from U-238)	6.90E-01	2.20E-01						4.30E-01	6.20E-01					U
Pa-234m (Assumed from U-238)	6.90E-01	2.20E-01						3.60E+00	6.80E+00					U
Ac-227														
Ra-228	7.60E-01	1.90E-01												
Pa-231	1.00E-01	1.20E+00					UJ							
Beta Sum	**1.98E+01**	**3.22E+00**						**2.24E+01**	**7.54E+00**					
Total Activity Sum	**2.50E+01**	**3.46E+00**						**2.76E+01**	**7.65E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.10E+00						**0.01**	**(from gamma)**		**0.31**			
Gross Beta	4.90E+00	1.00E+00					J	**4.40**	**2.30**		**120**			
Total Activity	9.50E+00	4.00E+00					J	**2.92**	**2.10**		**89.8**			

0107115-9			TMF-0238					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.20E-01	3.70E-01	-3.00E-02	1.20E-01	**0.39**	**333**	U
Ra-226	9.90E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	2.80E-01												
Th-230	1.08E+00	3.20E-01												
Th-232	8.80E-01	2.80E-01												
U-234	1.29E+00	3.20E-01												
U-235	2.10E-01	1.10E-01						-1.00E-01	4.70E-01	1.00E-02	4.40E-01	**0.17**	**244**	U
U-238	1.10E+00	2.90E-01												
Total U Alpha	**2.60E+00**	**4.46E-01**												
Alpha Sum	**4.92E+00**	**2.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.79E+01	3.90E+00	1.72E+01	5.00E+00	**0.11**	**3.99**								
Th-234 (Assumed from U-238)	1.10E+00	2.90E-01						1.10E+00	1.20E+00	1.30E+00	1.00E+00	**0.13**	**16.7**	
Pa-234m (Assumed from U-238)	1.10E+00	2.90E-01						7.00E+00	1.60E+01	8.00E+00	2.30E+01	**0.04**	**13.3**	U
Ac-227														
Ra-228	7.30E-01	3.10E-01	1.15E+00	6.30E-01	**0.60**	**44.7**								
Pa-231	-1.40E+00	2.50E+00	-2.80E+00	2.70E+00	**0.38**	**66.7**	UJ							
Beta Sum	**2.07E+01**	**3.95E+00**						**2.66E+01**	**1.65E+01**	**2.73E+01**	**2.36E+01**			
Total Activity Sum	**2.56E+01**	**4.60E+00**						**3.15E+01**	**1.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.30E+00	1.40E+00						**0.50**	**(from gamma)**		**24.6**			
Gross Beta	7.40E+00	1.30E+00					J	**3.19**	**1.16**		**94.5**			
Total Activity	1.40E+01	4.20E+00					J	**1.86**	**1.02**		**58.5**			

0107115-10			TMF-0239					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	3.20E-01					U
Ra-226	8.50E-01	2.20E-01	8.60E-01	2.00E-01	**0.03**	**1.17**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	3.60E-01												
Th-230	1.04E+00	3.30E-01					J							
Th-232	1.05E+00	3.30E-01												
U-234	7.80E-01	2.00E-01												
U-235	8.30E-02	5.90E-02					J	-1.70E-01	2.70E-01					U
U-238	6.50E-01	1.80E-01												
Total U Alpha	**1.51E+00**	**2.75E-01**												
Alpha Sum	**4.37E+00**	**1.60E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.75E+01	3.60E+00												
Th-234 (Assumed from U-238)	6.50E-01	1.80E-01						1.13E+00	8.30E-01					
Pa-234m (Assumed from U-238)	6.50E-01	1.80E-01						-5.30E+00	9.40E+00					U
Ac-227														
Ra-228	8.80E-01	2.40E-01												
Pa-231	-9.00E-01	1.60E+00					UJ							
Beta Sum	**1.96E+01**	**3.62E+00**						**1.41E+01**	**1.01E+01**					
Total Activity Sum	**2.39E+01**	**3.96E+00**						**1.85E+01**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+00	1.20E+00						**0.51**	**(from gamma)**		**21.0**			
Gross Beta	5.90E+00	1.10E+00					J	**3.61**	**0.81**		**107**			
Total Activity	9.50E+00	3.90E+00					J	**2.60**	**0.82**		**86.4**			

0107115-11			TMF-0240					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.20E-01					U
Ra-226	6.50E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	3.70E-01												
Th-230	6.60E-01	2.60E-01												
Th-232	6.80E-01	2.50E-01												
U-234	8.90E-01	2.40E-01												
U-235	5.90E-02	5.40E-02					J	1.20E-01	4.30E-01					U
U-238	9.20E-01	2.40E-01												
Total U Alpha	**1.87E+00**	**3.44E-01**												
Alpha Sum	**4.91E+00**	**2.52E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	9.40E+00	3.40E+00												
Th-234 (Assumed from U-238)	9.20E-01	2.40E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	9.20E-01	2.40E-01						-7.00E+00	2.00E+01					U
Ac-227														
Ra-228	4.20E-01	4.90E-01												
Pa-231	2.00E-01	2.70E+00					UJ							
Beta Sum	**1.17E+01**	**3.47E+00**						**3.64E+00**	**2.03E+01**					
Total Activity Sum	**1.66E+01**	**4.28E+00**						**8.55E+00**	**2.05E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.40E+00	1.90E+00						**0.47**	**(from gamma)**		**26.4**			
Gross Beta	4.30E+00	1.80E+00					J	**1.89**	**0.03**		**92.4**			
Total Activity	4.80E+00	3.80E+00					J	**2.06**	**0.18**		**110.3**			

0107115-12			TMF-0241					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.80E-02	8.60E-02					U
Ra-226	9.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	2.90E-01												
Th-230	6.90E-01	2.30E-01					J							
Th-232	9.70E-01	2.80E-01												
U-234	8.10E-01	2.10E-01												
U-235	1.08E-01	6.60E-02						-1.00E-01	2.70E-01					U
U-238	8.30E-01	2.10E-01												
Total U Alpha	**1.75E+00**	**3.04E-01**												
Alpha Sum	**4.62E+00**	**1.56E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.81E+01	3.90E+00												
Th-234 (Assumed from U-238)	8.30E-01	2.10E-01						5.60E-01	6.10E-01					
Pa-234m (Assumed from U-238)	8.30E-01	2.10E-01						7.30E+00	9.10E+00					U
Ac-227														
Ra-228	8.50E-01	2.90E-01												
Pa-231	-5.00E-01	1.60E+00					UJ							
Beta Sum	**2.06E+01**	**3.93E+00**						**2.68E+01**	**9.93E+00**					
Total Activity Sum	**2.52E+01**	**4.22E+00**						**3.14E+01**	**1.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.10E+00						**0.36**	**(from gamma)**		**13.8**			
Gross Beta	5.90E+00	1.10E+00					J	**3.59**	**2.09**		**111**			
Total Activity	1.02E+01	4.00E+00					J	**2.57**	**1.96**		**84.6**			

Radiological Analytical Data Verification
Comments on Data for SDG 0107116

This sample delivery group (SDG) contained thirteen individual soil samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0294	0107116-1
TMF-0295	0107116-2
TMF-0296	0107116-3
TMF-9342	0107116-4
TMF-9343	0107116-5
TMF-9344	0107116-6
TMF-0306	0107116-7
TMF-0307	0107116-8
TMF-0308	0107116-9
TMF-0243	0107116-10
TMF-0242	0107116-11
TMF-0244	0107116-12
TMF-0245	0107116-13

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty

$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the method blanks for gamma spectrometry.

Equipment Rinsate Sample:

There was no indication of contamination of the equipment rinsate blank for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. In addition, ^{40}K, ^{137}Cs, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples.

The ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near total equilibrium with ^{238}U and ^{232}Th. Results for natural ^{40}K were reported for all samples. A result for fission product ^{137}Cs was reported for one sample. However, a ^{137}Cs peak was identified in gamma spectrometry report for TMF-0294 but not reported by the laboratory. The ^{137}Cs activity in this sample was higher than the required DL (1.65*TPU). **Inclusion of ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, and ^{208}Tl in the database is not recommended since any modeling will assume equilibrium with parent $^{235/238}$U or ^{232}Th.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{231}Pa results for samples TMF-0295 (laboratory duplicate), TMF-0307 (laboratory duplicate), and TMF-0242 (laboratory duplicate). **Therefore, it is recommended that the ^{231}Pa results for samples TMF-0295, (laboratory duplicate), TMF-0307 (laboratory duplicate), and TMF-0242 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination in the $^{234/235/238}$U and $^{228/230/232}$Th alpha spectrometry analyses.

Equipment Rinsate Sample:

There was an indication of ^{228}Th and ^{230}Th contamination of equipment rinsate blank contamination for alpha spectrometry analyses. All associated sample results less than 5 times the blank value for ^{228}Th and ^{230}Th analyses should be qualified as estimated (J). All samples had ^{228}Th and ^{230}Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 46.32% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TMF-9342, TMF-9343, TMF-9343 (laboratory duplicate), TMF-9344, TMF-0307, TMF-0308, and TMF-0242 for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th

blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.84 " 0.27 to 1.32 " 0.36 pCi/g. Spectral interference observed is also observed in the isotopic uranium analyses for sample TMF-0307. The ^{234}U peak tails into the ^{235}U peak region. **Therefore, it is recommended that the ^{235}U result for samples TMF-0307 and ^{230}Th results for samples TMF-9342, TMF-9343, TMF-9343 (laboratory duplicate), TMF-9344, TMF-0307, TMF-0308, and TMF-0242 be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least five extra peaks. These peaks are in the 5.8 MeV, 6.3 MeV, 6.7 MeV, 6.9 MeV, and 7.1 MeV regions. It is assumed that the peaks can be attributed to ^{216}Po, ^{217}At, ^{225}Ac and ^{221}Fr, which are progeny of ^{228}Th and the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the method blank for ^{226}Ra analyses.

Equipment Rinsate Sample:

There was no indication of ^{226}Ra contamination of equipment rinsate blank contamination for the radon emmination analyses.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the ^{226}Ra analyses were within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recovery was within acceptable limits for the ^{226}Ra analyses.

Method Detection Limit:

All samples met the required method detection limit (MDL) of 0.5 pCi/g for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Sample:

There was no indication of gross alpha or gross beta contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample Analysis:

The MSS results for the gross alpha/beta analyses were within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, and ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/g. Sample TMF-0244 gross alpha analyses exceeded the required MDL. Samples TMF-9344, TMF-0308, TMF-0242, and TMF-0244 gross beta analyses exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY

Method Blank:

There was no indication of blank contamination for the total activity analyses.

Equipment Rinsate Sample:

There was no indication of total activity contamination of equipment rinsate blank.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity laboratory duplicate DER is within acceptable limits.

Matrix Spike Sample:

The MSS analysis result was within acceptable limits for the total activity analysis.

Spectral Analysis:

Spectral plots of the total activity analyses were not included in the laboratory data package.

Method Detection Limit:

The required method detection limit (MDL) for the total activity analysis is 10 pCi/g. All samples met the required MDLs.

Quantification:

It is recommended that the total activity analysis results for samples TMF-0294, TMF-0295, TMF-0296, TMF-9342, TMF-9343, TMF-9344, TMF-0306, TMF-0307, TMF-0308, TMF-0243, TMF-0242, and TMF-0245 be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, and ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties except for sample TMF-0307. The ^{234}Th gamma spectrometry result for this sample is smaller than the ^{238}U alpha spectrometry result. However, the ^{234}Th result for TMF-0307 (laboratory duplicate) is in agreement with the uranium alpha result. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (1.33 and 1.67) for samples TMF-0296 and TMF-0243 indicate that the gross alpha analyses did not agree with the sum of the alpha emitters within a 99% confidence level. In addition, the RPDs (42.2% and 50.6%) were also outside acceptable limits. The gross alpha activity was smaller than the alpha sum value. The gross alpha analysis was performed by gas proportional counting, which has uncertainties in corrections for geometry and self-absorption of the alpha particles, which may cause the negative bias observed in the gross alpha analysis. **Therefore, it is recommended that the gross alpha results for samples TMF-0296 and TMF-0243 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (ranging from 2.53 to 4.70) for all samples are greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The corresponding RPDs (ranging from 93.5% to 130%) are also outside acceptable limits. The gross beta activity for all samples was smaller than the beta sum values by approximately a factor ranging from 3 to 5. This negative bias is most likely due to the loss of volatile radionuclides and volatile radionuclide salts as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sum of Alpha and Beta Emitters:

The DERs (ranging from 2.28 to 3.76) for all samples, except TMF-0244, indicate that the total activity analyses are not in agreement with the sum of the alpha and beta emitters within a 99% confidence level. In addition, the corresponding RPDs (ranging from 95.9% to 128%) are also outside acceptable limits. These samples have total activity results that are less than the sum of the alpha and beta emitters by an approximate factor of ranging from 2 to 4. This is most likely

due to a negative bias in the total activity results due to the loss of volatile radionuclides and/or radionuclide salts as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples except TMF-0306. The ^{228}Ra result in sample TMF-0306 is smaller than the ^{232}Th result by a factor of 1.24 and is indicative of either a non-equilibrium condition or sample heterogeneity. No qualification of the ^{228}Ra or ^{232}Th results is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa gamma activity and ^{235}U alpha activity, it was assumed that the protactinium was in equilibrium with uranium. The ^{231}Pa and ^{235}U activities are outside the measurement uncertainties for samples TMF-0295 (laboratory duplicate), TMF-0307 (laboratory duplicate), TMF-0243 and TMF-0242. For sample TMF-0243, the ^{231}Pa activity is greater than the ^{235}U alpha result by a factor of about 1.5 and is indicative of either a non-equilibrium condition or sample heterogeneity. Samples TMF-0295 (laboratory duplicate), TMF-0307 (laboratory duplicate), and TMF-0242 were previously qualified due to improper background subtraction. No qualification of the ^{231}Pa or ^{235}U results is necessary.

Summary:

For all samples, there was agreement within the measurement uncertainties between the total activity results and the sum of the gross alpha and gross beta results. However, there appears to be a negative bias on the gross beta and total activity results. (According to laboratory procedure, the gross alpha/beta and total activity samples are heated to dryness prior to counting. The loss of volatile radionuclides is likely. **Therefore it is recommended that individual analysis results be used.)**

0107116-1			TMF-0294					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.10E-01	4.70E-01					U
Ra-226	8.00E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	3.20E-01	9.80E-01	3.70E-01	**0.47**	**26.6**								
Th-230	9.40E-01	2.90E-01	9.10E-01	2.90E-01	**0.07**	**3.24**								
Th-232	6.60E-01	2.30E-01	8.90E-01	2.90E-01	**0.62**	**29.7**								
U-234	8.20E-01	2.20E-01												
U-235	7.00E-02	5.80E-02						2.10E-01	3.30E-01					U
U-238	7.10E-01	2.00E-01												
Total U Alpha	**1.60E+00**	**3.03E-01**												
Alpha Sum	**4.30E+00**	**1.73E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.48E+01	3.10E+00												
Th-234 (Assumed from U-238)	7.10E-01	2.00E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	7.10E-01	2.00E-01						9.00E-01	9.20E+00					U
Ac-227														
Ra-228	6.10E-01	2.20E-01												
Pa-231	-5.00E-01	1.80E+00					U							
Beta Sum	**1.68E+01**	**3.13E+00**						**1.71E+01**	**9.78E+00**					
Total Activity Sum	**2.11E+01**	**3.57E+00**						**2.14E+01**	**9.93E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.10E+00	4.56E+00	9.80E-01	**0.91**	**25.6**		**0.78**	**(from gamma)**		**31.4**			
Gross Beta	4.07E+00	8.10E-01	3.50E+00	7.60E-01	**0.51**	**15.1**	J	**3.93**	**1.32**		**122**			
Total Activity	6.80E+00	3.90E+00	5.80E+00	4.00E+00	**0.18**	**15.9**	J	**2.70**	**1.36**		**102**			

0107116-2			TMF-0295					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-01	3.10E-01	-6.00E-02	4.00E-01	**0.28**	**108**	U
Ra-226	4.90E-01	1.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	3.70E-01												
Th-230	9.30E-01	3.20E-01												
Th-232	7.60E-01	2.90E-01												
U-234	1.10E+00	2.80E-01	1.18E+00	2.70E-01	**0.21**	**7.02**								
U-235	1.07E-01	7.50E-02	1.63E-01	8.60E-02	**0.49**	**41.5**		1.90E-01	3.30E-01	2.90E-01	2.50E-01	**0.24**	**41.7**	U
U-238	1.09E+00	2.70E-01	1.05E+01	2.50E-01	**25.6**	**162**								
Total U Alpha	**2.30E+00**	**3.96E-01**	**1.18E+01**	**3.78E-01**										
Alpha Sum	**4.62E+00**	**1.69E+00**	**8.33E+00**	**2.02E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.83E+01	3.50E+00	1.47E+01	3.40E+00	**0.74**	**21.8**								
Th-234 (Assumed from U-238)	1.09E+00	2.70E-01	1.05E+01	2.50E-01	**25.6**	**162**		1.00E+00	9.60E-01	1.80E+00	1.40E+00	**0.47**	**57.1**	
Pa-234m (Assumed from U-238)	1.09E+00	2.70E-01	1.05E+01	2.50E-01	**25.6**	**162**		5.40E+00	8.80E+00	8.00E+00	1.20E+01	**0.17**	**38.8**	U
Ac-227														
Ra-228	7.30E-01	2.30E-01	6.70E-01	2.70E-01	**0.17**	**8.57**								
Pa-231	-7.00E-01	1.70E+00	-3.90E+00	2.20E+00	**1.15**	**139**	U							
Beta Sum	**2.11E+01**	**3.53E+00**	**3.59E+01**	**3.44E+00**				**2.53E+01**	**9.52E+00**	**2.47E+01**	**1.26E+01**			
Total Activity Sum	**2.57E+01**	**3.92E+00**	**4.42E+01**	**3.99E+00**				**3.00E+01**	**9.67E+00**	**3.30E+01**	**1.27E+01**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+00	1.00E+00						**0.09**	**(from gamma)**		**3.89**			
Gross Beta	5.51E+00	9.70E-01					J	**4.26**	**2.07**		**117**			
Total Activity	1.12E+01	4.30E+00					J	**2.50**	**1.77**		**78.7**			

0107116-3			TMF-0296					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	2.90E-01					U
Ra-226	1.04E+00	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	3.30E-01												
Th-230	7.80E-01	2.50E-01												
Th-232	9.70E-01	2.80E-01												
U-234	7.50E-01	2.00E-01												
U-235	7.70E-02	5.60E-02						6.00E-02	2.80E-01					U
U-238	9.90E-01	2.40E-01												
Total U Alpha	**1.82E+00**	**3.17E-01**												
Alpha Sum	**5.88E+00**	**1.25E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.56E+01	3.20E+00												
Th-234 (Assumed from U-238)	9.90E-01	2.40E-01						3.40E-01	6.60E-01					U
Pa-234m (Assumed from U-238)	9.90E-01	2.40E-01						5.30E+00	8.30E+00					U
Ac-227														
Ra-228	7.30E-01	2.40E-01												
Pa-231	2.00E-01	1.20E+00					U							
Beta Sum	**1.83E+01**	**3.23E+00**						**2.20E+01**	**8.92E+00**					
Total Activity Sum	**2.42E+01**	**3.47E+00**						**2.79E+01**	**9.01E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.83E+00	9.00E-01					J	**1.33**	**(from gamma)**		**42.2**			
Gross Beta	3.50E+00	7.50E-01					J	**4.47**	**2.07**		**136**			
Total Activity	8.20E+00	3.90E+00					J	**3.07**	**2.00**		**98.8**			

0107116-4			TMF-9342					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.50E-02	8.30E-02					U
Ra-226	3.90E-01	1.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	3.20E-01												
Th-230	1.32E+00	3.60E-01					J							
Th-232	9.30E-01	2.90E-01												
U-234	6.70E-01	1.80E-01												
U-235	1.20E-01	6.80E-02						0.00E+00	2.50E-01					U
U-238	8.40E-01	2.10E-01												
Total U Alpha	**1.63E+00**	**2.85E-01**												
Alpha Sum	**3.71E+00**	**1.58E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.26E+01	3.00E+00												
Th-234 (Assumed from U-238)	8.40E-01	2.10E-01						2.20E-01	6.90E-01					U
Pa-234m (Assumed from U-238)	8.40E-01	2.10E-01						1.10E+00	8.30E+00					U
Ac-227														
Ra-228	6.70E-01	2.50E-01												
Pa-231	-1.50E+00	1.60E+00					U							
Beta Sum	**1.48E+01**	**3.03E+00**						**1.44E+01**	**8.86E+00**					
Total Activity Sum	**1.85E+01**	**3.42E+00**						**1.81E+01**	**9.00E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.10E+00	1.00E+00						**0.74**	**(from gamma)**		**31.6**			
Gross Beta	4.37E+00	8.50E-01					J	**3.30**	**1.13**		**109**			
Total Activity	6.50E+00	4.00E+00					J	**2.28**	**1.18**		**95.9**			

0107116-5			TMF-9343					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.10E-01					U
Ra-226	9.20E-01	2.10E-01	9.90E-01	2.10E-01	**0.24**	**7.33**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	3.60E-01	1.01E+00	3.40E-01	**0.08**	**4.04**								
Th-230	1.03E+00	3.30E-01	8.40E-01	2.70E-01	**0.45**	**20.3**	J							
Th-232	8.40E-01	2.90E-01	6.90E-01	2.50E-01	**0.39**	**19.6**								
U-234	8.20E-01	2.20E-01												
U-235	5.80E-02	5.20E-02						-1.90E-01	2.70E-01					U
U-238	7.40E-01	2.10E-01												
Total U Alpha	**1.62E+00**	**3.09E-01**												
Alpha Sum	**5.65E+00**	**1.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	1.40E-01	8.60E-02												
K-40	1.43E+01	3.40E+00												
Th-234 (Assumed from U-238)	7.40E-01	2.10E-01						5.10E-01	8.70E-01					U
Pa-234m (Assumed from U-238)	7.40E-01	2.10E-01						1.10E+01	1.20E+01					
Ac-227														
Ra-228	7.90E-01	2.60E-01												
Pa-231	3.00E-01	1.80E+00					U							
Beta Sum	**1.67E+01**	**3.43E+00**						**2.68E+01**	**1.25E+01**					
Total Activity Sum	**2.24E+01**	**3.85E+00**						**3.24E+01**	**1.26E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.00E+00	4.80E+00	1.00E+00	**0.28**	**8.00**		**0.22**	**(from gamma)**		**8.26**			
Gross Beta	4.36E+00	8.40E-01	4.08E+00	8.30E-01	**0.24**	**6.64**	J	**3.51**	**1.79**		**117**			
Total Activity	7.00E+00	3.90E+00	5.50E+00	3.80E+00	**0.28**	**24.0**	J	**2.81**	**1.92**		**105**			

0107116-6			TMF-9344					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	5.40E-01					U
Ra-226	6.80E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	3.90E-01												
Th-230	9.80E-01	3.20E-01					J							
Th-232	1.02E+00	3.20E-01												
U-234	7.70E-01	2.30E-01	9.70E-01	2.40E-01	**0.60**	**23.0**								
U-235	9.20E-02	7.00E-02	1.19E-01	7.10E-02	**0.27**	**25.6**		1.40E-01	3.30E-01					U
U-238	8.00E-01	2.30E-01	1.01E+00	2.40E-01	**0.63**	**23.2**								
Total U Alpha	**1.66E+00**	**3.33E-01**	**2.10E+00**	**3.47E-01**										
Alpha Sum	**5.55E+00**	**1.77E+00**	**2.10E+00**	**3.47E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.73E+01	3.80E+00												
Th-234 (Assumed from U-238)	8.00E-01	2.30E-01	1.01E+00	2.40E-01	**0.63**	**23.2**		5.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	8.00E-01	2.30E-01	1.01E+00	2.40E-01	**0.63**	**23.2**		-1.20E+01	1.30E+01					U
Ac-227														
Ra-228	7.60E-01	2.90E-01												
Pa-231	1.00E-01	1.80E+00					U							
Beta Sum	**1.97E+01**	**3.83E+00**	**2.02E+00**	**3.39E-01**				**6.57E+00**	**1.36E+01**					
Total Activity Sum	**2.52E+01**	**4.22E+00**	**4.12E+00**	**4.85E-01**				**1.21E+01**	**1.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.26E+00	1.00E+00						**0.64**	**(from gamma)**		**26.3**			
Gross Beta	4.80E+00	1.10E+00					J	**3.73**	**0.13**		**122**			
Total Activity	6.90E+00	3.90E+00	5.80E+00	4.00E+00	**0.20**	**17.3**	J	**3.19**	**0.37**		**114**			

0107116-7			TMF-0306					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.10E-01	1.50E-01					U
Ra-226	6.70E-01	1.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	3.20E-01												
Th-230	1.16E+00	3.50E-01												
Th-232	1.11E+00	3.40E-01												
U-234	6.80E-01	2.00E-01												
U-235	3.70E-02	4.20E-02						9.00E-02	2.50E-01					U
U-238	7.00E-01	2.10E-01												
Total U Alpha	**1.42E+00**	**2.93E-01**												
Alpha Sum	**5.46E+00**	**1.27E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.83E+01	3.30E+00												
Th-234 (Assumed from U-238)	7.00E-01	2.10E-01						4.90E-01	7.00E-01					U
Pa-234m (Assumed from U-238)	7.00E-01	2.10E-01						-9.00E-01	6.20E+00					U
Ac-227														
Ra-228	4.70E-01	1.50E-01												
Pa-231	4.00E-01	1.20E+00					U							
Beta Sum	**2.02E+01**	**3.32E+00**						**1.84E+01**	**7.06E+00**					
Total Activity Sum	**2.57E+01**	**3.56E+00**						**2.39E+01**	**7.18E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.90E+00	1.00E+00						**0.27**	**(from gamma)**		**7.80**			
Gross Beta	4.55E+00	8.60E-01					J	**4.57**	**1.95**		**127**			
Total Activity	8.30E+00	4.00E+00					J	**3.25**	**1.89**		**102**			

0107116-8			TMF-0307					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	2.30E-01	-1.70E-01	3.10E-01	**0.13**	**34.5**	U
Ra-226	8.30E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	3.70E-01												
Th-230	9.70E-01	3.10E-01					J							
Th-232	7.90E-01	2.80E-01												
U-234	9.20E-01	2.50E-01												
U-235	1.04E-01	7.50E-02					J	2.00E-02	2.70E-01	1.50E-01	3.00E-01	**0.32**	**153**	U
U-238	8.80E-01	2.40E-01												
Total U Alpha	**1.90E+00**	**3.55E-01**												
Alpha Sum	**4.98E+00**	**1.93E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.93E+01	3.50E+00	1.75E+01	3.60E+00	**0.36**	**9.78**								
Th-234 (Assumed from U-238)	8.80E-01	2.40E-01						-2.00E-02	6.30E-01	4.80E-01	8.00E-01	**0.49**	**217**	U
Pa-234m (Assumed from U-238)	8.80E-01	2.40E-01						1.70E+00	7.10E+00	2.30E+00	9.10E+00	**0.05**	**30.0**	U
Ac-227														
Ra-228	7.10E-01	1.80E-01	8.00E-01	2.50E-01	**0.29**	**11.9**								
Pa-231	-5.00E-01	2.00E+00	-2.00E+00	1.80E+00	**0.56**	**120**	U							
Beta Sum	**2.17E+01**	**3.53E+00**						**2.16E+01**	**7.95E+00**	**2.08E+01**	**9.82E+00**			
Total Activity Sum	**2.67E+01**	**4.02E+00**						**2.66E+01**	**8.18E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+00	1.20E+00						**0.54**	**(from gamma)**		**21.7**			
Gross Beta	4.60E+00	8.90E-01					J	**4.70**	**2.13**		**130**			
Total Activity	5.90E+00	3.80E+00					J	**3.76**	**2.30**		**128**			

0107116-9			TMF-0308					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	4.90E-01					U
Ra-226	9.30E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.23E+00	3.80E-01												
Th-230	1.04E+00	3.00E-01					J							
Th-232	9.90E-01	2.90E-01												
U-234	7.60E-01	2.10E-01												
U-235	4.10E-02	4.60E-02						-1.00E-02	3.00E-01					U
U-238	8.40E-01	2.30E-01												
Total U Alpha	**1.64E+00**	**3.15E-01**												
Alpha Sum	**5.47E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.61E+01	3.30E+00												
Th-234 (Assumed from U-238)	8.40E-01	2.30E-01						1.40E+00	1.00E+00					
Pa-234m (Assumed from U-238)	8.40E-01	2.30E-01						6.50E+00	9.00E+00					U
Ac-227														
Ra-228	7.20E-01	2.30E-01												
Pa-231	-4.00E-01	1.80E+00					U							
Beta Sum	**1.85E+01**	**3.33E+00**						**2.47E+01**	**9.64E+00**					
Total Activity Sum	**2.39E+01**	**3.76E+00**						**3.01E+01**	**9.80E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+00	1.00E+00						**0.63**	**(from gamma)**		**26.3**			
Gross Beta	4.40E+00	1.10E+00					J	**4.01**	**2.09**		**123**			
Total Activity	7.60E+00	3.90E+00					J	**3.01**	**2.14**		**104**			

0107116-10			TMF-0243					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.20E-02	8.60E-02					U
Ra-226	9.00E-01	2.60E-01	6.40E-01	1.70E-01	**0.84**	**33.8**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	3.70E-01												
Th-230	1.23E+00	3.60E-01												
Th-232	7.70E-01	2.70E-01												
U-234	7.50E-01	1.90E-01												
U-235	8.10E-02	5.40E-02						0.00E+00	2.80E-01					U
U-238	6.40E-01	1.70E-01												
Total U Alpha	**1.47E+00**	**2.61E-01**												
Alpha Sum	**6.71E+00**	**1.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.45E+01	3.30E+00												
Th-234 (Assumed from U-238)	6.40E-01	1.70E-01						6.70E-01	5.60E-01					
Pa-234m (Assumed from U-238)	6.40E-01	1.70E-01						-1.00E+00	1.10E+01					U
Ac-227														
Ra-228	8.80E-01	2.70E-01												
Pa-231	1.50E+00	1.30E+00												
Beta Sum	**1.68E+01**	**3.32E+00**						**1.52E+01**	**1.15E+01**					
Total Activity Sum	**2.36E+01**	**3.59E+00**						**2.19E+01**	**1.16E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.00E+00	8.90E-01					J	**1.67**	**(from gamma)**		**50.6**			
Gross Beta	4.60E+00	8.70E-01					J	**3.56**	**0.92**		**114**			
Total Activity	9.10E+00	3.90E+00					J	**2.73**	**1.05**		**88.5**			

0107116-11			TMF0242					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.50E-02	9.50E-02					U
Ra-226	1.03E+00	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.17E+00	3.90E-01												
Th-230	8.80E-01	2.80E-01					J							
Th-232	8.50E-01	2.80E-01												
U-234	1.10E+00	2.60E-01												
U-235	6.00E-02	5.10E-02						0.00E+00	2.50E-01					U
U-238	9.60E-01	2.30E-01												
Total U Alpha	**2.12E+00**	**3.51E-01**												
Alpha Sum	**3.98E+00**	**1.52E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.87E+01	3.80E+00												
Th-234 (Assumed from U-238)	9.60E-01	2.30E-01						1.38E+00	8.80E-01					
Pa-234m (Assumed from U-238)	9.60E-01	2.30E-01						4.40E+00	9.20E+00					U
Ac-227														
Ra-228	7.50E-01	2.40E-01												
Pa-231	-2.30E+00	1.50E+00					UJ							
Beta Sum	**2.11E+01**	**3.83E+00**						**2.50E+01**	**1.00E+01**					
Total Activity Sum	**2.51E+01**	**4.12E+00**						**2.89E+01**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+00	1.10E+00						**0.70**	**(from gamma)**		**28.4**			
Gross Beta	4.72E+00	9.60E-01					J	**4.15**	**2.01**		**127**			
Total Activity	8.60E+00	3.90E+00					J	**2.91**	**1.88**		**97.8**			

0107116-12			TMF-0244					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	1.50E-01					U
Ra-226	5.60E-01	1.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.50E-01	3.10E-01					U							
Th-230	5.00E-01	2.30E-01												
Th-232	5.00E-01	2.30E-01												
U-234	6.50E-01	1.80E-01												
U-235	2.00E-02	2.90E-02					U	-1.40E-01	2.50E-01					U
U-238	5.20E-01	1.60E-01												
Total U Alpha	**1.19E+00**	**2.43E-01**												
Alpha Sum	**2.90E+00**	**1.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	8.20E+00	1.80E+00												
Th-234 (Assumed from U-238)	5.20E-01	1.60E-01						7.80E-01	7.10E-01					
Pa-234m (Assumed from U-238)	5.20E-01	1.60E-01						8.10E+00	6.80E+00					
Ac-227														
Ra-228	4.00E-01	1.50E-01												
Pa-231	0.00E+00	1.20E+00					U							
Beta Sum	**9.64E+00**	**1.83E+00**						**1.75E+01**	**7.07E+00**					
Total Activity Sum	**1.25E+01**	**2.19E+00**						**2.04E+01**	**7.17E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.70E+00	1.20E+00						**0.47**	**(from gamma)**		**24.2**			
Gross Beta	3.50E+00	1.60E+00					J	**2.53**	**1.93**		**93.5**			
Total Activity	8.50E+00	4.50E+00						**0.81**	**1.40**		**38.4**			

0107116-13			TMF-0245					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.80E-01	5.00E-01					U
Ra-226	9.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	3.40E-01												
Th-230	9.60E-01	3.10E-01												
Th-232	8.60E-01	2.90E-01												
U-234	7.00E-01	2.10E-01												
U-235	8.70E-02	6.70E-02						4.00E-02	3.30E-01					U
U-238	6.90E-01	2.10E-01												
Total U Alpha	**1.48E+00**	**3.04E-01**												
Alpha Sum	**5.56E+00**	**1.83E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.82E+01	3.90E+00												
Th-234 (Assumed from U-238)	6.90E-01	2.10E-01						7.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	6.90E-01	2.10E-01						-4.00E+00	1.10E+01					U
Ac-227														
Ra-228	5.60E-01	2.50E-01												
Pa-231	7.00E-01	1.90E+00					U							
Beta Sum	**2.02E+01**	**3.93E+00**						**1.55E+01**	**1.17E+01**					
Total Activity Sum	**2.58E+01**	**4.33E+00**						**2.11E+01**	**1.19E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.70E+00	1.00E+00						**0.41**	**(from gamma)**		**16.7**			
Gross Beta	4.70E+00	9.10E-01					J	**3.85**	**0.92**		**125**			
Total Activity	9.10E+00	3.90E+00					J	**2.86**	**0.96**		**95.6**			

Radiological Analytical Data Verification
Comments on Data for SDG 0108014

This sample delivery group (SDG) contained ten (10) individual soil samples from the town of Tonawanda Landfill vicinity FUSRAP property Tonawanda, NY for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] for all samples included $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{226}Ra by radon emanation; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U, ^{241}Am and radioisotopes detected above the decision level (DL) by gamma spectrometry; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting. All of the analyses requested by the statement of work (SOW) were performed and reported by Paragon Analytics. The samples were received by Paragon Analytics, Inc. on August 2, 2001. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data. The gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TMF-0312	0108014-1
TMF-0313	0108014-2
TMF-0314	0108014-3
TMF-0315	0108014-4
TMF-0316	0108014-5
TMF-0317	0108014-6
TMF-0309	0108014-7
TMF-0310	0108014-8
TMF-0311	0108014-9
TMF-9250	0108014-10

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the samples.

Equipment Rinsate Sample:

No target radionuclide equipment rinsate blank contamination was observed in the EQ-1 and EQ-2 equipment rinsate blanks. ^{137}Cs activity was observed in the equipment rinsate blank EQ-1, but it was not observed in all samples. However, ^{137}Cs activity was reported by the laboratory in sample TMF–0315 as the ^{137}Cs activity in the sample was higher than the required DL (1.65*TPU). All associated samples results less than 5 times the blank value for ^{137}Cs analyses should be qualified as estimated (J). ^{137}Cs activity value observed in the sample TMF-0315 was greater than 5 times the ^{137}Cs concentration identified in the rinsate blank. No qualification on Cs-137 results in the sample is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits for the gamma spectrometry analysis.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses except ^{235}U. The DER (1.47) was outside the acceptable limits for ^{235}U as well as the RPD (404**%). Therefore it is recommended that ^{235}U gamma spectrometry results for all samples be qualified as estimated (J).**

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium. Results for natural ^{40}K were also reported for all samples. The result for fission product ^{137}Cs activity was reported by the laboratory for sample TMF–0315 as the ^{137}Cs activity in the sample was higher than the required DL (1.65*TPU). There were no incidents of identified radionuclides being excluded from the laboratory reports.

In addition, $^{212/214}$Bi, $^{212/214}$Pb, and ^{208}Tl gamma emitting radionuclides were reported for most samples. The $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl reported results are progeny from the ^{238}U and ^{232}Th series. These reported radionuclides may be due to near or total equilibrium with ^{238}U and ^{232}Th. The presence of $^{212/214}$Pb, $^{212/214}$Bi, and ^{208}Tl in the stated concentration is not out of the question for these samples considering the amount of $^{228/232}$Th and $^{234/238}$U present. **Therefore, it is recommended that they remain in the data base for information purposes only.**

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the ^{241}Am (-5.30E-01±3.80E-01) and ^{235}U (-7.10E-01±5.00E-01) results for sample TMF-0312 and ^{231}Pa result (-2.30±1.70) for sample TMF-0313 (laboratory duplicate). **It is recommended that the gamma spectrometry ^{241}Am and ^{235}U results for sample TMF-0312 and ^{231}Pa result for the laboratory duplicate sample TMF-0313 be qualified as estimated (J).** No other problems were observed for the gamma spectrometry analyses.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for $^{234/235}$U and ^{230}Th analyses in the method blank. All associated sample results less than 5 times the blank value for $^{234/235}$U and ^{230}Th analyses should be qualified as estimated (J). The ^{234}U and ^{230}Th analyses results for all samples were greater than 5 times the blank. However, ^{235}U results for all samples were less than 5 times the method blank result. **Therefore, it is recommended that the ^{235}U results for all samples be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of equipment rinsate blank contamination for the isotopic uranium analysis.

There were indications of equipment rinsate blank contamination for $^{228/230/232}$Th. All associated samples result less than 5 times the blank value for $^{228/230/232}$Th analyses should be qualified as estimated (J). However, $^{228/230/232}$Th activity values for all samples are greater than 5 times the $^{228/230/232}$Th concentration identified in the rinsate blank. No qualification of the isotopic thorium results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries are within acceptable limit. The tracer recoveries were greater than 11.71% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results of $^{234/235/238}$U and $^{228/230/232}$Th for all samples have less than 10% uncertainty, except for $^{228/230/232}$Th result for sample TMF-0309 (10.23%). **Therefore, it is recommended that the $^{228/230/232}$Th results for sample TMF-0309 be qualified as estimated (J).**

Spectral Analysis:

No Spectral interferences were observed in the samples' alpha spectra for $^{224/235/238}$U and $^{228/230/232}$Th analysis.

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 1.0 pCi/g for $^{224/235/238}$U and $^{228/230/232}$Th.

3.0 ^{226}Ra ANALYSES

Method Blank:

There is no indication of blank contamination in the method blank sample for the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the ^{226}Ra analysis.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The DER (1.34) and RPD (40%) are outside the acceptable limits for the duplicate analysis for all ^{226}Ra analyses. **Therefore, it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J).**

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were within acceptable limits.

Method Detection Limit and Quantitation:

All samples met the required method detection limit (MDL) of 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in method blank for the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs and RPDs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting and requires the digestate to be taken to dryness, which is not quantitative and does not include volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.

5.0 TOTAL ACTIVITY BY LIQUID SCINTILLATION COUNTING

Method Blank:

There was no indication of blank contamination in method blank samples for the total activity analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the equipment rinsate blank for the total activity analyses.

Laboratory Control Sample:

The percent recovery for the reported LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The total activity analysis duplicate DER is within acceptable limits.

Matrix Spike Sample:

The percent recovery for the MSS for the total activity analysis is within acceptable limits.

Quantitation and Method Detection Limit:

The required MDC for the Total Activity analysis is 10 pCi/g. All sample results met the required MDC. **It is recommended that the total activity analysis results for all samples be qualified as estimated (J), since the total activity analysis appears to have a negative bias. This negative bias may be due to the digestate being taken to dryness, which allowed the loss of volatile radionuclides or volatile radionuclide salts (e.g., ^{3}H, ^{99}Tc, ^{40}K salts). Also, the laboratory used an 8M HNO_3 leach instead of total sample dissolution that was requested in the SOW. This also may cause a negative bias since not all of the radionuclides of interest may have been removed from the sample especially any indigenous radionuclides such as radium, thorium, uranium, and their daughters.**

6.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gammas agree within the uncertainties. No further qualification of the gamma spectrometry results is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for gross alpha to sum of alpha activities are within acceptable limits for all samples indicating that the gross alpha analyses for all samples agree with the sum of the alpha emitters within a 99% confidence level. No qualification of the gross alpha result is necessary.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (1.41 – 4.52) for all samples, the sums of the beta emitters activity and gross beta activity are outside the acceptable limits as well as the RPD values (70.3% - 125%). The gross beta results are 3-5 times smaller than the sum of the beta emitters for all samples. This negative bias is most likely due to the sample preparation as discussed above. Since all of the gross beta results have been qualified for this reason, no further qualification of the gross beta results is necessary.

Total Activity to Sums of Alpha and Beta Emitters:

When comparing the total activity to the total activity sum i.e., the sums of the beta emitters and the sum of alpha, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (2.61 – 3.81) for all samples are out side the acceptable limits as well as the RPD values (138%-149%). %). The total activity results are 2-3 times smaller than the sum of the alpha and beta emitters for all samples. This negative bias is most likely due to the sample preparation as discussed above. No further qualification of the total activity results is recommended since the total activity results for the listed samples were previously qualified for this reason.

^{228}Ac Gamma and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

Summary:

Based on the agreements between the gross alpha analyses and the sums of the individual alpha activities, all activity except gross beta activity is accounted for in all samples. Due to exclusion of volatile beta and daughter beta emitting radionuclides from the natural chain in the gross beta measurements the sums of beta activities in the sample was greater than the gross beta activity in all samples. Similarly, for the same reason the total activity for all samples was greater than the sum of the gross activities.

0108014-1			TMF-0312					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.30E-01	3.80E-01	-2.00E-02	1.10E-01	**1.29**	**185**	UJ
Ra-226	8.10E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	4.10E-01	1.11E+00	3.60E-01	**0.44**	**24.2**								
Th-230	9.00E-01	2.90E-01	8.80E-01	2.50E-01	**0.05**	**2.25**								
Th-232	9.20E-01	2.90E-01	9.20E-01	2.60E-01	**0.00**	**0.00**								
U-234	7.60E-01	2.20E-01												
U-235	1.31E-01	8.20E-02					J	-7.10E-01	5.00E-01	2.40E-01	4.10E-01	**1.47**	**404**	UJ
U-238	7.80E-01	2.20E-01												
Total U Alpha	**1.67E+00**	**3.22E-01**												
Alpha Sum	**4.09E+00**	**2.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.72E+01	3.90E+00	1.31E+01	4.70E+00	**0.67**	**27.1**								
Th-234 (Assumed from U-238)	7.80E-01	2.20E-01						1.40E+00	1.50E+00	6.00E-01	1.10E+00	**0.43**	**80.0**	
Pa-234m (Assumed from U-238)	7.80E-01	2.20E-01						8.00E+00	1.60E+01	-3.00E+00	1.90E+01	**0.44**	**440**	U
Ac-227														
Ra-228	5.50E-01	3.20E-01	6.90E-01	6.00E-01	**0.21**	**22.6**								
Pa-231	-1.20E+00	2.60E+00	1.30E+00	3.20E+00	**0.61**	**5000**	U							
Beta Sum	**1.92E+01**	**3.94E+00**						**2.70E+01**	**1.65E+01**	**1.15E+01**	**1.96E+01**			
Total Activity Sum	**2.33E+01**	**4.63E+00**						**3.11E+01**	**1.67E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+00	1.10E+00						**0.04**	**(from gamma)**		**2.6**			
Gross Beta	4.04E+00	9.30E-01					J	**3.74**	**1.39**		**130**			
Total Activity	7.00E+00	4.00E+00					J	**2.66**	**1.40**		**107**			

0108014-2			TMF-0313					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	2.30E-01	1.40E-01	3.10E-01	**0.54**	**600**	U
Ra-226	8.60E-01	1.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.25E+00	4.50E-01												
Th-230	1.03E+00	3.20E-01												
Th-232	1.05E+00	3.20E-01												
U-234	7.50E-01	2.00E-01	5.20E-01	1.60E-01	**0.90**	**36.2**								
U-235	9.40E-02	6.30E-02	2.80E-02	3.50E-02	**0.92**	**108**	J	2.60E-01	2.60E-01	1.00E-01	3.10E-01	**0.40**	**88.9**	J
U-238	6.50E-01	1.80E-01	5.40E-01	1.60E-01	**0.46**	**18.5**								
Total U Alpha	**1.49E+00**	**2.76E-01**	**1.09E+00**	**2.29E-01**										
Alpha Sum	**4.69E+00**	**1.94E+00**	**-9.82E-01**	**1.55E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.90E+01	3.40E+00	1.77E+01	3.60E+00	**0.26**	**7.08**								
Th-234 (Assumed from U-238)	6.50E-01	1.80E-01	5.40E-01	1.60E-01	**0.46**	**18.5**		3.20E-01	6.70E-01	4.80E-01	8.60E-01	**0.15**	**40.0**	U
Pa-234m (Assumed from U-238)	6.50E-01	1.80E-01	5.40E-01	1.60E-01	**0.46**	**18.5**		2.00E+00	6.40E+00	2.00E-01	9.90E+00	**0.15**	**164**	U
Ac-227														
Ra-228	7.40E-01	1.90E-01	5.60E-01	1.90E-01	**0.67**	**27.7**								
Pa-231	-1.10E+00	2.00E+00	-2.30E+00	1.70E+00	**0.46**	**70.6**	UJ							
Beta Sum	**2.09E+01**	**3.42E+00**	**1.91E+01**	**3.62E+00**				**2.19E+01**	**7.28E+00**	**1.87E+01**	**1.06E+01**			
Total Activity Sum	**2.56E+01**	**3.93E+00**	**1.81E+01**	**3.93E+00**				**2.66E+01**	**7.54E+00**	**1.77E+01**	**1.07E+01**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.20E+00	1.20E+00						**0.22**	**(from gamma)**		**10.2**			
Gross Beta	4.82E+00	9.80E-01					J	**4.52**	**2.33**		**125**			
Total Activity	6.20E+00	3.70E+00					J	**3.59**	**2.43**		**122**			

0108014-3			TMF-0314					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-01	3.20E-01					U
Ra-226	8.30E-01	1.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	4.00E-01												
Th-230	9.20E-01	2.90E-01												
Th-232	7.60E-01	2.40E-01												
U-234	1.12E+00	2.70E-01												
U-235	9.00E-03	2.20E-02					UJ	-1.70E-01	2.90E-01					UJ
U-238	8.80E-01	2.30E-01												
Total U Alpha	**2.01E+00**	**3.55E-01**												
Alpha Sum	**4.47E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.71E+01	3.50E+00												
Th-234 (Assumed from U-238)	8.80E-01	2.30E-01						9.80E-01	9.70E-01					
Pa-234m (Assumed from U-238)	8.80E-01	2.30E-01						-3.00E+00	1.00E+01					U
Ac-227														
Ra-228	6.80E-01	2.20E-01												
Pa-231	-1.30E+00	1.80E+00					U							
Beta Sum	**1.94E+01**	**3.53E+00**						**1.56E+01**	**1.06E+01**					
Total Activity Sum	**2.39E+01**	**3.94E+00**						**2.01E+01**	**1.08E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+00	1.00E+00	4.41E+00	9.80E-01	**0.06**	**2.02**		**0.02**	**(from gamma)**		**0.7**			
Gross Beta	4.07E+00	9.10E-01	5.11E+00	9.70E-01	**0.78**	**22.7**	J	**4.20**	**1.08**		**131**			
Total Activity	3.50E+00	3.60E+00	5.00E+00	3.70E+00	**0.29**	**35.3**	J	**3.81**	**1.46**		**149**			

0108014-4			TMF-0315					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.80E-01	4.20E-01					U
Ra-226	9.10E-01	2.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	3.90E-01	4.30E-01												
Th-230	1.14E+00	3.60E-01												
Th-232	6.30E-01	2.60E-01												
U-234	1.21E+00	2.80E-01												
U-235	1.23E-01	7.60E-02					J	5.00E-02	5.30E-01					UJ
U-238	9.80E-01	2.50E-01												
Total U Alpha	**2.31E+00**	**3.83E-01**												
Alpha Sum	**6.01E+00**	**2.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Cs-137	2.10E-01	1.10E-01												
K-40	1.11E+01	3.00E+00												
Th-234 (Assumed from U-238)	9.80E-01	2.50E-01						1.00E+00	1.40E+00					U
Pa-234m (Assumed from U-238)	9.80E-01	2.50E-01						1.20E+01	1.80E+01					U
Ac-227														
Ra-228	6.00E-01	3.50E-01												
Pa-231	7.00E-01	2.60E+00					U							
Beta Sum	**1.40E+01**	**3.06E+00**						**2.50E+01**	**1.83E+01**					
Total Activity Sum	**2.00E+01**	**3.93E+00**						**3.10E+01**	**1.85E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.40E+00	1.20E+00						**0.59**	**(from gamma)**		**31.0**			
Gross Beta	4.77E+00	9.60E-01					J	**2.86**	**1.10**		**98.1**			
Total Activity	4.60E+00	3.90E+00					J	**2.78**	**1.40**		**125**			

0108014-5			TMF-0316					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.30E-01					U
Ra-226	7.20E-01	1.50E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	4.30E-01												
Th-230	7.70E-01	2.80E-01												
Th-232	4.10E-01	2.10E-01												
U-234	1.13E+00	2.60E-01												
U-235	1.09E-01	6.90E-02					J	-3.20E-01	4.20E-01					UJ
U-238	9.50E-01	2.30E-01												
Total U Alpha	**2.19E+00**	**3.54E-01**												
Alpha Sum	**5.11E+00**	**2.61E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	6.80E+00	3.20E+00												
Th-234 (Assumed from U-238)	9.50E-01	2.30E-01						-2.00E-01	1.00E+00					U
Pa-234m (Assumed from U-238)	9.50E-01	2.30E-01						-1.60E+01	2.00E+01					U
Ac-227														
Ra-228	5.40E-01	6.20E-01												
Pa-231	3.00E-01	2.80E+00					U							
Beta Sum	**9.28E+00**	**3.29E+00**						**-8.82E+00**	**2.03E+01**					
Total Activity Sum	**1.44E+01**	**4.20E+00**						**-3.72E+00**	**2.05E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.50E+00	1.00E+00						**0.58**	**(from gamma)**		**37.4**			
Gross Beta	4.45E+00	9.30E-01					J	**1.41**	**0.65**		**70.3**			
Total Activity	8.00E+00	3.90E+00					J	**1.11**	**0.56**		**57.0**			

0108014-6			TMF-0317					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.50E-02	8.80E-02					U
Ra-226	1.05E+00	2.40E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	4.00E-01												
Th-230	1.08E+00	3.10E-01												
Th-232	9.90E-01	3.00E-01												
U-234	8.80E-01	2.40E-01												
U-235	7.80E-02	6.30E-02					J	7.00E-02	2.70E-01					UJ
U-238	7.30E-01	2.20E-01												
Total U Alpha	**1.69E+00**	**3.32E-01**												
Alpha Sum	**5.62E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.73E+01	3.80E+00												
Th-234 (Assumed from U-238)	7.30E-01	2.20E-01						1.33E+00	7.00E-01					
Pa-234m (Assumed from U-238)	7.30E-01	2.20E-01						-2.00E+00	1.20E+01					U
Ac-227														
Ra-228	7.20E-01	2.80E-01												
Pa-231	-1.00E-01	1.50E+00					U							
Beta Sum	**1.95E+01**	**3.83E+00**						**1.73E+01**	**1.26E+01**					
Total Activity Sum	**2.51E+01**	**4.12E+00**						**2.30E+01**	**1.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.94E+00	9.00E-01						**0.95**	**(from gamma)**		**35.1**			
Gross Beta	4.34E+00	8.90E-01					J	**3.85**	**1.03**		**127**			
Total Activity	4.70E+00	3.60E+00					J	**3.73**	**1.38**		**137**			

0108014-7			TMF-0309					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.80E-01	3.40E-01					U
Ra-226	1.03E+00	2.20E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	4.40E-01					J							
Th-230	1.35E+00	4.10E-01					J							
Th-232	1.14E+00	3.90E-01					J							
U-234	9.60E-01	2.40E-01												
U-235	7.50E-02	5.90E-02					J	1.00E-02	4.50E-01					UJ
U-238	1.24E+00	2.90E-01												
Total U Alpha	**2.28E+00**	**3.81E-01**												
Alpha Sum	**7.78E+00**	**2.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.57E+01	3.50E+00												
Th-234 (Assumed from U-238)	1.24E+00	2.90E-01						1.00E+00	1.30E+00					U
Pa-234m (Assumed from U-238)	1.24E+00	2.90E-01						3.00E+00	1.50E+01					U
Ac-227														
Ra-228	6.70E-01	3.30E-01												
Pa-231	1.50E+00	2.70E+00					U							
Beta Sum	**1.90E+01**	**3.55E+00**						**2.06E+01**	**1.55E+01**					
Total Activity Sum	**2.68E+01**	**4.39E+00**						**2.83E+01**	**1.57E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.00E+00	1.70E+00						**0.07**	**(from gamma)**		**2.9**			
Gross Beta	5.40E+00	1.10E+00					J	**3.66**	**0.98**		**112**			
Total Activity	5.60E+00	3.80E+00					J	**3.65**	**1.41**		**131**			

0108014-8			TMF-0310					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.10E-01					U
Ra-226	6.60E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.10E-01	2.00E-01												
Th-230	8.60E-01	1.90E-01												
Th-232	8.30E-01	1.90E-01												
U-234	7.50E-01	2.10E-01												
U-235	5.40E-02	4.90E-02					J	0.00E+00	3.40E-01					UJ
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.53E+00**	**2.94E-01**												
Alpha Sum	**5.40E+00**	**2.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.15E+01	3.80E+00												
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						6.20E-01	7.00E-01					
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						1.30E+01	2.10E+01					U
Ac-227														
Ra-228	7.70E-01	4.20E-01												
Pa-231	9.00E-01	2.90E+00					U							
Beta Sum	**1.38E+01**	**3.85E+00**						**2.60E+01**	**2.14E+01**					
Total Activity Sum	**1.92E+01**	**4.68E+00**						**3.14E+01**	**2.15E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+00	1.00E+00						**0.42**	**(from gamma)**		**25.1**			
Gross Beta	4.47E+00	9.50E-01					J	**2.36**	**1.01**		**102**			
Total Activity	3.50E+00	3.80E+00					J	**2.61**	**1.28**		**138**			

0108014-9			TMF-0311					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	4.80E-01					U
Ra-226	8.20E-01	1.60E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	4.80E-01												
Th-230	9.10E-01	3.40E-01												
Th-232	1.09E+00	3.50E-01												
U-234	6.10E-01	1.80E-01												
U-235	6.30E-02	5.60E-02					J	4.00E-02	3.20E-01					UJ
U-238	8.30E-01	2.20E-01												
Total U Alpha	**1.50E+00**	**2.90E-01**												
Alpha Sum	**4.41E+00**	**1.71E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.70E+01	3.80E+00												
Th-234 (Assumed from U-238)	8.30E-01	2.20E-01						1.50E+00	1.40E+00					
Pa-234m (Assumed from U-238)	8.30E-01	2.20E-01						1.50E+01	1.30E+01					
Ac-227														
Ra-228	6.60E-01	2.70E-01												
Pa-231	-8.00E-01	1.70E+00					U							
Beta Sum	**1.92E+01**	**3.83E+00**						**3.41E+01**	**1.36E+01**					
Total Activity Sum	**2.36E+01**	**4.19E+00**						**3.85E+01**	**1.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.00E+00	1.00E+00						**0.30**	**(from gamma)**		**12.5**			
Gross Beta	4.58E+00	9.10E-01					J	**3.72**	**2.16**		**123**			
Total Activity	7.00E+00	3.70E+00					J	**2.98**	**2.21**		**109**			

0108014-10			TMF-9250					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.40E-01					U
Ra-226	9.60E-01	1.90E-01	6.40E-01	1.50E-01	**1.32**	**40**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	6.50E-01	4.60E-01												
Th-230	7.90E-01	2.80E-01												
Th-232	5.60E-01	2.30E-01												
U-234	6.10E-01	1.80E-01												
U-235	3.90E-02	4.50E-02					J	2.00E-02	2.40E-01					UJ
U-238	6.60E-01	1.90E-01												
Total U Alpha	**1.31E+00**	**2.66E-01**												
Alpha Sum	**5.44E+00**	**1.27E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	1.11E+01	2.20E+00												
Th-234 (Assumed from U-238)	6.60E-01	1.90E-01						2.40E-01	4.80E-01					U
Pa-234m (Assumed from U-238)	6.60E-01	1.90E-01						5.70E+00	7.00E+00					U
Ac-227														
Ra-228	5.40E-01	1.80E-01												
Pa-231	1.30E+00	1.20E+00												
Beta Sum	**1.31E+01**	**2.23E+00**						**1.77E+01**	**7.36E+00**					
Total Activity Sum	**1.86E+01**	**2.57E+00**						**2.32E+01**	**7.47E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.10E+00	1.10E+00						**0.80**	**(from gamma)**		**28.07**			
Gross Beta	2.94E+00	7.90E-01					J	**4.30**	**2.00**		**127**			
Total Activity	5.20E+00	4.00E+00					J	**2.81**	**2.12**		**112**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070024

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting and total activity by liquid scintillation counting for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0400	G01070024-01A
TLF-0401	G01070024-02A
TLF-9418	G01070024-03A
TLF-9419	G01070024-04A
TLF-0402	G01070024-05A
TLF-0403	G01070024-06A
TLF-0404	G01070024-07A
TLF-0405	G01070024-08A
TLF-0406	G01070024-09A
TLF-0407	G01070024-10A
TLF-0408	G01070024-11A
TLF-0409	G01070024-12A
TLF-0410	G01070024-13A
TLF-0411	G01070024-14A
TLF-0412	G01070024-15A
TLF-0413	G01070024-16A
TLF-0414	G01070024-17A
TLF-0415	G01070024-18A
TLF-0450	G01070024-19A
TLF-0451	G01070024-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was indication of blank contamination in the gamma spectrometry method blanks for ^{234}Th. All associated sample results less than 5 times the blank value for ^{234}Th analysis should be qualified as estimated (J). **Therefore, it is recommended that the ^{234}Th results for samples TLF-0400, TLF-0401, TLF-9419, TLF-0403, TLF-0404, TLF-0405, TLF-0407, TLF-0409, TLF-0411, TLF-0415, TLF-0450, TLF-0451 and TLF-0451 (laboratory duplicate) be qualified as estimated (J).**

Equipment Rinsate Blanks:

There were indications of equipment rinsate blank contamination for ^{228}Ra, ^{234}Th and ^{234m}Pa. All associated sample results less than 5 times the blank values for ^{228}Ra, ^{234}Th and ^{234m}Pa analyses should be qualified as estimated (J). All sample results for ^{228}Ra were greater than 5 times the rinsate blank; therefore, no qualification of the ^{228}Ra results is necessary. **However, it is recommended that the ^{234}Th results for samples TLF-0401, TLF-0409, TLF-0411 and TLF-0415 and ^{234m}Pa results for samples TLF-0400, TLF-0401, TLF-9419, TLF-0402, TLF-0403, TLF-0404, TLF-0405, TLF-0406, TLF-0407, TLF-0409, TLF-0412, TLF-0413, TLF-0415, TLF-0450, and TLF-0451 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses except for ^{228}Ra (1.38), which is outside acceptable limits. The RPD (64.5) was also outside acceptable limits. **Therefore, it is recommended that the ^{228}Ra results for all samples be qualified as estimated (J).**

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The software calculates the uncertainty for a positive result in the same manner. Therefore it is acceptable for the laboratory to report the absolute value of the negative uncertainty.

The laboratory was instructed also to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in eleven of the samples above the decision level. The activity range of the ^{40}K was 8.64E0 pCi/g to 2.20E1 pCi/g, which are normal levels for ^{40}K in soil. Also, ^{137}Cs was identified in five of the samples above the decision level. The activity range of ^{137}Cs was 9.14E-2 pCi/g to 5.33E-1 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There is no indication of blank contamination for $^{234/235/238}$U or $^{228/230/232}$Th analyses.

Equipment Rinsate Blanks:

There were indications of equipment rinsate blank contamination for ^{234}U. All associated sample results less than 5 times the blank values for ^{234}U analyses should be qualified as estimated (J). All samples have activities greater than 5 times the equipment rinsate values. Therefore, no qualification of the data is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 13% for all samples for the alpha analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the isotopic uranium analysis for samples TLF-0400 (10.2%), TLF-0402 (10.4%) and TLF-0411 (10.2%). There is also greater than 10% uncertainty in the sample-specific percent recovery results for the isotopic thorium analysis for samples TLF-9418 (10.8%), TLF-0403 (11.6%), TLF-0407 (10.2%) and TLF-0413 (11.4%). **Therefore, it is recommended that the $^{234/235/238}$U results for samples TLF-0400, TLF-0402, and TLF-0411 and the $^{228/230/232}$Th results for samples TLF-9418, TLF-0403, TLF-0407 and TLF-0413 be qualified as estimated (J).**

Spectral Analysis:

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.8 MeV and 6.3 MeV, regions. It is assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blanks:

There were indications of equipment rinsate blank contamination for ^{226}Ra. All associated sample results less than 5 times the blank value for ^{226}Ra analyses should be qualified as estimated (J). All samples have activities greater than 5 times the equipment rinsate values. Therefore, no qualification of the data is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 75.6%. No qualification of the data is necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha analyses. There was indication of blank contamination in the gross beta analyses. All samples with results less than 5 times the gross beta blank should be qualified as estimated (J). **Therefore, samples TLF-0400, TLF-9418, TLF-0403, TLF-0406, TLF-0407, TLF-0410, TLF-0413, TLF-0415, TLF-0450, TLF-0451, and TLF-0451 (laboratory duplicate) should be qualified as estimated (J).**

Equipment Rinsate Blanks:

There were no indications of equipment rinsate blank contamination for the gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analysis.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

A matrix spike was not analyzed for the gross alpha/beta analysis. The statement of work required that a matrix spike be analyzed for analyses that did not have sample-specific chemical recovery mechanisms. This indicates that the laboratory may not have met the DQOs for these samples. However, since the gross alpha/beta analyses are just estimates, no qualification is recommended.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analysis is 1.0 pCi/g. All of the sample results did not meet the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blanks:

There were no indications of equipment rinsate blank contamination for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra result for sample TLF-0451 does not agree with the ^{232}Th result. The laboratory duplicates for each analysis are in agreement with one another. The ^{228}Th and ^{232}Th

results for sample TLF-0451 were in equilibrium. Since the ^{228}Ra result was two times greater than the ^{232}Th result, sample heterogeneity seems to be an issue.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0409. This is probably due to sample heterogeneity, and since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for samples TLF-0400 (2.10), TLF-0401 (1.45), TLF-9418 (1.82), TLF-0402 (2.46), TLF-0405 (1.71), TLF-0406 (1.95), TLF-0408 (2.04), TLF-0409 (2.00), TLF-0410 (1.96) TLF-0412 (2.28), TLF-0414 (1.71), TLF-0415 (2.20), and TLF-0451 (1.70) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (131%, 105%, 115%, 121%, 107%, 111%, 122%, 104%, 114%, 127%, 98.5%, 132%, and 114%, respectfully) also exceed acceptable limits. The samples have gross alpha results that are 2 to 5 times greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias in the gross alpha analysis. **It is recommended that the possibility of missing activity be looked into in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs for samples TLF-0400 (2.06), TLF-0401 (3.84), TLF-9418 (3.22), TLF-9419 (3.51), TLF-0402 (3.86), TLF-0403 (3.21), TLF-0404 (3.73), TLF-0405 (3.60), TLF-0406 (3.39), TLF-0407 (2.76), TLF-0408 (3.65), TLF-0409 (3.71), TLF-0410 (4.08), TLF-0411 (3.46), TLF-0412 (4.27), TLF-0414 (3.87), TLF-0415 (2.95), TLF-0450 (1.91) and TLF-0451 (2.86) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (132%, 178%, 162%, 162%,107%, 169%, 174%, 160%, 163%, 159%, 140%, 165%, 161%, 167%, 174%, 172%, 164%, 156%, 124% and 136%, respectfully) also exceed acceptable limits. The samples have a gross beta result greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, as discussed in Section 1.0, the DERs would likely be within limits. **It is recommended that the laboratory report all gamma results above the DL.**

Furthermore, it is recommended that the possibility of missing activity be looked into in the future.

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for samples TLF-0400 (4.77), TLF-0401 (4.79), TLF-9418 (4.92), TLF-9419 (4.66), TLF-0402 (4.67), TLF-0403 (4.34), TLF-0404 (4.59), TLF-0405 (4.78), TLF-0406 (4.72), TLF-0407 (2.21), TLF-0408 (4.49), TLF-0409 (4.42), TLF-0410 (4.54), TLF-0411 (1.70), TLF-0412 (4.95), TLF-0414 (4.49), TLF-0415 (4.83), TLF-0450 (4.41) and TLF-0451 (4.28) were greater than 1.29 indicating that the total activity results are not in agreement with the total activity sum within a 99% confidence level. The RPDs (152%, 161%, 155%, 149%, 149%, 151%, 141%, 152%, 152%, 133%, 150%, 135%, 145%, 155%, 158%, 146%, 157%, 140% and 136%, respectfully) also exceed acceptable limits. The samples have a total activity result greater than the total activity sum. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, as discussed in Section 1.0, the DERs would likely be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future. No qualification of the data is necessary since the total activity analysis is used for comparison purposes.**

REVISED

Tonawanda Landfill Data Summary Tables

G01070024-01A			TLF0400					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.70E-02	9.90E-02					
Ra-226	1.02E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.80E-01	2.10E-01												
Th-230	9.40E-01	3.10E-01												
Th-232	5.90E-01	2.30E-01												
U-234	8.20E-01	3.00E-01					J							
U-235	1.00E-03	5.90E-02					UJ	-1.00E-01	1.90E+00					U
U-238	6.50E-01	2.60E-01					J							
Total U Alpha	**1.47E+00**	**4.01E-01**												
Alpha Sum	**4.17E+00**	**1.10E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	6.50E-01	2.60E-01						1.38E+00	6.90E-01					J
Pa-234m (Assumed from U-238)	6.50E-01	2.60E-01						-5.00E+00	3.60E+01					UJ
K-40														
Ra-228	9.20E-01	3.90E-01					J							
Pa-231	-3.70E-01	9.80E-01					U							
Beta Sum	**2.18E+00**	**5.49E-01**						**-2.74E+00**	**3.60E+01**					
Total Activity Sum	**6.34E+00**	**1.23E+00**						**1.42E+00**	**3.60E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.99E+01	7.40E+00					J	**2.10**	**(from gamma)**		**131**			
Gross Beta	1.07E+01	4.10E+00					J	**2.06**	**0.37**		**132**			
Total Activity	4.64E+01	8.30E+00						**4.77**	**1.22**		**152**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-02A			TLF0401					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	1.70E-01					U
Ra-226	1.18E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.80E-01												
Th-230	7.80E-01	2.80E-01												
Th-232	8.10E-01	2.60E-01												
U-234	5.40E-01	2.30E-01												
U-235	4.10E-02	5.70E-02					U	-2.00E-01	1.20E+00					U
U-238	5.10E-01	2.20E-01												
Total U Alpha	**1.09E+00**	**3.23E-01**												
Alpha Sum	**4.22E+00**	**2.43E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	5.10E-01	2.20E-01						7.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	5.10E-01	2.20E-01						-4.00E+00	6.60E+01					UJ
K-40														
Ra-228	4.80E-01	3.90E-01					J							
Pa-231	-5.00E-01	2.60E+00					U							
Beta Sum	**1.44E+00**	**5.88E-01**						**-2.88E+00**	**6.60E+01**					
Total Activity Sum	**5.66E+00**	**2.50E+00**						**1.34E+00**	**6.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	6.00E+00					J	**1.45**	**(from gamma)**		**105**			
Gross Beta	2.42E+01	5.90E+00					J	**3.84**	**0.41**		**178**			
Total Activity	5.23E+01	9.40E+00						**4.79**	**0.76**		**161**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-03A			TLF9418					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	1.50E-01					U
Ra-226	9.90E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.80E-01	2.70E-01					J							
Th-230	7.90E-01	3.20E-01					J							
Th-232	9.00E-01	3.10E-01					J							
U-234	5.90E-01	2.30E-01												
U-235	5.40E-02	6.80E-02					U	1.30E-01	3.60E-01					U
U-238	6.60E-01	2.50E-01												
Total U Alpha	**1.30E+00**	**3.46E-01**												
Alpha Sum	**5.01E+00**	**1.67E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	6.60E-01	2.50E-01						3.30E+00	1.30E+00					
Pa-234m (Assumed from U-238)	6.60E-01	2.50E-01						3.00E+00	1.20E+01					U
K-40														
Ra-228	5.40E-01	3.20E-01					J							
Pa-231	5.00E-01	1.70E+00					U							
Beta Sum	**1.92E+00**	**5.19E-01**						**6.90E+00**	**1.21E+01**					
Total Activity Sum	**6.93E+00**	**1.75E+00**						**1.19E+01**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.85E+01	7.20E+00					J	**1.82**	**(from gamma)**		**115**			
Gross Beta	1.81E+01	5.00E+00					J	**3.22**	**0.86**		**162**			
Total Activity	5.49E+01	9.60E+00						**4.92**	**2.77**		**155**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-04A			TLF9419					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.40E-01					U
Ra-226	1.48E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.90E-01												
Th-230	6.70E-01	2.40E-01												
Th-232	9.60E-01	2.80E-01												
U-234	6.70E-01	2.50E-01												
U-235	9.20E-02	8.60E-02						-2.00E-01	1.10E+00					U
U-238	7.20E-01	2.60E-01												
Total U Alpha	**1.48E+00**	**3.71E-01**												
Alpha Sum	**5.10E+00**	**2.02E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.20E-01	2.60E-01						1.35E+00	6.60E-01					J
Pa-234m (Assumed from U-238)	7.20E-01	2.60E-01						-4.00E+00	5.00E+01					UJ
K-40														
Ra-228	7.60E-01	3.80E-01					J							
Pa-231	-4.00E-01	2.10E+00					U							
Beta Sum	**2.15E+00**	**5.86E-01**						**-1.94E+00**	**5.00E+01**					
Total Activity Sum	**7.25E+00**	**2.10E+00**						**3.16E+00**	**5.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.26E+01	6.10E+00					J	**1.17**	**(from gamma)**		**84.7**			
Gross Beta	2.05E+01	5.20E+00					J	**3.51**	**0.45**		**162**			
Total Activity	4.94E+01	8.80E+00						**4.66**	**0.91**		**149**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-05A			TLF0402					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.90E-01					U
Ra-226	8.00E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.20E-01												
Th-230	1.05E+00	2.40E-01												
Th-232	8.60E-01	2.10E-01												
U-234	1.00E+00	3.40E-01					J							
U-235	3.30E-02	6.30E-02					UJ	-5.00E-02	9.10E-01					U
U-238	7.40E-01	2.80E-01					J							
Total U Alpha	**1.77E+00**	**4.45E-01**												
Alpha Sum	**4.97E+00**	**1.91E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.40E-01	2.80E-01						3.10E+00	1.40E+00					
Pa-234m (Assumed from U-238)	7.40E-01	2.80E-01						-5.00E+00	5.00E+01					UJ
K-40														
Ra-228	6.70E-01	4.40E-01					J							
Pa-231	-5.00E-01	2.00E+00					U							
Beta Sum	**2.09E+00**	**6.39E-01**						**-1.29E+00**	**5.00E+01**					
Total Activity Sum	**7.06E+00**	**2.01E+00**						**3.68E+00**	**5.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.02E+01	5.90E+00					J	**2.46**	**(from gamma)**		**121**			
Gross Beta	2.46E+01	5.80E+00					J	**3.86**	**0.51**		**169**			
Total Activity	4.88E+01	8.70E+00						**4.67**	**0.89**		**149**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-06A			TLF0403					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.40E-01					U
Ra-226	9.70E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.90E-01	3.00E-01					J							
Th-230	8.70E-01	3.70E-01					J							
Th-232	9.00E-01	3.60E-01					J							
U-234	5.10E-01	2.00E-01												
U-235	4.10E-02	5.70E-02					U	5.00E-02	3.10E-01					U
U-238	4.40E-01	1.80E-01												
Total U Alpha	**9.91E-01**	**2.75E-01**												
Alpha Sum	**4.05E+00**	**2.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	4.40E-01	1.80E-01						1.37E+00	7.40E-01					J
Pa-234m (Assumed from U-238)	4.40E-01	1.80E-01						-1.00E+00	2.30E+01					UJ
K-40														
Ra-228	3.10E-01	4.00E-01					UJ							
Pa-231	-3.00E-01	3.00E+00					U							
Beta Sum	**1.15E+00**	**5.95E-01**						**6.44E-01**	**2.30E+01**					
Total Activity Sum	**5.21E+00**	**2.85E+00**						**4.70E+00**	**2.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.13E+01	5.70E+00					J	**1.14**	**(from gamma)**		**94.4**			
Gross Beta	1.67E+01	4.80E+00					J	**3.21**	**0.68**		**174**			
Total Activity	3.72E+01	6.80E+00						**4.34**	**1.35**		**151**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-07A			TLF0404					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.10E-01					U
Ra-226	1.01E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	2.50E-01												
Th-230	1.05E+00	2.60E-01												
Th-232	9.40E-01	2.40E-01												
U-234	9.40E-01	3.00E-01												
U-235	5.20E-02	6.50E-02					U	-1.00E-01	5.90E+00					U
U-238	8.60E-01	2.90E-01												
Total U Alpha	**1.85E+00**	**4.22E-01**												
Alpha Sum	**6.38E+00**	**8.49E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.60E-01	2.90E-01						1.70E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	8.60E-01	2.90E-01						-5.00E+00	4.50E+01					UJ
K-40														
Ra-228	7.60E-01	3.50E-01					J							
Pa-231	6.30E-01	5.90E-01												
Beta Sum	**2.56E+00**	**5.44E-01**						**-2.46E+00**	**4.50E+01**					
Total Activity Sum	**8.93E+00**	**1.01E+00**						**3.91E+00**	**4.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.20E+01	5.50E+00					J	**1.01**	**(from gamma)**		**61.2**			
Gross Beta	2.28E+01	5.40E+00					J	**3.73**	**0.56**		**160**			
Total Activity	5.14E+01	9.20E+00						**4.59**	**1.03**		**141**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-08A			TLF0405					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.20E-01					U
Ra-226	1.05E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.16E+00	3.40E-01												
Th-230	9.50E-01	3.00E-01												
Th-232	6.90E-01	2.50E-01												
U-234	1.15E+00	3.40E-01												
U-235	3.70E-02	5.20E-02					U	1.50E-01	3.40E-01					U
U-238	7.50E-01	2.60E-01												
Total U Alpha	**1.94E+00**	**4.31E-01**												
Alpha Sum	**5.61E+00**	**3.14E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.50E-01	2.60E-01						1.28E+00	6.90E-01					J
Pa-234m (Assumed from U-238)	7.50E-01	2.60E-01						-1.00E+00	1.70E+01					UJ
K-40														
Ra-228	7.60E-01	3.10E-01					J							
Pa-231	-2.00E-01	3.40E+00					U							
Beta Sum	**2.24E+00**	**6.31E-01**						**1.02E+00**	**1.70E+01**					
Total Activity Sum	**7.84E+00**	**3.21E+00**						**6.62E+00**	**1.73E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.84E+01	6.80E+00					J	**1.71**	**(from gamma)**		**107**			
Gross Beta	2.18E+01	5.40E+00					J	**3.60**	**1.16**		**163**			
Total Activity	5.80E+01	1.00E+01						**4.78**	**2.57**		**152**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-09A			TLF0406					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.60E-01					U
Ra-226	1.40E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.30E-01												
Th-230	7.70E-01	2.20E-01												
Th-232	9.40E-01	2.40E-01												
U-234	1.01E+00	3.00E-01												
U-235	8.40E-02	7.90E-02						-2.00E-01	1.50E+00					U
U-238	6.90E-01	2.30E-01												
Total U Alpha	**1.78E+00**	**3.86E-01**												
Alpha Sum	**4.77E+00**	**2.08E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	6.90E-01	2.30E-01						3.50E+00	1.50E+00					
Pa-234m (Assumed from U-238)	6.90E-01	2.30E-01						-3.00E+00	7.90E+01					UJ
K-40														
Ra-228	9.70E-01	3.60E-01					J							
Pa-231	-1.10E+00	2.20E+00					U							
Beta Sum	**2.22E+00**	**5.52E-01**						**1.34E+00**	**7.90E+01**					
Total Activity Sum	**6.99E+00**	**2.15E+00**						**6.11E+00**	**7.90E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.66E+01	5.70E+00					J	**1.95**	**(from gamma)**		**111**			
Gross Beta	1.96E+01	5.10E+00					J	**3.39**	**0.23**		**159**			
Total Activity	5.16E+01	9.20E+00						**4.72**	**0.57**		**152**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-10A			TLF0407					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.70E-01					U
Ra-226	7.30E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.70E-01	2.70E-01					J							
Th-230	1.15E+00	3.60E-01					J							
Th-232	5.10E-01	2.10E-01					J							
U-234	7.80E-01	2.50E-01												
U-235	6.50E-02	6.50E-02						-2.00E-02	6.10E-01					U
U-238	9.80E-01	2.90E-01												
Total U Alpha	**1.83E+00**	**3.88E-01**												
Alpha Sum	**4.79E+00**	**1.17E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	9.80E-01	2.90E-01						1.10E+00	1.30E+00					J
Pa-234m (Assumed from U-238)	9.80E-01	2.90E-01						-1.00E+00	3.70E+01					UJ
K-40														
Ra-228	7.90E-01	3.30E-01					J							
Pa-231	0.00E+00	1.30E+01					U							
Beta Sum	**2.75E+00**	**1.65E+00**						**8.90E-01**	**3.71E+01**					
Total Activity Sum	**7.54E+00**	**1.18E+01**						**5.68E+00**	**3.89E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.31E+01	6.40E+00					J	**0.62**	**(from gamma)**		**93**			
Gross Beta	1.57E+01	4.40E+00					J	**2.76**	**0.40**		**140**			
Total Activity	3.76E+01	6.70E+00						**2.21**	**0.81**		**133**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-11A			TLF0408					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.80E-01					U
Ra-226	7.20E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	2.60E-01												
Th-230	7.90E-01	2.30E-01												
Th-232	7.60E-01	2.30E-01												
U-234	9.50E-01	2.80E-01												
U-235	4.00E-02	5.50E-02					U	6.00E-02	4.00E-01					U
U-238	7.30E-01	2.40E-01												
Total U Alpha	**1.72E+00**	**3.73E-01**												
Alpha Sum	**4.51E+00**	**2.15E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.30E-01	2.40E-01						2.80E+00	1.30E+00					
Pa-234m (Assumed from U-238)	7.30E-01	2.40E-01						1.00E+00	1.30E+01					U
K-40														
Ra-228	7.30E-01	3.70E-01					J							
Pa-231	-4.00E-01	2.30E+00					U							
Beta Sum	**2.14E+00**	**5.73E-01**						**4.48E+00**	**1.31E+01**					
Total Activity Sum	**6.65E+00**	**2.23E+00**						**8.99E+00**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.85E+01	6.50E+00					J	**2.04**	**(from gamma)**		**122**			
Gross Beta	2.23E+01	5.50E+00					J	**3.65**	**1.26**		**165**			
Total Activity	4.70E+01	8.70E+00						**4.49**	**2.40**		**150**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-12A			TLF0409					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								-3.00E-02	1.40E-01					U
Ra-226	9.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	2.10E-01												
Th-230	9.30E-01	2.40E-01												
Th-232	1.01E+00	2.50E-01												
U-234	7.50E-01	2.60E-01												
U-235	4.00E-02	6.10E-02					U	-1.00E-01	2.00E+00					U
U-238	9.00E-01	2.80E-01												
Total U Alpha	**1.69E+00**	**3.87E-01**												
Alpha Sum	**6.72E+00**	**8.60E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	9.00E-01	2.80E-01						4.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	9.00E-01	2.80E-01						-5.00E+00	3.50E+01					UJ
K-40														
Ra-228	6.60E-01	3.20E-01					J							
Pa-231	1.51E+00	6.70E-01												
Beta Sum	**2.64E+00**	**5.15E-01**						**-3.76E+00**	**3.50E+01**					
Total Activity Sum	**9.36E+00**	**1.00E+00**						**2.96E+00**	**3.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.14E+01	7.30E+00					J	**2.00**	**(from gamma)**		**104**			
Gross Beta	2.46E+01	5.90E+00					J	**3.71**	**0.80**		**161**			
Total Activity	4.85E+01	8.80E+00						**4.42**	**1.26**		**135**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-13A			TLF0410					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.50E-01					U
Ra-226	1.33E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	2.40E-01												
Th-230	8.80E-01	2.60E-01												
Th-232	1.00E+00	2.70E-01												
U-234	6.80E-01	2.30E-01												
U-235	3.20E-02	4.40E-02					U	-2.00E-02	5.60E-01					U
U-238	8.40E-01	2.60E-01												
Total U Alpha	**1.55E+00**	**3.50E-01**												
Alpha Sum	**5.16E+00**	**1.66E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.40E-01	2.60E-01						2.05E+00	7.80E-01					
Pa-234m (Assumed from U-238)	8.40E-01	2.60E-01						1.00E+00	1.10E+01					U
K-40														
Ra-228	1.04E+00	4.70E-01					J							
Pa-231	-5.00E-01	1.70E+00					U							
Beta Sum	**2.66E+00**	**6.31E-01**						**4.03E+00**	**1.10E+01**					
Total Activity Sum	**7.82E+00**	**1.78E+00**						**9.19E+00**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.89E+01	6.80E+00					J	**1.96**	**(from gamma)**		**114**			
Gross Beta	2.93E+01	6.50E+00					J	**4.08**	**1.97**		**167**			
Total Activity	4.95E+01	9.00E+00						**4.54**	**2.81**		**145**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-14A			TLF0411					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.50E-01					U
Ra-226	9.80E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	2.70E-01												
Th-230	6.90E-01	2.60E-01												
Th-232	8.20E-01	2.90E-01												
U-234	6.80E-01	2.70E-01					J							
U-235	1.80E-01	1.30E-01					J	-2.00E-01	1.10E+00					U
U-238	5.70E-01	2.40E-01					J							
Total U Alpha	**1.43E+00**	**3.84E-01**												
Alpha Sum	**4.62E+00**	**2.43E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	5.70E-01	2.40E-01						4.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	5.70E-01	2.40E-01						2.20E+00	9.70E+00					U
K-40														
Ra-228	5.90E-01	3.40E-01					J							
Pa-231	0.00E+00	2.70E+01					U							
Beta Sum	**1.73E+00**	**3.28E+00**						**3.19E+00**	**1.03E+01**					
Total Activity Sum	**6.35E+00**	**2.45E+01**						**7.81E+00**	**2.64E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.28E+01	6.10E+00					J	**0.33**	**(from gamma)**		**93.9**			
Gross Beta	2.45E+01	5.70E+00					J	**3.46**	**1.81**		**174**			
Total Activity	5.07E+01	9.10E+00						**1.70**	**1.54**		**155**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-15A			TLF0412					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.90E-02	9.60E-02					U
Ra-226	2.60E-02	7.40E-02					U							
Np-237		.												
Pu-238														
Pu-239														
Th-228	1.06E+00	2.70E-01												
Th-230	7.00E-01	2.00E-01												
Th-232	9.30E-01	2.40E-01												
U-234	8.40E-01	2.70E-01												
U-235	8.80E-02	7.90E-02						-1.00E-01	4.10E+00					U
U-238	8.20E-01	2.60E-01												
Total U Alpha	**1.75E+00**	**3.83E-01**												
Alpha Sum	**4.01E+00**	**1.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.20E-01	2.60E-01						2.20E+00	1.10E+00					
Pa-234m (Assumed from U-238)	8.20E-01	2.60E-01						-5.00E+00	4.10E+01					UJ
K-40														
Ra-228	8.00E-01	3.70E-01					J							
Pa-231	-5.00E-01	1.50E+00					U							
Beta Sum	**2.38E+00**	**5.52E-01**						**-2.06E+00**	**4.10E+01**					
Total Activity Sum	**6.39E+00**	**1.57E+00**						**1.95E+00**	**4.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.79E+01	5.90E+00					J	**2.28**	**(from gamma)**		**127**			
Gross Beta	3.15E+01	6.80E+00					J	**4.27**	**0.81**		**172**			
Total Activity	5.45E+01	9.60E+00						**4.95**	**1.25**		**158**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-16A			TLF0413					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.50E-01					U
Ra-226	9.00E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	2.70E-01					J							
Th-230	9.60E-01	3.30E-01					J							
Th-232	7.60E-01	2.80E-01					J							
U-234	8.10E-01	2.50E-01												
U-235	1.00E-03	3.70E-02					U	-5.00E-02	9.00E-01					U
U-238	4.90E-01	1.90E-01												
Total U Alpha	**1.30E+00**	**3.16E-01**												
Alpha Sum	**4.62E+00**	**4.41E+02**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	4.90E-01	1.90E-01						2.90E+00	1.50E+00					
Pa-234m (Assumed from U-238)	4.90E-01	1.90E-01						-6.00E+00	5.60E+01					UJ
K-40														
Ra-228	1.70E-01	4.40E-01					UJ							
Pa-231	0.00E+00	4.90E+02					U							
Beta Sum	**1.15E+00**	**5.88E+01**						**-2.93E+00**	**8.12E+01**					
Total Activity Sum	**5.77E+00**	**4.45E+02**						**1.69E+00**	**4.48E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.38E+01	5.80E+00					J	**0.02**	**(from gamma)**		**100**			
Gross Beta	1.56E+01	4.30E+00					J	**0.25**	**0.23**		**173**			
Total Activity	4.21E+01	7.70E+00						**0.08**	**0.09**		**152**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-17A			TLF0414					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.20E-01					U
Ra-226	1.06E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.20E-01												
Th-230	1.12E+00	2.50E-01												
Th-232	7.50E-01	1.90E-01												
U-234	7.30E-01	2.50E-01												
U-235	1.80E-02	5.00E-02					U	-1.00E-01	2.00E+00					U
U-238	6.60E-01	2.40E-01												
Total U Alpha	**1.41E+00**	**3.50E-01**												
Alpha Sum	**4.93E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	6.60E-01	2.40E-01						3.00E+00	1.10E+00					
Pa-234m (Assumed from U-238)	6.60E-01	2.40E-01						2.80E+00	9.20E+00					U
K-40														
Ra-228	1.20E+00	5.80E-01					J							
Pa-231	-4.00E-01	1.90E+00					U							
Beta Sum	**2.47E+00**	**7.10E-01**						**6.95E+00**	**9.29E+00**					
Total Activity Sum	**7.40E+00**	**1.94E+00**						**1.19E+01**	**9.46E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.45E+01	5.30E+00					J	**1.71**	**(from gamma)**		**98.5**			
Gross Beta	2.51E+01	5.80E+00					J	**3.87**	**1.66**		**164**			
Total Activity	4.74E+01	8.70E+00						**4.49**	**2.76**		**146**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-18A			TLF0415					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.30E-01					U
Ra-226	5.80E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	2.60E-01												
Th-230	7.00E-01	2.40E-01												
Th-232	7.00E-01	2.60E-01												
U-234	7.10E-01	2.50E-01												
U-235	1.80E-02	4.90E-02					U	2.00E-01	3.80E-01					U
U-238	7.90E-01	2.70E-01												
Total U Alpha	**1.52E+00**	**3.71E-01**												
Alpha Sum	**4.17E+00**	**6.46E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	7.90E-01	2.70E-01						5.80E-01	4.60E-01					J
Pa-234m (Assumed from U-238)	7.90E-01	2.70E-01						0.00E+00	8.90E+02					UJ
K-40														
Ra-228	6.30E-01	3.00E-01					J							
Pa-231	-7.00E-02	2.50E-01					U							
Beta Sum	**2.20E+00**	**4.87E-01**						**1.20E+00**	**8.90E+02**					
Total Activity Sum	**6.37E+00**	**8.09E-01**						**5.37E+00**	**8.90E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.05E+01	7.40E+00					J	**2.20**	**(from gamma)**		**132**			
Gross Beta	1.76E+01	5.20E+00					J	**2.95**	**0.02**		**156**			
Total Activity	5.24E+01	9.50E+00						**4.83**	**0.05**		**157**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-19A			TLF0450					FROM GAMMA						
Analyses	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**	**Result (pCi/g)**	**Uncertainty (pCi/g)**	**Duplicate Result (pCi/g)**	**Duplicate Uncertainty (pCi/g)**	**DER**	**RPD**	**Val Q**
Am-241								9.00E-03	7.90E-02					U
Ra-226	8.50E-01	2.20E-01	7.70E-01	2.10E-01	**0.26**	**10**								
Np-237														
Pu-238														
Pu-239														
Th-228	4.60E-01	1.80E-01												
Th-230	8.00E-01	2.50E-01												
Th-232	4.90E-01	1.90E-01												
U-234	4.70E-01	2.00E-01												
U-235	1.40E-02	4.80E-02					U	-2.00E-02	4.60E-01					U
U-238	8.80E-01	2.80E-01												
Total U Alpha	**1.36E+00**	**3.47E-01**												
Alpha Sum	**4.05E+00**	**1.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	8.80E-01	2.80E-01						1.38E+00	5.80E-01					J
Pa-234m (Assumed from U-238)	8.80E-01	2.80E-01						-5.00E+00	2.30E+01					UJ
K-40														
Ra-228	4.00E-01	2.40E-01					J							
Pa-231	1.00E-01	1.30E+00					U							
Beta Sum	**2.17E+00**	**4.89E-01**						**-3.21E+00**	**2.30E+01**					
Total Activity Sum	**6.23E+00**	**1.38E+00**						**8.46E-01**	**2.30E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.02E+01	5.60E+00					J	**1.07**	**(from gamma)**		**86.2**			
Gross Beta	9.30E+00	3.70E+00					J	**1.91**	**0.54**		**124**			
Total Activity	3.55E+01	6.50E+00						**4.41**	**1.45**		**140**			

REVISED
Tonawanda Landfill Data Summary Tables

G01070024-20A			TLF0451					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.50E-01	-4.00E-02	1.50E-01	**0.14**	**54.5**	U
Ra-226	1.02E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.40E-01	8.90E-01	2.60E-01	**0.28**	**11.9**								
Th-230	8.60E-01	2.60E-01	8.40E-01	2.60E-01	**0.05**	**2.35**								
Th-232	8.60E-01	2.50E-01	8.40E-01	2.50E-01	**0.06**	**2.35**								
U-234	5.80E-01	2.30E-01	5.70E-01	2.00E-01	**0.03**	**1.74**								
U-235	3.40E-02	5.40E-02	2.20E-02	4.20E-02	**0.18**	**42.9**	U	-3.60E-01	6.80E-01	-1.00E-01	1.00E+00	**0.22**	**113**	U
U-238	9.50E-01	3.10E-01	6.30E-01	2.10E-01	**0.85**	**40.5**								
Total U Alpha	**1.56E+00**	**3.90E-01**	**1.22E+00**	**2.93E-01**										
Alpha Sum	**4.73E+00**	**2.16E+00**	**3.88E+00**	**1.37E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228														
Th-234 (Assumed from U-238)	9.50E-01	3.10E-01	6.30E-01	2.10E-01	**0.85**	**40.5**		1.00E+00	1.10E+00	1.67E+00	7.90E-01	**0.49**	**50.2**	J
Pa-234m (Assumed from U-238)	9.50E-01	3.10E-01	6.30E-01	2.10E-01	**0.85**	**40.5**		2.00E-01	8.10E+00	9.00E-01	9.10E+00	**0.06**	**127**	UJ
K-40														
Ra-228	1.64E+00	4.70E-01	8.40E-01	3.40E-01	**1.38**	**64.5**	J							
Pa-231	-4.00E-01	2.30E+00	1.00E-01	1.40E+00	**0.19**	**333**	U							
Beta Sum	**3.49E+00**	**6.99E-01**	**2.11E+00**	**4.82E-01**				**2.79E+00**	**8.19E+00**	**3.42E+00**	**9.14E+00**			
Total Activity Sum	**8.23E+00**	**2.28E+00**	**5.99E+00**	**1.45E+00**				**7.53E+00**	**8.47E+00**	**7.30E+00**	**9.24E+00**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.72E+01	7.00E+00	1.51E+01	6.20E+00	**0.22**	**13.0**	J	**1.70**	**(from gamma)**		**114**			
Gross Beta	1.82E+01	5.10E+00	1.84E+01	5.10E+00	**0.03**	**1.1**	J	**2.86**	**1.60**		**136**			
Total Activity	4.30E+01	7.80E+00	4.41E+01	7.90E+00	**0.10**	**2.53**		**4.28**	**3.08**		**136**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070025

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0452	G01070025-01A
TLF-0453	G01070025-02A
TLF-0420	G01070025-03A
TLF-0421	G01070025-04A
TLF-0422	G01070025-05A
TLF-0423	G01070025-06A
TLF-0424	G01070025-07A
TLF-0425	G01070025-08A
TLF-0426	G01070025-09A
TLF-0427	G01070025-10A
TLF-0428	G01070025-11A
TLF-0429	G01070025-12A
TLF-9438	G01070025-13A
TLF-9439	G01070025-14A
TLF-0430	G01070025-15A
TLF-0431	G01070025-16A
TLF-0432	G01070025-17A
TLF-0433	G01070025-18A
TLF-0434	G01070025-19A
TLF-0435	G01070025-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. **Therefore, samples TLF-0423 and TLF-0424 for ^{228}Ra, TLF-0453, TLF-0427, and TLF-0429 for ^{234}Th, and TLF-0452, TLF-0453, TLF-0420, TLF-0422, TLF-0423, TLF-0424, TLF-0425, TLF-0426, TLF-0427, TLF-0428, TLF-0429, TLF-9438, TLF-9439, TLF-0431, TLF-0432, TLF-0433, and TLF-0434 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The software calculates the uncertainty for a positive result in the same manner. Therefore it is acceptable for the laboratory to report the absolute value of the negative uncertainty.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in seventeen of the samples above the decision level. The activity range for ^{40}K was 8.45E0 pCi/g to 2.24E1 pCi/g, which are normal levels for ^{40}K naturally found in soil. Also, ^{137}Cs was identified in three of the samples above the decision level. The activity range for ^{137}Cs was 9.21E-2 pCi/g to 3.44E-1 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{230}Th analyses. All samples with ^{230}Th results less than 5 times the blank should be qualified as estimated (J). **Therefore, the ^{230}Th results for TLF-0452 should be qualified as estimated (J).**

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 15% for all samples for the alpha analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the isotopic uranium analysis for samples TLF-0432 (12.3%), TLF-0433 (12.6%) and TLF-0435 (laboratory duplicate) (10.4%). There is also greater than 10% uncertainty in the sample-specific percent recovery results for the isotopic thorium analysis for samples TLF-0453 (10.2%) and TLF-0433 (10.9%). **Therefore, it is recommended that the $^{234/235/238}$U results for samples TLF-0432, TLF-0433, and TLF-0435 (laboratory duplicate) and the $^{228/230/232}$Th results for samples TLF-0453 and TLF-0433 be qualified as estimated (J).**

Spectral Analysis:

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.8 MeV and 6.3 MeV, regions. It is assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 81.9%. The sample specific chemical recovery for sample TLF-0432 exceeded 100% (102.8%). The laboratory used the calculated recovery even if it exceeded 100%, which will place a negative

bias on the final results. However since the recoveries did not have a greater than 10% negative bias, no qualification of the data is necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross beta analysis. There was indication of blank contamination in the gross alpha analysis. Therefore, all samples with results less than 5 times the gross alpha blank should be qualified as estimated (J). All samples had results less than 5 times the blank value for the gross alpha analysis. **Therefore, the gross alpha analysis for all samples should be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

A matrix spike was not analyzed for the gross alpha/beta analyses. The statement of work required that a matrix spike be analyzed for analyses that did not have sample-specific chemical recovery mechanisms. This indicates that the laboratory may not have met the DQOs for these samples. However, since the gross alpha/beta analyses are just estimates, no qualification is recommended.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results did not meet the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra result for sample TLF-0432 does not agree with the ^{232}Th result. The laboratory duplicates for each analysis are in agreement with one another. For sample TLF-0432, the ^{228}Th and ^{232}Th are in equilibrium. Since the ^{228}Ra result is two times greater than either the $^{228/232}$Th results, it appears that there may be a heterogeneity issue.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF-0452, TLF-0426 and TLF-9438. These differences are most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0452 (1.53), TLF-0453 (1.61), TLF-0421 (1.77), TLF-0422 (2.24), TLF-0424 (2.34), TLF-0430 (1.61), and TLF-0432 (1.62), were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (90.3%, 120%, 113%, 131%, 126%, 98.4%, and 90.8%, respectfully) also exceed acceptable limits. The samples have a gross alpha result greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the missing activity be looked into in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0452 (2.79), TLF-0453 (2.80), TLF-0420 (3.68), TLF-0421 (3.59), TLF-0422 (2.60), TLF-0423 (3.40), TLF-0424 (3.54), TLF-0425 (2.66), TLF-0426 (3.01), TLF-0427 (3.05), TLF-0428 (3.13), TLF-0429 (3.61), TLF-9438 (2.69), TLF-9439 (3.05), TLF-0430 (3.47), TLF-0431 (2.75), TLF-0432 (3.05), TLF-0434 (2.72), and TLF-0435 (3.34) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (140%, 151%, 165%, 156%, 152%, 148%, 163%, 141%, 140%, 145%, 148%, 163%, 135%, 154%, 159%, 155%, 122%, 155% and 150% respectfully) also exceed acceptable limits. The samples have a gross beta result greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the decision level. Furthermore, it is recommended that the missing activity be looked into in the future.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs for all samples also exceed acceptable limits. The samples have a total activity result greater than the total activity sum. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the decision level. Furthermore, it is recommended that the missing activity be looked into in the future. No qualification of the data is necessary since the total activity analysis is for comparison purposes only.**

G01070025-01A			TLF 0452					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.50E-01					U
Ra-226	8.40E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.20E-01												
Th-230	8.30E-01	2.30E-01					J							
Th-232	7.70E-01	2.20E-01												
U-234	7.00E-01	2.50E-01												
U-235	-1.70E-02	4.80E-02					U	7.00E-02	3.30E-01					U
U-238	8.40E-01	2.70E-01												
Total U Alpha	**1.52E+00**	**3.71E-01**												
Alpha Sum	**6.50E+00**	**1.02E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.70E-01						3.20E+00	1.30E+00					
Pa-234m (Assumed from U-238)	8.40E-01	2.70E-01						3.00E-01	8.70E+00					UJ
Ac-227														
Ra-228	7.00E-01	3.00E-01												
Pa-231	1.94E+00	9.20E-01												
Beta Sum	**2.61E+00**	**4.98E-01**						**4.43E+00**	**8.80E+00**					
Total Activity Sum	**9.11E+00**	**1.13E+00**						**1.09E+01**	**8.86E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.72E+01	6.90E+00					J	**1.53**	**(from gamma)**		**90.3**			
Gross Beta	1.47E+01	4.30E+00					J	**2.79**	**1.05**		**140**			
Total Activity	3.21E+01	5.80E+00						**3.89**	**2.00**		**112**			

G01070025-02A			TLF 0453					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.10E-01					U
Ra-226	7.60E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	3.10E-01					J							
Th-230	8.90E-01	3.30E-01					J							
Th-232	8.40E-01	2.90E-01					J							
U-234	5.70E-01	2.00E-01												
U-235	1.10E-02	3.90E-02					U	-1.00E-01	1.10E+00					U
U-238	7.70E-01	2.40E-01												
Total U Alpha	**1.35E+00**	**3.15E-01**												
Alpha Sum	**4.32E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.40E-01						5.30E-01	8.90E-01					UJ
Pa-234m (Assumed from U-238)	7.70E-01	2.40E-01						-2.00E+00	3.50E+01					UJ
Ac-227														
Ra-228	5.70E-01	2.40E-01												
Pa-231	-5.00E-01	1.80E+00					U							
Beta Sum	**2.05E+00**	**4.68E-01**						**-9.60E-01**	**3.50E+01**					
Total Activity Sum	**6.37E+00**	**1.81E+00**						**3.36E+00**	**3.51E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.72E+01	7.80E+00					J	**1.61**	**(from gamma)**		**120**			
Gross Beta	1.47E+01	4.50E+00					J	**2.80**	**0.44**		**151**			
Total Activity	3.24E+01	5.90E+00						**4.22**	**0.82**		**134**			

G01070025-03A			TLF 0420					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.80E-01					U
Ra-226	7.10E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	3.30E-01												
Th-230	9.60E-01	3.10E-01												
Th-232	9.40E-01	3.00E-01												
U-234	7.70E-01	2.50E-01												
U-235	3.20E-02	4.50E-02					U	3.80E-01	3.70E-01					
U-238	7.80E-01	2.50E-01												
Total U Alpha	**1.58E+00**	**3.56E-01**												
Alpha Sum	**5.41E+00**	**1.59E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.50E-01						1.60E+00	1.10E+00					
Pa-234m (Assumed from U-238)	7.80E-01	2.50E-01						0.00E+00	7.20E+02					UJ
Ac-227														
Ra-228	6.10E-01	4.40E-01												
Pa-231	2.00E-01	1.60E+00					U							
Beta Sum	**2.19E+00**	**5.96E-01**						**2.23E+00**	**7.20E+02**					
Total Activity Sum	**7.61E+00**	**1.70E+00**						**7.65E+00**	**7.20E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.50E+00	5.90E+00					J	**0.67**	**(from gamma)**		**54.8**			
Gross Beta	2.29E+01	5.60E+00					J	**3.68**	**0.03**		**165**			
Total Activity	3.37E+01	6.10E+00						**4.12**	**0.04**		**126**			

G01070025-04A			TLF 0421					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.40E-01					U
Ra-226	1.18E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	2.20E-01												
Th-230	9.10E-01	2.60E-01												
Th-232	8.30E-01	2.30E-01												
U-234	6.40E-01	2.40E-01												
U-235	4.70E-02	6.50E-02					U	-2.50E-01	8.70E-01					U
U-238	1.08E+00	3.30E-01												
Total U Alpha	**1.77E+00**	**4.13E-01**												
Alpha Sum	**4.88E+00**	**2.34E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.08E+00	3.30E-01						8.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	1.08E+00	3.30E-01						4.10E+00	9.40E+00					U
Ac-227														
Ra-228	7.00E-01	3.10E-01												
Pa-231	-6.00E-01	2.50E+00					U							
Beta Sum	**2.79E+00**	**6.36E-01**						**5.53E+00**	**9.47E+00**					
Total Activity Sum	**7.67E+00**	**2.43E+00**						**1.04E+01**	**9.76E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.76E+01	6.80E+00					J	**1.77**	**(from gamma)**		**113**			
Gross Beta	2.23E+01	5.40E+00					J	**3.59**	**1.54**		**156**			
Total Activity	3.61E+01	6.50E+00						**4.10**	**2.19**		**130**			

G01070025-05A			TLF 0422					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.10E-01					U
Ra-226	9.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	2.70E-01												
Th-230	9.00E-01	2.80E-01												
Th-232	1.02E+00	3.00E-01												
U-234	7.50E-01	2.50E-01												
U-235	6.80E-02	6.70E-02						1.20E-01	3.00E-01					U
U-238	7.20E-01	2.50E-01												
Total U Alpha	**1.54E+00**	**3.60E-01**												
Alpha Sum	**4.79E+00**	**1.67E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.50E-01						2.01E+00	7.50E-01					
Pa-234m (Assumed from U-238)	7.20E-01	2.50E-01						-4.00E+00	6.50E+01					UJ
Ac-227														
Ra-228	6.20E-01	3.00E-01												
Pa-231	-4.00E-01	1.70E+00					U							
Beta Sum	**2.01E+00**	**5.07E-01**						**-1.42E+00**	**6.50E+01**					
Total Activity Sum	**6.80E+00**	**1.74E+00**						**3.37E+00**	**6.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.29E+01	7.90E+00					J	**2.24**	**(from gamma)**		**131**			
Gross Beta	1.48E+01	4.90E+00					J	**2.60**	**0.25**		**152**			
Total Activity	2.73E+01	5.10E+00						**3.80**	**0.37**		**120**			

G01070025-06A			TLF 0423					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.70E-01					U
Ra-226	1.91E+00	4.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.00E-01												
Th-230	1.08E+00	2.30E-01												
Th-232	7.20E-01	1.70E-01												
U-234	8.90E-01	2.90E-01												
U-235	-9.00E-03	5.20E-02					U	-1.00E-01	3.50E+00					U
U-238	1.10E+00	3.40E-01												
Total U Alpha	**1.98E+00**	**4.50E-01**												
Alpha Sum	**6.56E+00**	**2.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.10E+00	3.40E-01						7.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	1.10E+00	3.40E-01						0.00E+00	3.40E+02					UJ
Ac-227														
Ra-228	7.10E-01	3.50E-01					J							
Pa-231	0.00E+00	2.70E+00					U							
Beta Sum	**2.91E+00**	**6.77E-01**						**1.41E+00**	**3.40E+02**					
Total Activity Sum	**9.47E+00**	**2.62E+00**						**7.97E+00**	**3.40E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.24E+01	5.40E+00					J	**0.98**	**(from gamma)**		**61.6**			
Gross Beta	1.94E+01	4.80E+00					J	**3.40**	**0.05**		**148**			
Total Activity	3.40E+01	6.20E+00						**3.64**	**0.08**		**113**			

G01070025-07A			TLF 0424					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	2.00E-01					U
Ra-226	1.23E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	1.90E-01												
Th-230	8.80E-01	2.00E-01												
Th-232	8.90E-01	2.00E-01												
U-234	9.60E-01	2.90E-01												
U-235	-1.20E-02	4.50E-02					U	8.00E-02	4.10E-01					U
U-238	8.80E-01	2.80E-01												
Total U Alpha	**1.83E+00**	**4.06E-01**												
Alpha Sum	**5.20E+00**	**2.16E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.80E-01	2.80E-01						2.05E+00	9.10E-01					
Pa-234m (Assumed from U-238)	8.80E-01	2.80E-01						0.00E+00	1.70E+01					UJ
Ac-227														
Ra-228	6.60E-01	4.10E-01					J							
Pa-231	-5.00E-01	2.30E+00					U							
Beta Sum	**2.36E+00**	**6.33E-01**						**2.65E+00**	**1.70E+01**					
Total Activity Sum	**7.56E+00**	**2.25E+00**						**7.85E+00**	**1.72E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.28E+01	7.20E+00					J	**2.34**	**(from gamma)**		**125.7**			
Gross Beta	2.30E+01	5.80E+00					J	**3.54**	**1.13**		**163**			
Total Activity	3.00E+01	5.40E+00						**3.84**	**1.23**		**119.5**			

G01070025-08A			TLF 0425					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.20E-01					U
Ra-226	1.01E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	1.90E-01												
Th-230	7.70E-01	2.00E-01												
Th-232	6.90E-01	1.80E-01												
U-234	7.20E-01	2.50E-01												
U-235	3.80E-02	5.80E-02					U	0.00E+00	4.00E-01					U
U-238	7.70E-01	2.50E-01												
Total U Alpha	**1.53E+00**	**3.58E-01**												
Alpha Sum	**5.74E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.50E-01						1.19E+00	1.00E+00					
Pa-234m (Assumed from U-238)	7.70E-01	2.50E-01						0.00E+00	1.00E+02					UJ
Ac-227														
Ra-228	9.00E-01	3.50E-01												
Pa-231	1.10E+00	1.60E+00					U							
Beta Sum	**2.57E+00**	**5.33E-01**						**2.22E+00**	**1.00E+02**					
Total Activity Sum	**8.31E+00**	**1.63E+00**						**7.96E+00**	**1.00E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.80E+00	5.30E+00					J	**0.55**	**(from gamma)**		**42.1**			
Gross Beta	1.49E+01	4.60E+00					J	**2.66**	**0.13**		**141**			
Total Activity	3.01E+01	5.50E+00						**3.80**	**0.22**		**113**			

G01070025-09A			TLF 0426					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	3.90E-01					U
Ra-226	9.10E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.01E+00	2.60E-01												
Th-230	1.00E+00	2.60E-01												
Th-232	8.60E-01	2.30E-01												
U-234	7.30E-01	2.50E-01												
U-235	0.00E+00	4.70E-02					U	1.00E-02	3.10E-01					U
U-238	8.60E-01	2.80E-01												
Total U Alpha	**1.59E+00**	**3.78E-01**												
Alpha Sum	**9.78E+00**	**1.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.80E-01						4.40E+00	1.70E+00					
Pa-234m (Assumed from U-238)	8.60E-01	2.80E-01						5.00E-01	9.50E+00					UJ
Ac-227														
Ra-228	5.30E-01	2.90E-01												
Pa-231	4.90E+00	2.10E+00												
Beta Sum	**2.84E+00**	**5.52E-01**						**6.02E+00**	**9.66E+00**					
Total Activity Sum	**1.26E+01**	**2.07E+00**						**1.58E+01**	**9.86E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	5.90E+00					J	**0.61**	**(from gamma)**		**32.7**			
Gross Beta	1.62E+01	4.40E+00					J	**3.01**	**0.96**		**140**			
Total Activity	2.33E+01	4.30E+00						**2.24**	**0.70**		**59.5**			

G01070025-10A			TLF 0427					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.50E-01	1.50E-01					
Ra-226	1.10E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	2.20E-01												
Th-230	1.07E+00	2.70E-01												
Th-232	7.50E-01	2.10E-01												
U-234	7.80E-01	2.50E-01												
U-235	2.90E-02	4.60E-02					U	-4.00E-02	8.70E-01					U
U-238	8.90E-01	2.70E-01												
Total U Alpha	**1.70E+00**	**3.71E-01**												
Alpha Sum	**5.49E+00**	**1.48E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.70E-01						4.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	8.90E-01	2.70E-01						-1.00E+00	1.70E+01					UJ
Ac-227														
Ra-228	8.60E-01	3.30E-01												
Pa-231	1.00E-01	1.50E+00					U							
Beta Sum	**2.65E+00**	**5.36E-01**						**2.72E-01**	**1.70E+01**					
Total Activity Sum	**8.14E+00**	**1.58E+00**						**5.76E+00**	**1.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.60E+00	5.40E+00					J	**0.56**	**(from gamma)**		**44.2**			
Gross Beta	1.68E+01	4.60E+00					J	**3.05**	**0.94**		**145**			
Total Activity	2.67E+01	4.70E+00						**3.74**	**1.18**		**107**			

G01070025-11A			TLF 0428					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.20E-01					U
Ra-226	7.90E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	2.40E-01												
Th-230	9.70E-01	2.90E-01												
Th-232	9.20E-01	2.60E-01												
U-234	7.20E-01	2.30E-01												
U-235	2.20E-02	4.20E-02					U	-1.00E-01	3.50E+00					U
U-238	9.30E-01	2.70E-01												
Total U Alpha	**1.67E+00**	**3.57E-01**												
Alpha Sum	**4.86E+00**	**1.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	2.70E-01						3.20E+00	1.00E+00					
Pa-234m (Assumed from U-238)	9.30E-01	2.70E-01						0.00E+00	1.00E+01					UJ
Ac-227														
Ra-228	7.40E-01	3.60E-01												
Pa-231	-2.00E-01	1.40E+00					U							
Beta Sum	**2.58E+00**	**5.51E-01**						**3.92E+00**	**1.01E+01**					
Total Activity Sum	**7.44E+00**	**1.51E+00**						**8.78E+00**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.90E+00	5.60E+00					J	**0.01**	**(from gamma)**		**0.78**			
Gross Beta	1.74E+01	4.70E+00					J	**3.13**	**1.21**		**148**			
Total Activity	2.85E+01	5.20E+00						**3.89**	**1.73**		**117**			

G01070025-12A			TLF 0429					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.40E-01					U
Ra-226	8.60E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.60E-01												
Th-230	6.20E-01	2.20E-01					J							
Th-232	6.50E-01	2.10E-01												
U-234	8.80E-01	2.60E-01												
U-235	3.70E-02	5.20E-02					U	-2.80E-01	7.80E-01					U
U-238	7.10E-01	2.30E-01												
Total U Alpha	**1.63E+00**	**3.51E-01**												
Alpha Sum	**4.66E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.10E-01	2.30E-01						6.70E-01	5.40E-01					J
Pa-234m (Assumed from U-238)	7.10E-01	2.30E-01						-2.00E+00	5.10E+01					UJ
Ac-227														
Ra-228	7.30E-01	3.00E-01												
Pa-231	1.00E-01	1.60E+00					U							
Beta Sum	**2.16E+00**	**4.82E-01**						**-5.88E-01**	**5.10E+01**					
Total Activity Sum	**6.82E+00**	**1.63E+00**						**4.07E+00**	**5.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.90E+00	5.10E+00					J	**0.05**	**(from gamma)**		**5.09**			
Gross Beta	2.14E+01	5.30E+00					J	**3.61**	**0.43**		**163**			
Total Activity	3.17E+01	5.60E+00						**4.27**	**0.54**		**129**			

G01070025-13A			TLF 9438					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.10E-01					U
Ra-226	8.70E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.70E-01	2.80E-01												
Th-230	1.08E+00	3.00E-01												
Th-232	7.60E-01	2.50E-01												
U-234	6.20E-01	2.20E-01												
U-235	4.10E-02	5.70E-02					U	-4.00E-02	6.70E-01					U
U-238	1.00E+00	3.00E-01												
Total U Alpha	**1.66E+00**	**3.76E-01**												
Alpha Sum	**6.68E+00**	**9.37E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.00E+00	3.00E-01						1.70E+00	1.10E+00					
Pa-234m (Assumed from U-238)	1.00E+00	3.00E-01						-4.00E+00	5.50E+01					UJ
Ac-227														
Ra-228	6.30E-01	4.10E-01												
Pa-231	1.49E+00	7.40E-01												
Beta Sum	**2.81E+00**	**5.97E-01**						**-1.49E+00**	**5.50E+01**					
Total Activity Sum	**9.49E+00**	**1.11E+00**						**5.19E+00**	**5.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.17E+01	4.90E+00					J	**1.01**	**(from gamma)**		**54.6**			
Gross Beta	1.45E+01	4.30E+00					J	**2.69**	**0.29**		**135**			
Total Activity	3.47E+01	6.20E+00						**4.00**	**0.53**		**114**			

G01070025-14A			TLF 9439					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.70E-01					U
Ra-226	7.60E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.40E-01	2.60E-01												
Th-230	1.28E+00	3.10E-01												
Th-232	8.90E-01	2.40E-01												
U-234	8.60E-01	2.80E-01												
U-235	4.90E-02	6.10E-02					U	-1.00E-01	3.20E+00					U
U-238	6.80E-01	2.40E-01												
Total U Alpha	**1.59E+00**	**3.74E-01**												
Alpha Sum	**5.09E+00**	**2.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.80E-01	2.40E-01						9.70E-01	8.50E-01					
Pa-234m (Assumed from U-238)	6.80E-01	2.40E-01						-1.00E+00	2.80E+01					UJ
Ac-227														
Ra-228	7.20E-01	3.60E-01												
Pa-231	-3.00E-01	3.20E+00					U							
Beta Sum	**2.04E+00**	**6.26E-01**						**6.54E-01**	**2.80E+01**					
Total Activity Sum	**7.13E+00**	**3.01E+00**						**5.74E+00**	**2.82E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.30E+00	5.10E+00					J	**0.71**	**(from gamma)**		**58.5**			
Gross Beta	1.56E+01	4.40E+00					J	**3.05**	**0.53**		**154**			
Total Activity	3.85E+01	6.90E+00						**4.17**	**1.13**		**137**			

G01070025-15A			TLF 0430					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	2.40E-01					U
Ra-226	1.28E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.70E-01												
Th-230	1.02E+00	2.70E-01												
Th-232	8.60E-01	2.40E-01												
U-234	7.20E-01	2.40E-01												
U-235	4.80E-02	5.50E-02						2.10E-01	3.90E-01					U
U-238	8.30E-01	2.60E-01												
Total U Alpha	**1.60E+00**	**3.58E-01**												
Alpha Sum	**5.93E+00**	**1.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.60E-01						2.05E+00	9.50E-01					
Pa-234m (Assumed from U-238)	8.30E-01	2.60E-01						5.00E+00	1.30E+01					U
Ac-227														
Ra-228	6.70E-01	3.60E-01												
Pa-231	2.00E-01	1.80E+00					U							
Beta Sum	**2.35E+00**	**5.58E-01**						**7.74E+00**	**1.30E+01**					
Total Activity Sum	**8.28E+00**	**1.83E+00**						**1.37E+01**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.74E+01	6.90E+00					J	**1.61**	**(from gamma)**		**98.4**			
Gross Beta	2.05E+01	5.20E+00					J	**3.47**	**0.91**		**159**			
Total Activity	3.21E+01	5.90E+00						**3.86**	**1.28**		**118**			

G01070025-16A			TLF 0431					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.30E-01					U
Ra-226	8.40E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	2.10E-01												
Th-230	8.00E-01	2.30E-01												
Th-232	6.10E-01	1.90E-01												
U-234	9.00E-01	2.90E-01												
U-235	4.40E-02	6.10E-02					U	0.00E+00	2.40E+01					U
U-238	6.80E-01	2.40E-01												
Total U Alpha	**1.62E+00**	**3.81E-01**												
Alpha Sum	**4.03E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.80E-01	2.40E-01						9.30E-01	9.10E-01					
Pa-234m (Assumed from U-238)	6.80E-01	2.40E-01						-5.00E+00	3.50E+01					UJ
Ac-227														
Ra-228	3.60E-01	3.40E-01												
Pa-231	-6.00E-01	1.90E+00					U							
Beta Sum	**1.65E+00**	**5.32E-01**						**-3.78E+00**	**3.50E+01**					
Total Activity Sum	**5.68E+00**	**1.88E+00**						**2.52E-01**	**3.51E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	5.20E+00					J	**0.81**	**(from gamma)**		**71.3**			
Gross Beta	1.30E+01	4.10E+00					J	**2.75**	**0.48**		**155**			
Total Activity	3.51E+01	6.40E+00						**4.41**	**0.98**		**144**			

G01070025-17A			TLF 0432					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.20E-01					U
Ra-226	9.70E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.40E-01	2.10E-01												
Th-230	1.00E+00	2.40E-01												
Th-232	8.50E-01	2.10E-01												
U-234	1.33E+00	4.70E-01					J							
U-235	2.20E-01	1.70E-01					J	0.00E+00	3.90E+01					U
U-238	1.86E+00	5.80E-01					J							
Total U Alpha	**3.41E+00**	**7.66E-01**												
Alpha Sum	**7.25E+00**	**1.85E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.86E+00	5.80E-01						2.30E+00	1.20E+00					
Pa-234m (Assumed from U-238)	1.86E+00	5.80E-01						-5.00E+00	4.30E+01					UJ
Ac-227														
Ra-228	1.80E+00	5.00E-01												
Pa-231	2.00E-01	1.80E+00					U							
Beta Sum	**5.54E+00**	**9.85E-01**						**-8.76E-01**	**4.30E+01**					
Total Activity Sum	**1.28E+01**	**2.09E+00**						**6.37E+00**	**4.31E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.93E+01	7.20E+00					J	**1.62**	**(from gamma)**		**90.8**			
Gross Beta	2.29E+01	5.60E+00					J	**3.05**	**0.55**		**122**			
Total Activity	3.32E+01	5.90E+00						**3.26**	**0.62**		**88.7**			

G01070025-18A			TLF 0433					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.40E-01					U
Ra-226	1.36E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	3.30E-01					J							
Th-230	1.21E+00	4.10E-01					J							
Th-232	7.50E-01	2.80E-01					J							
U-234	2.38E+00	6.90E-01					J							
U-235	2.10E-01	1.70E-01					J	-1.00E-01	3.10E+00					U
U-238	2.49E+00	7.10E-01					J							
Total U Alpha	**5.08E+00**	**1.00E+00**												
Alpha Sum	**8.95E+00**	**2.17E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.49E+00	7.10E-01						1.49E+00	7.50E-01					
Pa-234m (Assumed from U-238)	2.49E+00	7.10E-01						4.00E-01	7.60E+00					UJ
Ac-227														
Ra-228	8.60E-01	3.10E-01												
Pa-231	-2.00E-01	2.00E+00					U							
Beta Sum	**5.82E+00**	**1.08E+00**						**2.73E+00**	**7.65E+00**					
Total Activity Sum	**1.48E+01**	**2.42E+00**						**1.17E+01**	**7.95E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.00E+01	5.80E+00					J	**0.17**	**(from gamma)**		**11.1**			
Gross Beta	6.60E+00	3.60E+00					J	**0.21**	**0.46**		**12.6**			
Total Activity	4.00E+01	7.10E+00						**3.36**	**2.66**		**92.2**			

G01070025-19A			TLF 0434					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.50E-01					U
Ra-226	7.80E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	2.10E-01												
Th-230	7.50E-01	2.00E-01												
Th-232	8.50E-01	2.20E-01												
U-234	5.20E-01	1.90E-01												
U-235	4.00E-03	3.90E-02					U	1.00E-02	4.10E-01					U
U-238	6.10E-01	2.10E-01												
Total U Alpha	**1.13E+00**	**2.86E-01**												
Alpha Sum	**3.83E+00**	**2.22E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.10E-01	2.10E-01						3.80E+00	1.60E+00					
Pa-234m (Assumed from U-238)	6.10E-01	2.10E-01						-1.00E+00	2.80E+01					UJ
Ac-227														
Ra-228	5.30E-01	3.60E-01												
Pa-231	-5.00E-01	2.40E+00					U							
Beta Sum	**1.69E+00**	**5.48E-01**						**3.27E+00**	**2.80E+01**					
Total Activity Sum	**5.52E+00**	**2.29E+00**						**7.10E+00**	**2.81E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.40E+00	4.40E+00					J	**0.52**	**(from gamma)**		**50.1**			
Gross Beta	1.32E+01	4.20E+00					J	**2.72**	**0.35**		**155**			
Total Activity	3.57E+01	6.30E+00						**4.50**	**0.99**		**146**			

G01070025-20A			TLF 0435					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.60E-01	-5.00E-02	1.80E-01	**0.04**	**22.2**	U
Ra-226	1.15E+00	2.80E-01	1.12E+00	2.80E-01	**0.08**	**2.64**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.07E+00	3.20E-01	1.06E+00	3.10E-01	**0.02**	**0.94**								
Th-230	1.06E+00	3.30E-01	1.25E+00	3.60E-01	**0.39**	**16.5**								
Th-232	8.10E-01	2.70E-01	8.80E-01	2.70E-01	**0.18**	**8.28**								
U-234	8.20E-01	2.50E-01	9.90E-01	3.30E-01	**0.41**	**18.8**								
U-235	2.80E-02	3.90E-02	1.40E-01	1.10E-01	**0.96**	**133**	U	-4.00E-02	8.30E-01	1.00E-02	4.10E-01	**0.05**	**333**	U
U-238	1.02E+00	2.80E-01	6.10E-01	2.40E-01	**1.11**	**50.3**								
Total U Alpha	**1.87E+00**	**3.77E-01**	**1.74E+00**	**4.23E-01**										
Alpha Sum	**6.05E+00**	**1.77E+00**	**5.51E+00**	**1.95E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.02E+00	2.80E-01	6.10E-01	2.40E-01	**1.11**	**50.3**		1.30E+00	8.10E-01	1.86E+00	8.70E-01	**0.47**	**35.4**	
Pa-234m (Assumed from U-238)	1.02E+00	2.80E-01	6.10E-01	2.40E-01	**1.11**	**50.3**		4.00E+00	1.00E+01	1.00E+00	1.20E+01	**0.19**	**120**	U
Ac-227														
Ra-228	9.50E-01	3.70E-01	1.09E+00	4.30E-01	**0.25**	**13.7**								
Pa-231	1.00E-01	1.80E+00	-6.00E-01	2.00E+00	**0.26**	**280**	U							
Beta Sum	**3.00E+00**	**5.83E-01**	**2.24E+00**	**5.98E-01**				**6.26E+00**	**1.00E+01**	**3.88E+00**	**1.20E+01**			
Total Activity Sum	**9.05E+00**	**1.86E+00**	**7.75E+00**	**2.04E+00**				**1.23E+01**	**1.02E+01**	**9.39E+00**	**1.22E+01**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.07E+01	6.30E+00	2.10E+01	7.80E+00	**1.03**	**65.0**	J	**0.71**	**(from gamma)**		**55.6**			
Gross Beta	2.08E+01	5.30E+00	2.56E+01	6.20E+00	**0.59**	**20.7**	J	**3.34**	**1.28**		**150**			
Total Activity	4.12E+01	7.30E+00	4.00E+01	7.30E+00	**0.12**	**2.96**		**4.27**	**2.30**		**128**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070026

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0436	G01070026-01A
TLF-0437	G01070026-02A
TLF-0416	G01070026-03A
TLF-0417	G01070026-04A
TLF-0460	G01070026-05A
TLF-0461	G01070026-06A
TLF-0456	G01070026-07A
TLF-0457	G01070026-08A
TLF-0748	G01070026-09A
TLF-0749	G01070026-10A
TLF-0750	G01070026-11A
TLF-0751	G01070026-12A
TLF-0752	G01070026-13A
TLF-0753	G01070026-14A
TLF-9768	G01070026-15A
TLF-9769	G01070026-16A
TLF-0756	G01070026-17A
TLF-0757	G01070026-18A
TLF-0762	G01070026-19A
TLF-0763	G01070026-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in the gamma spectrometry method blank for ^{234}Th. All samples with results less than 5 times the blank for ^{234}Th should be qualified as estimated. **Therefore, it is recommended that the ^{234}Th results for all samples be qualified as estimated (J).**

Improper background subtraction was indicated for the ^{241}Am blank result. Improper background subtraction is indicted when a negative result is reported with a smaller 2σ uncertainty. This could indicate a possible negative bias on the sample results for ^{241}Am. Since none of the ^{241}Am results for the samples indicate an improper background subtraction, it does not appear there is a negative bias on the results. Therefore, no qualification is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. All sample results for ^{228}Ra were greater than 5 times the rinsate blank; therefore, no qualification of the ^{228}Ra results is necessary. **However, it is recommended that samples TLF-0437, TLF-0417, and TLF-0762 for ^{234}Th, and TLF-0436, TLF-0417 (laboratory duplicate), TLF-0461, TLF-0456, TLF-0457, TLF-0751, TLF-0752, TLF-0753, TLF-9768, TLF-0756, TLF-0757, TLF-0762, and TLF-0763 for ^{234}Pa be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analyses for all gamma spectrometry analyses except for ^{234}Th (1.43), which was outside acceptable limits. The RPD (130%) for ^{234}Th was also outside acceptable limits. **Therefore, it is recommended that the ^{234}Th results for all samples be qualified as estimated (J).**

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The software calculates the uncertainty for a positive result in the same manner. Therefore it is acceptable for the laboratory to report the absolute value of the negative uncertainty.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in twelve of the samples above the DL. The activity range for ^{40}K was 1.25E1 pCi/g to 1.86E1 pCi/g, which are normal levels for ^{40}K naturally found in soil. Also, ^{137}Cs was identified in four of the samples above the DL. The activity range for ^{137}Cs was 1.09E-1 pCi/g to 4.20E-1 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{232}Th analyses. All samples with ^{232}Th results less than 5 times the blank should be qualified as estimated. All of the results for ^{232}Th were greater than 5 times the blank. Therefore, no qualification of the ^{232}Th results is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 71% for all samples for the alpha analyses. Samples TLF-0436 (101%), TLF-0460 (105%), TLF-0748 (103%), TLF-0751 (103%), TLF-0752 (102%), and TLF-0756 (103%) had a greater than 100% sample specific chemical recovery for $^{228/230/232}$Th analyses. The laboratory used the calculated recoveries even if the exceeded 100%, which will place a negative bias on the results. However, since the bias is less than 10%, no qualification is necessary.

Spectral Analysis:

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.8 MeV and 6.3 MeV, regions. It is assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was an indication of blank contamination in the ^{226}Ra analysis. All samples with ^{226}Ra results less than 5 times the blank should be qualified as estimated. **Therefore, it is recommended that the ^{226}Ra results for sample TLF-0762 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 84%. No qualification of the data is necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recoveries for the gross alpha/beta LCSs are within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The MS recoveries for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results did not meet the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra results for all samples are in agreement with the ^{232}Th results.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF-0417, TLF-9769, TLF-0756 and TLF-0762. These differences are most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0437 (1.40), TLF-0416 (1.41), TLF-0417 (1.92), TLF-0460 (2.10), TLF-0461 (1.72), TLF-0456 (1.70), TLF-0457 (1.65), TLF-0748 (1.50), TLF-0750 (1.32), TLF-0751 (1.87), TLF-0752 (1.83), TLF-0753 (1.85), TLF-0757 (2.37), and TLF-0763 (1.42) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (89.7%, 77.4%, 97.3%, 107%, 83.2%, 88.5%, 90.2%, 92.2%, 84.9%, 92.7%, 97.6%, 100%, 131%, and 77.5%, respectfully) also exceed acceptable limits. The samples have gross alpha results that are 2 to 5 times greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possibility of missing activity be looked into in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs (2.87 to 3.99) for all samples were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (145% to 167%) for all samples also exceed acceptable limits. The samples have gross beta results 6 to 11 times greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (1.97 to 3.31) for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs (80% to 124%) for all samples also exceed acceptable limits. The samples have a total activity result 2 to 4 times greater than the sum of the alpha and beta emitters. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future. No qualification of the data is necessary since the total activity analysis is for comparison purposes.**

G01070026-01A			TLF 0436					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01					U
Ra-226	9.70E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	1.60E-01												
Th-230	8.20E-01	1.80E-01												
Th-232	7.00E-01	1.60E-01												
U-234	8.90E-01	2.80E-01												
U-235	9.10E-02	8.50E-02						2.00E-02	3.30E-01					U
U-238	9.60E-01	3.00E-01												
Total U Alpha	**1.94E+00**	**4.19E-01**												
Alpha Sum	**4.85E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.60E-01	3.00E-01						1.77E+00	7.90E-01					J
Pa-234m (Assumed from U-238)	9.60E-01	3.00E-01						1.00E-01	9.00E+00					UJ
Ac-227														
Ra-228	5.80E-01	3.10E-01												
Pa-231	-3.00E-01	1.60E+00					U							
Beta Sum	**2.46E+00**	**5.59E-01**						**2.41E+00**	**9.04E+00**					
Total Activity Sum	**7.32E+00**	**1.64E+00**						**7.27E+00**	**9.17E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.10E+01	5.00E+00					J	**1.17**	**(from gamma)**		**77.6**			
Gross Beta	1.99E+01	4.90E+00					J	**3.54**	**1.70**		**156**			
Total Activity	2.99E+01	6.90E+00						**3.18**	**1.97**		**121**			

G01070026-02A			TLF 0437					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.40E-01					U
Ra-226	7.80E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	1.90E-01												
Th-230	9.10E-01	2.00E-01												
Th-232	6.90E-01	1.70E-01												
U-234	7.90E-01	2.80E-01												
U-235	7.80E-02	8.70E-02						2.20E-01	2.80E-01					U
U-238	7.30E-01	2.60E-01												
Total U Alpha	**1.60E+00**	**3.92E-01**												
Alpha Sum	**4.15E+00**	**1.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.60E-01						5.90E-01	3.10E-01					J
Pa-234m (Assumed from U-238)	7.30E-01	2.60E-01						1.40E+00	7.60E+00					U
Ac-227														
Ra-228	5.30E-01	2.40E-01												
Pa-231	-7.00E-01	1.50E+00					U							
Beta Sum	**1.91E+00**	**4.75E-01**						**2.44E+00**	**7.61E+00**					
Total Activity Sum	**6.05E+00**	**1.53E+00**						**6.58E+00**	**7.75E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.09E+01	4.60E+00					J	**1.40**	**(from gamma)**		**89.7**			
Gross Beta	1.58E+01	4.30E+00					J	**3.21**	**1.53**		**157**			
Total Activity	2.38E+01	6.00E+00						**2.87**	**1.76**		**119**			

G01070026-03A			TLF 0416					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01					U
Ra-226	1.25E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.00E-01												
Th-230	9.70E-01	2.10E-01												
Th-232	9.90E-01	2.10E-01												
U-234	9.40E-01	3.00E-01												
U-235	1.50E-01	1.10E-01						1.30E-01	3.80E-01					U
U-238	8.90E-01	2.90E-01												
Total U Alpha	**1.98E+00**	**4.32E-01**												
Alpha Sum	**6.01E+00**	**1.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.90E-01						1.60E+00	1.00E+00					J
Pa-234m (Assumed from U-238)	8.90E-01	2.90E-01						2.70E+00	7.90E+00					U
Ac-227														
Ra-228	8.10E-01	3.30E-01												
Pa-231	-1.00E-01	1.30E+00					U							
Beta Sum	**2.58E+00**	**5.49E-01**						**5.10E+00**	**7.97E+00**					
Total Activity Sum	**8.59E+00**	**1.44E+00**						**1.11E+01**	**8.08E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	5.20E+00					J	**1.41**	**(from gamma)**		**77.4**			
Gross Beta	2.22E+01	5.30E+00					J	**3.68**	**1.79**		**158**			
Total Activity	3.32E+01	7.30E+00						**3.31**	**2.03**		**118**			

G01070026-04A			TLF 0417					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01	-2.00E-02	1.40E-01	**0.34**	**600**	U
Ra-226	1.21E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.10E-01	1.70E-01												
Th-230	8.10E-01	1.90E-01												
Th-232	9.00E-01	2.00E-01												
U-234	8.60E-01	2.60E-01												
U-235	3.10E-02	4.30E-02					U	-8.00E-02	6.60E-01	3.30E-01	3.30E-01	**0.56**	**328**	U
U-238	7.40E-01	2.40E-01												
Total U Alpha	**1.63E+00**	**3.56E-01**												
Alpha Sum	**6.70E+00**	**1.22E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.40E-01						3.30E-01	2.30E-01	1.56E+00	8.30E-01	**1.43**	**130**	J
Pa-234m (Assumed from U-238)	7.40E-01	2.40E-01						3.70E+00	7.80E+00	-4.00E+00	3.90E+01	**0.19**	**5133**	U
Ac-227														
Ra-228	6.40E-01	2.50E-01	5.40E-01	3.10E-01	**0.25**	**16.9**								
Pa-231	1.60E+00	1.20E+00	-4.00E-01	1.70E+00	**0.96**	**333**								
Beta Sum	**2.31E+00**	**4.45E-01**						**4.86E+00**	**7.81E+00**	**-1.95E+00**	**3.90E+01**			
Total Activity Sum	**9.01E+00**	**1.30E+00**						**1.16E+01**	**7.90E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.94E+01	6.50E+00					J	**1.92**	**(from gamma)**		**97.3**			
Gross Beta	1.72E+01	4.70E+00					J	**3.15**	**1.35**		**153**			
Total Activity	2.37E+01	6.20E+00						**2.32**	**1.21**		**89.8**			

G01070026-05A			TLF 0460					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.50E-01					U
Ra-226	1.15E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.00E-01												
Th-230	9.00E-01	2.00E-01												
Th-232	9.70E-01	2.10E-01												
U-234	9.60E-01	2.90E-01												
U-235	7.40E-02	7.40E-02						-1.40E-01	4.60E-01					U
U-238	9.60E-01	2.90E-01												
Total U Alpha	**1.99E+00**	**4.17E-01**												
Alpha Sum	**6.33E+00**	**1.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.60E-01	2.90E-01						1.96E+00	8.40E-01					J
Pa-234m (Assumed from U-238)	9.60E-01	2.90E-01						2.00E+00	1.20E+01					U
Ac-227														
Ra-228	6.80E-01	3.40E-01												
Pa-231	5.00E-01	1.70E+00					U							
Beta Sum	**2.66E+00**	**5.70E-01**						**4.70E+00**	**1.20E+01**					
Total Activity Sum	**8.99E+00**	**1.75E+00**						**1.10E+01**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.08E+01	6.70E+00					J	**2.10**	**(from gamma)**		**107**			
Gross Beta	1.68E+01	4.90E+00					J	**2.87**	**0.93**		**145**			
Total Activity	2.74E+01	6.90E+00						**2.59**	**1.17**		**101**			

G01070026-06A			TLF 0461					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.60E-01					U
Ra-226	1.10E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.34E+00	2.80E-01												
Th-230	1.22E+00	2.50E-01												
Th-232	1.24E+00	2.60E-01												
U-234	1.11E+00	3.20E-01												
U-235	9.00E-03	4.50E-02					U	0.00E+00	3.30E-01					U
U-238	1.07E+00	3.10E-01												
Total U Alpha	**2.19E+00**	**4.48E-01**												
Alpha Sum	**6.64E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.07E+00	3.10E-01						1.60E+00	6.90E-01					J
Pa-234m (Assumed from U-238)	1.07E+00	3.10E-01						-5.00E+00	1.10E+01					UJ
Ac-227														
Ra-228	8.60E-01	3.10E-01												
Pa-231	-5.00E-01	1.40E+00					U							
Beta Sum	**2.94E+00**	**5.63E-01**						**-2.60E+00**	**1.10E+01**					
Total Activity Sum	**9.58E+00**	**1.55E+00**						**4.04E+00**	**1.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	5.30E+00					J	**1.72**	**(from gamma)**		**83.2**			
Gross Beta	1.94E+01	5.10E+00					J	**3.21**	**1.81**		**147**			
Total Activity	2.84E+01	6.90E+00						**2.66**	**1.86**		**99.1**			

G01070026-07A			TLF 0456					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.50E-01					U
Ra-226	1.23E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.10E-01												
Th-230	9.60E-01	2.10E-01												
Th-232	9.60E-01	2.10E-01												
U-234	8.30E-01	2.70E-01												
U-235	6.20E-02	7.50E-02						9.00E-02	3.70E-01					U
U-238	9.20E-01	2.80E-01												
Total U Alpha	**1.81E+00**	**3.96E-01**												
Alpha Sum	**5.99E+00**	**1.73E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E-01	2.80E-01						1.82E+00	7.80E-01					J
Pa-234m (Assumed from U-238)	9.20E-01	2.80E-01						0.00E+00	2.50E+02					UJ
Ac-227														
Ra-228	8.60E-01	4.30E-01												
Pa-231	1.00E-01	1.80E+00					U							
Beta Sum	**2.71E+00**	**6.23E-01**						**2.69E+00**	**2.50E+02**					
Total Activity Sum	**8.70E+00**	**1.84E+00**						**8.68E+00**	**2.50E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.55E+01	5.30E+00					J	**1.70**	**(from gamma)**		**88.5**			
Gross Beta	2.25E+01	5.30E+00					J	**3.71**	**0.08**		**157**			
Total Activity	2.90E+01	6.90E+00						**2.84**	**0.08**		**108**			

G01070026-08A			TLF 0457					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.70E-01					U
Ra-226	1.15E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	1.70E-01												
Th-230	8.90E-01	2.00E-01												
Th-232	7.70E-01	1.70E-01												
U-234	7.70E-01	2.50E-01												
U-235	3.30E-02	5.10E-02					U	2.00E-02	3.50E-01					U
U-238	8.90E-01	2.60E-01												
Total U Alpha	**1.69E+00**	**3.64E-01**												
Alpha Sum	**5.33E+00**	**1.46E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.60E-01						1.56E+00	7.60E-01					J
Pa-234m (Assumed from U-238)	8.90E-01	2.60E-01						-4.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	6.40E-01	3.70E-01												
Pa-231	1.00E-01	1.50E+00					U							
Beta Sum	**2.43E+00**	**5.52E-01**						**-1.79E+00**	**1.20E+01**					
Total Activity Sum	**7.77E+00**	**1.56E+00**						**3.55E+00**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.41E+01	5.10E+00					J	**1.65**	**(from gamma)**		**90.2**			
Gross Beta	2.10E+01	4.90E+00					J	**3.77**	**1.75**		**158**			
Total Activity	2.86E+01	6.60E+00						**3.07**	**1.82**		**115**			

G01070026-09A			TLF 0748					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.10E-01					U
Ra-226	1.11E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	2.00E-01												
Th-230	1.23E+00	2.50E-01												
Th-232	9.00E-01	2.00E-01												
U-234	1.40E+00	3.90E-01												
U-235	1.12E-01	9.10E-02						2.00E-01	3.40E-01					U
U-238	8.60E-01	2.80E-01												
Total U Alpha	**2.37E+00**	**4.89E-01**												
Alpha Sum	**6.42E+00**	**1.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.80E-01						2.14E+00	7.00E-01					J
Pa-234m (Assumed from U-238)	8.60E-01	2.80E-01						2.00E+00	9.60E+00					U
Ac-227														
Ra-228	7.70E-01	2.90E-01												
Pa-231	-1.00E-01	1.80E+00					U							
Beta Sum	**2.48E+00**	**5.36E-01**						**4.90E+00**	**9.63E+00**					
Total Activity Sum	**8.90E+00**	**1.84E+00**						**1.13E+01**	**9.79E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.74E+01	7.10E+00					J	**1.50**	**(from gamma)**		**92.2**			
Gross Beta	2.01E+01	5.10E+00					J	**3.44**	**1.39**		**156**			
Total Activity	2.33E+01	6.40E+00						**2.16**	**1.02**		**89.4**			

G01070026-10A			TLF 0749					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	3.30E-01					U
Ra-226	1.03E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	2.30E-01												
Th-230	9.30E-01	2.10E-01												
Th-232	9.10E-01	2.10E-01												
U-234	6.40E-01	2.40E-01												
U-235	1.21E-01	9.50E-02						0.00E+00	2.10E+00					U
U-238	6.00E-01	1.30E-01												
Total U Alpha	**1.36E+00**	**2.89E-01**												
Alpha Sum	**5.41E+00**	**1.06E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.00E-01	1.30E-01						1.15E+00	6.90E-01					J
Pa-234m (Assumed from U-238)	6.00E-01	1.30E-01						1.00E+00	9.20E+00					U
Ac-227														
Ra-228	8.50E-01	3.00E-01												
Pa-231	2.00E-01	1.00E+00					U							
Beta Sum	**2.07E+00**	**3.72E-01**						**3.02E+00**	**9.23E+00**					
Total Activity Sum	**7.49E+00**	**1.13E+00**						**8.44E+00**	**9.29E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.14E+01	5.20E+00					J	**1.13**	**(from gamma)**		**71.3**			
Gross Beta	2.28E+01	5.30E+00					J	**3.90**	**1.86**		**167**			
Total Activity	2.93E+01	6.90E+00						**3.12**	**1.80**		**119**			

G01070026-11A			TLF 0750					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.60E-01					U
Ra-226	1.25E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	1.90E-01												
Th-230	9.30E-01	2.10E-01												
Th-232	8.60E-01	2.00E-01												
U-234	9.20E-01	3.10E-01												
U-235	7.10E-02	8.10E-02						2.90E-01	3.90E-01					U
U-238	7.80E-01	2.80E-01												
Total U Alpha	**1.77E+00**	**4.26E-01**												
Alpha Sum	**4.97E+00**	**2.00E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.80E-01						3.00E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	7.80E-01	2.80E-01						1.00E+00	1.40E+01					U
Ac-227														
Ra-228	7.00E-01	3.50E-01												
Pa-231	-7.00E-01	2.10E+00					U							
Beta Sum	**2.18E+00**	**5.85E-01**						**4.62E+00**	**1.40E+01**					
Total Activity Sum	**7.15E+00**	**2.08E+00**						**9.59E+00**	**1.42E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.23E+01	5.20E+00					J	**1.32**	**(from gamma)**		**84.9**			
Gross Beta	2.11E+01	5.20E+00					J	**3.62**	**1.10**		**163**			
Total Activity	3.07E+01	7.20E+00						**3.14**	**1.33**		**124**			

G01070026-12A			TLF 0751					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	2.30E-01					U
Ra-226	1.54E+00	4.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.16E+00	2.30E-01												
Th-230	9.80E-01	2.10E-01												
Th-232	1.14E+00	2.30E-01												
U-234	9.80E-01	2.80E-01												
U-235	3.70E-02	5.20E-02					U	1.00E-01	3.40E-01					U
U-238	9.30E-01	2.70E-01												
Total U Alpha	**1.95E+00**	**3.92E-01**												
Alpha Sum	**8.21E+00**	**1.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	2.70E-01						8.80E-01	6.50E-01					J
Pa-234m (Assumed from U-238)	9.30E-01	2.70E-01						-1.00E+00	2.60E+01					UJ
Ac-227														
Ra-228	8.80E-01	3.40E-01												
Pa-231	1.60E+00	1.80E+00												
Beta Sum	**2.93E+00**	**5.55E-01**						**9.52E-01**	**2.60E+01**					
Total Activity Sum	**1.11E+01**	**1.85E+00**						**9.16E+00**	**2.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.24E+01	7.40E+00					J	**1.87**	**(from gamma)**		**92.7**			
Gross Beta	2.83E+01	6.50E+00					J	**3.89**	**1.02**		**162**			
Total Activity	3.46E+01	7.70E+00						**2.96**	**0.94**		**103**			

G01070026-13A			TLF 0752					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.60E-01					U
Ra-226	1.07E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.03E+00	2.20E-01												
Th-230	9.10E-01	2.00E-01												
Th-232	9.90E-01	2.20E-01												
U-234	8.00E-01	2.60E-01												
U-235	2.50E-02	4.70E-02					U	2.10E-01	3.60E-01					U
U-238	8.90E-01	2.80E-01												
Total U Alpha	**1.72E+00**	**3.85E-01**												
Alpha Sum	**5.27E+00**	**1.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.80E-01						2.13E+00	9.60E-01					J
Pa-234m (Assumed from U-238)	8.90E-01	2.80E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	1.03E+00	4.20E-01												
Pa-231	-5.00E-01	2.10E+00					U							
Beta Sum	**2.75E+00**	**6.30E-01**						**3.10E+00**	**1.20E+01**					
Total Activity Sum	**8.02E+00**	**2.08E+00**						**8.37E+00**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.53E+01	5.10E+00					J	**1.83**	**(from gamma)**		**97.6**			
Gross Beta	1.75E+01	4.70E+00					J	**3.11**	**1.11**		**146**			
Total Activity	2.80E+01	6.90E+00						**2.77**	**1.40**		**111**			

G01070026-14A			TLF 0753					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.00E-01					U
Ra-226	1.18E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	2.00E-01												
Th-230	1.02E+00	2.20E-01												
Th-232	8.30E-01	1.90E-01												
U-234	7.30E-01	2.50E-01												
U-235	1.17E-01	9.20E-02						-1.00E-01	1.30E+00					U
U-238	9.60E-01	3.00E-01												
Total U Alpha	**1.81E+00**	**4.01E-01**												
Alpha Sum	**5.79E+00**	**1.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.60E-01	3.00E-01						9.50E-01	8.20E-01					J
Pa-234m (Assumed from U-238)	9.60E-01	3.00E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	7.70E-01	4.60E-01												
Pa-231	1.00E-01	1.90E+00					U							
Beta Sum	**2.70E+00**	**6.66E-01**						**1.73E+00**	**1.20E+01**					
Total Activity Sum	**8.49E+00**	**1.94E+00**						**7.52E+00**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.74E+01	6.00E+00					J	**1.85**	**(from gamma)**		**100**			
Gross Beta	1.92E+01	5.10E+00					J	**3.21**	**1.34**		**151**			
Total Activity	3.05E+01	7.10E+00						**2.99**	**1.63**		**113**			

G01070026-15A			TLF 9768					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.20E-01					U
Ra-226	1.41E+00	3.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.10E-01												
Th-230	9.00E-01	2.00E-01												
Th-232	9.10E-01	2.00E-01												
U-234	8.30E-01	2.60E-01												
U-235	8.00E-02	7.10E-02						8.00E-02	3.20E-01					U
U-238	8.00E-01	2.60E-01												
Total U Alpha	**1.71E+00**	**3.74E-01**												
Alpha Sum	**5.70E+00**	**1.18E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.60E-01						2.60E+00	1.20E+00					J
Pa-234m (Assumed from U-238)	8.00E-01	2.60E-01						8.00E-01	9.40E+00					UJ
Ac-227														
Ra-228	5.40E-01	2.70E-01												
Pa-231	-2.00E-01	1.10E+00					U							
Beta Sum	**2.12E+00**	**4.75E-01**						**3.92E+00**	**9.48E+00**					
Total Activity Sum	**7.82E+00**	**1.27E+00**						**9.62E+00**	**9.55E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.11E+01	4.20E+00					J	**1.24**	**(from gamma)**		**64.3**			
Gross Beta	1.74E+01	4.70E+00					J	**3.24**	**1.27**		**157**			
Total Activity	3.00E+01	7.00E+00						**3.12**	**1.72**		**117**			

G01070026-16A			TLF 9769					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	2.00E-01					U
Ra-226	1.19E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	1.80E-01												
Th-230	8.90E-01	2.00E-01												
Th-232	8.90E-01	2.00E-01												
U-234	8.80E-01	2.90E-01												
U-235	-9.00E-03	4.90E-02					U	2.00E-01	3.40E-01					U
U-238	6.90E-01	2.50E-01												
Total U Alpha	**1.56E+00**	**3.86E-01**												
Alpha Sum	**7.27E+00**	**1.07E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	2.50E-01						9.90E-01	7.90E-01					J
Pa-234m (Assumed from U-238)	6.90E-01	2.50E-01						3.00E+00	9.40E+00					U
Ac-227														
Ra-228	7.30E-01	3.50E-01												
Pa-231	2.20E+00	1.00E+00												
Beta Sum	**2.37E+00**	**5.12E-01**						**4.98E+00**	**9.44E+00**					
Total Activity Sum	**9.65E+00**	**1.19E+00**						**1.23E+01**	**9.50E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.44E+01	5.60E+00					J	**1.25**	**(from gamma)**		**65.8**			
Gross Beta	1.65E+01	4.70E+00					J	**2.99**	**1.09**		**150**			
Total Activity	2.25E+01	6.40E+00						**1.97**	**0.89**		**80.0**			

G01070026-17A			TLF 0756					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.20E-01					U
Ra-226	1.05E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	2.10E-01												
Th-230	1.22E+00	2.50E-01												
Th-232	1.00E+00	2.20E-01												
U-234	1.03E+00	3.10E-01												
U-235	7.10E-02	7.10E-02						4.10E-01	3.20E-01					
U-238	1.06E+00	3.20E-01												
Total U Alpha	**2.16E+00**	**4.51E-01**												
Alpha Sum	**7.92E+00**	**1.19E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+00	3.20E-01						1.40E+00	1.20E+00					J
Pa-234m (Assumed from U-238)	1.06E+00	3.20E-01						-1.00E+00	3.70E+01					UJ
Ac-227														
Ra-228	9.70E-01	4.50E-01												
Pa-231	1.70E+00	1.10E+00												
Beta Sum	**3.29E+00**	**6.52E-01**						**1.57E+00**	**3.70E+01**					
Total Activity Sum	**1.12E+01**	**1.36E+00**						**9.50E+00**	**3.70E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.44E+01	5.00E+00					J	**1.26**	**(from gamma)**		**58.1**			
Gross Beta	2.06E+01	5.10E+00					J	**3.37**	**0.51**		**145**			
Total Activity	2.65E+01	6.70E+00						**2.24**	**0.45**		**81.1**			

G01070026-18A			TLF 0757					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	2.00E-01					U
Ra-226	9.00E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	1.90E-01												
Th-230	8.00E-01	1.80E-01												
Th-232	8.50E-01	1.90E-01												
U-234	5.70E-01	2.10E-01												
U-235	4.10E-02	5.60E-02					U	0.00E+00	7.00E+00					U
U-238	5.60E-01	2.10E-01												
Total U Alpha	**1.17E+00**	**3.02E-01**												
Alpha Sum	**4.28E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.60E-01	2.10E-01						1.00E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	5.60E-01	2.10E-01						-1.00E+00	1.40E+01					UJ
Ac-227														
Ra-228	9.50E-01	3.50E-01												
Pa-231	-3.00E-01	1.60E+00					U							
Beta Sum	**2.03E+00**	**4.98E-01**						**9.14E-01**	**1.40E+01**					
Total Activity Sum	**6.32E+00**	**1.61E+00**						**5.20E+00**	**1.41E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.06E+01	6.70E+00					J	**2.37**	**(from gamma)**		**131**			
Gross Beta	1.97E+01	5.30E+00					J	**3.32**	**1.25**		**163**			
Total Activity	2.65E+01	6.80E+00						**2.89**	**1.36**		**123**			

G01070026-19A			TLF 0762					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.10E-01					U
Ra-226	4.30E-01	1.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	2.20E-01												
Th-230	1.00E+00	2.30E-01												
Th-232	8.70E-01	2.10E-01												
U-234	7.60E-01	2.80E-01												
U-235	4.70E-02	7.30E-02					U	3.00E-02	2.80E-01					U
U-238	7.30E-01	2.70E-01												
Total U Alpha	**1.54E+00**	**3.96E-01**												
Alpha Sum	**5.49E+00**	**7.24E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.70E-01						-2.30E-01	8.80E-01					UJ
Pa-234m (Assumed from U-238)	7.30E-01	2.70E-01						-2.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	8.20E-01	4.50E-01												
Pa-231	8.00E-01	4.80E-01												
Beta Sum	**2.38E+00**	**5.93E-01**						**-1.31E+00**	**1.20E+01**					
Total Activity Sum	**7.86E+00**	**9.36E-01**						**4.17E+00**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.10E+00	4.40E+00					J	**0.81**	**(from gamma)**		**49.5**			
Gross Beta	2.31E+01	5.60E+00					J	**3.68**	**1.84**		**163**			
Total Activity	2.89E+01	7.20E+00						**2.90**	**1.76**		**114**			

G01070026-20A			TLF 0763					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.40E-01					U
Ra-226	8.90E-01	2.50E-01	7.50E-01	2.20E-01	**0.42**	**17.1**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	1.80E-01	9.70E-01	2.30E-01	**0.72**	**24.3**								
Th-230	8.50E-01	2.00E-01	7.00E-01	1.80E-01	**0.56**	**19.4**								
Th-232	7.10E-01	1.70E-01	8.10E-01	2.00E-01	**0.38**	**13.2**								
U-234	8.60E-01	2.90E-01	9.50E-01	3.20E-01	**0.21**	**9.94**								
U-235	5.70E-02	6.50E-02	1.70E-01	1.20E-01	**0.83**	**99.6**		-7.00E-02	9.00E-01					U
U-238	9.10E-01	3.00E-01	7.50E-01	2.70E-01	**0.40**	**19.3**								
Total U Alpha	**1.83E+00**	**4.22E-01**	**1.87E+00**	**4.36E-01**										
Alpha Sum	**7.11E+00**	**1.72E+00**	**5.10E+00**	**6.03E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.10E-01	3.00E-01	7.50E-01	2.70E-01	**0.40**	**19.3**		8.40E-01	5.10E-01					J
Pa-234m (Assumed from U-238)	9.10E-01	3.00E-01	7.50E-01	2.70E-01	**0.40**	**19.3**		-2.00E+00	1.30E+01					UJ
Ac-227														
Ra-228	6.60E-01	3.20E-01												
Pa-231	2.30E+00	1.80E+00												
Beta Sum	**2.76E+00**	**5.74E-01**	**1.50E+00**	**3.82E-01**				**-2.24E-01**	**1.30E+01**					
Total Activity Sum	**9.86E+00**	**1.82E+00**	**6.60E+00**	**7.14E-01**				**6.88E+00**	**1.31E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	6.10E+00	1.13E+01	5.10E+00	**0.60**	**35.0**	J	**1.42**	**(from gamma)**		**77.5**			
Gross Beta	1.72E+01	4.90E+00	1.92E+01	5.00E+00	**0.29**	**11.0**	J	**2.93**	**1.25**		**145**			
Total Activity	2.72E+01	7.00E+00	2.78E+01	7.00E+00	**0.06**	**2.18**		**2.40**	**1.37**		**93.6**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070031

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0454	G01070031-01A
TLF-0455	G01070031-02A
TLF-0458	G01070031-03A
TLF-0459	G01070031-04A
TLF-0462	G01070031-05A
TLF-0463	G01070031-06A
TLF-0500	G01070031-07A
TLF-0501	G01070031-08A
TLF-0730	G01070031-09A
TLF-9545	G01070031-10A
TLF-0731	G01070031-11A
TLF-0740	G01070031-12A
TLF-0786	G01070031-13A
TLF-0787	G01070031-14A
TLF-0780	G01070031-15A
TLF-0781	G01070031-16A
TLF-0783	G01070031-17A
TLF-0784	G01070031-18A
TLF-0868	G01070031-19A
TLF-0869	G01070031-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. All samples results for ^{228}Ra and ^{234}Th were greater than 5 times the rinsate blank; therefore, no qualification of the ^{228}Ra and ^{234}Th results is necessary. **However, it is recommended that samples TLF-0458, TLF-0462, TLF-0463, TLF-0500, TLF-0501, TLF-0787, TLF-0780, TLF-0784, TLF-0868, and TLF-0869 for ^{234}Pa be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analyses for all gamma spectrometry analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The software calculates the uncertainty for a positive result in the same manner. Therefore it is acceptable for the laboratory to report the absolute value of the negative uncertainty.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified, but not reported, in sixteen of the samples above the DL. The activity range for ^{40}K was 5.92E0 pCi/g to 2.39E1 pCi/g, which are normal levels for ^{40}K naturally found in soil. Also, ^{137}Cs was identified, but not reported, in five of the samples above the DL. The activity range for ^{137}Cs was 1.46E-1 pCi/g to 1.76E-1pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the $^{228/230/232}$Th analyses. All samples with $^{228/230232}$Th results less than 5 times the blank should be qualified as estimated. The $^{228/230232}$Th results were all greater than 5 times the blank results. Therefore, no qualification of the $^{228/230232}$Th results is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 24% for all samples for the alpha analyses. However, there is greater than 10% uncertainty in the sample-specific chemical recovery results for the isotopic uranium analysis for samples TLF-0454 (10.2%), TLF-0462 (10.3%), TLF-0730 (10.3%), TLF-9545 (10.1%), TLF-0740 (11.3%), TLF-0787 (10.2%), TLF-0781 (10.3%), TLF-0783 (10.1%), TLF-0784 (10.5%) and TLF-0869 (10.5%). **Therefore, it is recommended that the isotopic uranium results for samples TLF-0454, TLF-0462, TLF-0730, TLF-9545, TLF-0740, TLF-0787, TLF-0781 TLF-0783, TLF-0784 and TLF-0869 be qualified as estimated (J).**

Spectral Analysis:

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.8 MeV and 6.3 MeV, regions. It is assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 69%. The sample specific chemical recovery for sample TLF-0454 exceeded 100%. The laboratory was requested in the Statement of Work to calculate results using 100% if the sample-specific chemical

recovery exceeded 100%. The laboratory, however, used the calculated recovery (103%), which will place a negative bias on the final results. Since the recovery did not have a greater than 10% negative bias, no qualification of the data is necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross beta analyses. There was an indication of blank contamination in the gross alpha analyses. All samples with gross alpha results less than 5 times the blank should be qualified as estimated. All samples had gross alpha results greater than 5 times the blank. Therefore, no qualification of the gross alpha results is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recoveries for the gross alpha/beta LCSs are within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DER for the gross alpha analyses is within acceptable limits. The duplicate DER for the gross beta analyses is 2.19, which is outside acceptable limits. The RPD (84.7%) was also outside acceptable limits. **Therefore, it is recommended that all gross beta results be qualified as estimated (J).**

Matrix Spike Sample:

The MS recoveries for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results did not meet the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra results were in agreement with the ^{232}Th results.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF-0455, TLF-0463 and TLF-0869. These differences are most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0454 (1.72), TLF-0455 (1.40), TLF-0458 (1.81), TLF-0459 (1.34), TLF-0462 (1.33), TLF-0463 (1.49), TLF-0500 (1.63), TLF-0501 (1.97), TLF-0730 (1.51), TLF-9545 (1.36), TLF-0731 (2.01), TLF-0740 (1.47), TLF-0786 (2.01), TLF-0780 (2.09), TLF-0783 (1.38), TLF-0868 (1.81) and TLF-0869 (1.30) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (104%, 63.4%, 115%, 77.9%, 76.8%, 87.0%, 97.6%, 109%, 86.2%, 72.1%, 92.8%, 80.3%, 89.7%, 113%, 80.8%, 104%, and 72.1%, respectfully) also exceed acceptable limits. The samples have gross alpha results that are 2 to 4 times greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possibility of missing activity be looked into in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs (2.14 to 4.68) for all samples were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (102% to 167%) for all samples also exceed acceptable limits. The samples have gross beta results 3 to 11 times greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity DERs (2.02 to 3.84) for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the sum of the alpha and beta emitters within a 99% confidence level. The RPDs (72.0% to 133%) also exceed acceptable limits. The samples have a total activity result 2 to 5 times greater than the sum of the alpha and beta emitters. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future. No qualification of the data is necessary since the total activity analysis is for comparison purposes.**

G01070031-01A			TLF-0454					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.40E-01					U
Ra-226	8.30E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.80E-01	1.90E-01												
Th-230	9.60E-01	2.40E-01												
Th-232	8.60E-01	2.20E-01												
U-234	9.30E-01	3.20E-01					J							
U-235	8.50E-02	9.90E-02					J	4.00E-02	3.30E-01					U
U-238	7.10E-01	2.80E-01					J							
Total U Alpha	**1.73E+00**	**4.37E-01**												
Alpha Sum	**5.15E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.10E-01	2.80E-01						1.73E+00	7.20E-01					
Pa-234m (Assumed from U-238)	7.10E-01	2.80E-01						4.00E+00	1.10E+01					U
Ac-227														
Ra-228	5.40E-01	3.00E-01												
Pa-231	1.00E-01	1.60E+00					U							
Beta Sum	**1.97E+00**	**5.33E-01**						**6.28E+00**	**1.10E+01**					
Total Activity Sum	**7.12E+00**	**1.65E+00**						**1.14E+01**	**1.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.63E+01	6.30E+00					J	**1.72**	**(from gamma)**		**104**			
Gross Beta	1.99E+01	4.90E+00					J	**3.64**	**1.13**		**164**			
Total Activity	2.97E+01	6.70E+00						**3.27**	**1.41**		**123**			

G01070031-02A			TLF-0455					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.80E-01					U
Ra-226	1.18E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.24E+00	2.80E-01												
Th-230	1.34E+00	3.00E-01												
Th-232	1.13E+00	2.60E-01												
U-234	7.50E-01	2.70E-01												
U-235	8.40E-02	9.60E-02						0.00E+00	1.20E+00					
U-238	9.00E-01	3.00E-01												
Total U Alpha	**1.73E+00**	**4.15E-01**												
Alpha Sum	**8.04E+00**	**1.09E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	3.00E-01						9.00E-01	7.70E-01					
Pa-234m (Assumed from U-238)	9.00E-01	3.00E-01						3.60E+00	9.10E+00					U
Ac-227														
Ra-228	9.40E-01	3.50E-01												
Pa-231	1.57E+00	9.30E-01												
Beta Sum	**2.93E+00**	**5.61E-01**						**5.63E+00**	**9.14E+00**					
Total Activity Sum	**1.10E+01**	**1.23E+00**						**1.37E+01**	**9.20E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.55E+01	5.20E+00					J	**1.40**	**(from gamma)**		**63.4**			
Gross Beta	2.75E+01	5.50E+00					J	**4.44**	**2.05**		**162**			
Total Activity	3.85E+01	7.80E+00						**3.49**	**2.06**		**111**			

G01070031-03A			TLF-0458					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.50E-02	9.60E-02					U
Ra-226	1.00E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	1.90E-01												
Th-230	1.11E+00	2.70E-01												
Th-232	5.30E-01	1.70E-01												
U-234	6.90E-01	2.50E-01												
U-235	9.30E-02	9.40E-02						1.40E-01	2.70E-01					U
U-238	1.02E+00	3.20E-01												
Total U Alpha	**1.80E+00**	**4.17E-01**												
Alpha Sum	**4.53E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.02E+00	3.20E-01						9.80E-01	6.20E-01					
Pa-234m (Assumed from U-238)	1.02E+00	3.20E-01						-1.50E+00	1.50E+00					UJ
Ac-227														
Ra-228	4.00E-01	3.20E-01												
Pa-231	-6.00E-01	1.60E+00					U							
Beta Sum	**2.37E+00**	**5.87E-01**						**-1.92E-01**	**1.67E+00**					
Total Activity Sum	**6.90E+00**	**1.67E+00**						**4.34E+00**	**2.29E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.68E+01	6.60E+00					J	**1.81**	**(from gamma)**		**115**			
Gross Beta	1.70E+01	4.50E+00					J	**3.22**	**3.58**		**151**			
Total Activity	2.99E+01	6.60E+00						**3.38**	**3.66**		**125**			

G01070031-04A			TLF-0459					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.40E-01					U
Ra-226	1.02E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.50E-01												
Th-230	1.05E+00	2.50E-01												
Th-232	1.23E+00	2.80E-01												
U-234	1.00E+00	3.20E-01												
U-235	1.40E-01	1.10E-01						0.00E+00	2.20E+00					U
U-238	8.60E-01	2.90E-01												
Total U Alpha	**2.00E+00**	**4.46E-01**												
Alpha Sum	**5.93E+00**	**2.01E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.90E-01						1.10E+00	1.40E+00					U
Pa-234m (Assumed from U-238)	8.60E-01	2.90E-01						2.00E+00	1.10E+01					U
Ac-227														
Ra-228	1.05E+00	4.00E-01												
Pa-231	-4.00E-01	2.10E+00					U							
Beta Sum	**2.72E+00**	**6.26E-01**						**4.10E+00**	**1.11E+01**					
Total Activity Sum	**8.65E+00**	**2.11E+00**						**1.00E+01**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.35E+01	5.30E+00					J	**1.34**	**(from gamma)**		**77.9**			
Gross Beta	3.00E+01	5.80E+00					J	**4.68**	**2.07**		**167**			
Total Activity	3.93E+01	8.00E+00						**3.70**	**2.12**		**128**			

G01070031-05A			TLF-0462					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.20E-01					U
Ra-226	5.20E-01	1.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.90E-01	1.40E-01												
Th-230	7.90E-01	1.80E-01												
Th-232	6.30E-01	1.50E-01												
U-234	8.20E-01	2.80E-01					J							
U-235	7.00E-02	7.00E-02					J	2.10E-01	3.70E-01					U
U-238	6.70E-01	2.40E-01					J							
Total U Alpha	**1.56E+00**	**3.75E-01**												
Alpha Sum	**4.54E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.70E-01	2.40E-01						3.10E+00	1.20E+00					
Pa-234m (Assumed from U-238)	6.70E-01	2.40E-01						-1.00E+00	1.70E+01					UJ
Ac-227														
Ra-228	6.70E-01	3.50E-01												
Pa-231	5.00E-01	1.50E+00					U							
Beta Sum	**2.07E+00**	**5.20E-01**						**2.83E+00**	**1.70E+01**					
Total Activity Sum	**6.61E+00**	**1.53E+00**						**7.37E+00**	**1.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.02E+01	4.00E+00					J	**1.33**	**(from gamma)**		**76.8**			
Gross Beta	1.59E+01	3.50E+00					J	**3.91**	**0.75**		**154**			
Total Activity	2.57E+01	5.70E+00						**3.23**	**1.02**		**118**			

G01070031-06A			TLF-0463					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.90E-01					U
Ra-226	9.20E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.00E-01												
Th-230	6.90E-01	1.80E-01												
Th-232	8.60E-01	2.10E-01												
U-234	9.20E-01	3.10E-01												
U-235	2.90E-02	7.30E-02					U	4.00E-02	3.70E-01					U
U-238	8.00E-01	2.80E-01												
Total U Alpha	**1.75E+00**	**4.24E-01**												
Alpha Sum	**5.75E+00**	**7.49E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.80E-01						1.60E+00	1.10E+00					
Pa-234m (Assumed from U-238)	8.00E-01	2.80E-01						-2.60E-01	5.80E-01					UJ
Ac-227														
Ra-228	8.10E-01	3.10E-01												
Pa-231	8.00E-01	5.00E-01												
Beta Sum	**2.51E+00**	**5.06E-01**						**2.25E+00**	**1.28E+00**					
Total Activity Sum	**8.26E+00**	**9.04E-01**						**8.00E+00**	**1.49E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.46E+01	5.90E+00					J	**1.49**	**(from gamma)**		**87.0**			
Gross Beta	1.61E+01	4.60E+00					J	**2.94**	**2.90**		**146**			
Total Activity	3.55E+01	7.50E+00						**3.61**	**3.60**		**125**			

G01070031-07A			TLF-0500					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.10E-01					U
Ra-226	7.80E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	2.00E-01												
Th-230	8.80E-01	2.20E-01												
Th-232	6.70E-01	1.80E-01												
U-234	7.80E-01	2.80E-01												
U-235	8.60E-02	8.70E-02						2.30E-01	3.70E-01					U
U-238	7.70E-01	2.70E-01												
Total U Alpha	**1.64E+00**	**3.99E-01**												
Alpha Sum	**4.89E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.70E-01						2.02E+00	7.60E-01					
Pa-234m (Assumed from U-238)	7.70E-01	2.70E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	7.20E-01	2.90E-01												
Pa-231	2.00E-01	1.60E+00					U							
Beta Sum	**2.28E+00**	**5.16E-01**						**2.76E+00**	**1.20E+01**					
Total Activity Sum	**7.17E+00**	**1.64E+00**						**7.65E+00**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.42E+01	5.50E+00					J	**1.63**	**(from gamma)**		**97.6**			
Gross Beta	1.67E+01	4.40E+00					J	**3.25**	**1.09**		**152**			
Total Activity	3.55E+01	7.20E+00						**3.84**	**1.97**		**133**			

G01070031-08A			TLF-0501					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.40E-01					U
Ra-226	1.06E+00	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.10E-01												
Th-230	8.20E-01	2.10E-01												
Th-232	7.40E-01	2.00E-01												
U-234	6.70E-01	2.80E-01												
U-235	3.00E-02	9.00E-02					U	2.20E-01	3.10E-01					U
U-238	8.20E-01	2.90E-01												
Total U Alpha	**1.52E+00**	**4.13E-01**												
Alpha Sum	**4.86E+00**	**1.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.20E-01	2.90E-01						1.20E+00	6.30E-01					
Pa-234m (Assumed from U-238)	8.20E-01	2.90E-01						0.00E+00	2.00E+01					UJ
Ac-227														
Ra-228	6.10E-01	2.80E-01												
Pa-231	-1.00E-01	1.40E+00					U							
Beta Sum	**2.24E+00**	**5.24E-01**						**1.80E+00**	**2.00E+01**					
Total Activity Sum	**7.10E+00**	**1.49E+00**						**6.66E+00**	**2.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.64E+01	5.70E+00					J	**1.97**	**(from gamma)**		**109**			
Gross Beta	2.08E+01	4.50E+00					J	**4.10**	**0.93**		**161**			
Total Activity	3.50E+01	7.40E+00						**3.70**	**1.33**		**133**			

G01070031-09A			TLF-0730					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.10E-01	-1.00E-02	1.50E-01	**0.00**	**0.00**	U
Ra-226	1.20E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	2.10E-01												
Th-230	9.70E-01	2.20E-01												
Th-232	9.40E-01	2.10E-01												
U-234	6.10E-01	2.60E-01					J							
U-235	6.50E-02	7.50E-02					J	9.00E-02	2.60E-01	2.00E-02	4.50E-01	**0.13**	**127**	U
U-238	7.80E-01	2.90E-01					J							
Total U Alpha	**1.46E+00**	**3.97E-01**												
Alpha Sum	**5.37E+00**	**1.41E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.90E-01						1.58E+00	7.00E-01	1.70E+00	1.10E+00	**0.09**	**7.32**	
Pa-234m (Assumed from U-238)	7.80E-01	2.90E-01						3.10E+00	9.10E+00	1.00E+00	1.20E+01	**0.14**	**102**	U
Ac-227														
Ra-228	7.60E-01	3.10E-01	8.00E-01	4.20E-01	**0.08**	**5.13**								
Pa-231	-1.00E-01	1.40E+00	-3.00E-01	2.10E+00	**0.08**	**100**	U							
Beta Sum	**2.31E+00**	**5.41E-01**						**5.43E+00**	**9.13E+00**	**3.46E+00**	**1.21E+01**			
Total Activity Sum	**7.67E+00**	**1.51E+00**						**1.08E+01**	**9.24E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.35E+01	5.20E+00					J	**1.51**	**(from gamma)**		**86.2**			
Gross Beta	1.85E+01	4.20E+00					J	**3.82**	**1.30**		**156**			
Total Activity	3.45E+01	7.30E+00						**3.60**	**2.01**		**127**			

G01070031-10A			TLF-9545					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.40E-01					U
Ra-226	7.90E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.00E-01												
Th-230	9.50E-01	2.20E-01												
Th-232	8.90E-01	2.10E-01												
U-234	7.60E-01	2.80E-01					J							
U-235	1.04E-01	9.30E-02					J	2.30E-01	3.20E-01					U
U-238	1.15E+00	3.60E-01					J							
Total U Alpha	**2.01E+00**	**4.65E-01**												
Alpha Sum	**6.11E+00**	**8.51E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.15E+00	3.60E-01						8.90E-01	7.10E-01					
Pa-234m (Assumed from U-238)	1.15E+00	3.60E-01						1.10E+00	7.10E+00					U
Ac-227														
Ra-228	6.60E-01	3.50E-01												
Pa-231	7.20E-01	6.30E-01												
Beta Sum	**3.05E+00**	**6.22E-01**						**2.74E+00**	**7.14E+00**					
Total Activity Sum	**9.16E+00**	**1.05E+00**						**8.85E+00**	**7.19E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.30E+01	5.00E+00					J	**1.36**	**(from gamma)**		**72.1**			
Gross Beta	1.80E+01	4.20E+00					J	**3.52**	**1.84**		**142**			
Total Activity	3.37E+01	7.30E+00						**3.33**	**2.42**		**115**			

G01070031-11A			TLF-0731					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.90E-01					U
Ra-226	1.00E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	2.10E-01												
Th-230	1.04E+00	2.20E-01												
Th-232	1.03E+00	2.20E-01												
U-234	7.60E-01	2.80E-01												
U-235	6.90E-02	8.10E-02						3.80E-01	4.30E-01					
U-238	9.30E-01	3.10E-01												
Total U Alpha	**1.76E+00**	**4.26E-01**												
Alpha Sum	**6.59E+00**	**9.00E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	3.10E-01						1.93E+00	9.90E-01					
Pa-234m (Assumed from U-238)	9.30E-01	3.10E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	1.68E+00	5.00E-01												
Pa-231	9.20E-01	7.20E-01												
Beta Sum	**3.65E+00**	**6.71E-01**						**4.72E+00**	**1.11E+01**					
Total Activity Sum	**1.02E+01**	**1.12E+00**						**1.13E+01**	**1.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.80E+01	5.60E+00					J	**2.01**	**(from gamma)**		**92.8**			
Gross Beta	2.59E+01	5.30E+00					J	**4.16**	**1.73**		**151**			
Total Activity	4.01E+01	8.00E+00						**3.70**	**2.11**		**119**			

G01070031-12A			TLF-0740					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	2.10E-01					U
Ra-226	1.25E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.31E+00	2.70E-01												
Th-230	1.21E+00	2.50E-01												
Th-232	1.27E+00	2.60E-01												
U-234	1.50E+00	4.70E-01					J							
U-235	1.80E-01	1.40E-01					J	-1.60E-01	5.40E-01					U
U-238	1.48E+00	4.70E-01					J							
Total U Alpha	**3.16E+00**	**6.79E-01**												
Alpha Sum	**8.11E+00**	**1.69E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.48E+00	4.70E-01						1.43E+00	8.90E-01					
Pa-234m (Assumed from U-238)	1.48E+00	4.70E-01						2.50E+00	9.30E+00					U
Ac-227														
Ra-228	1.29E+00	3.70E-01												
Pa-231	-1.00E-01	1.60E+00					U							
Beta Sum	**4.24E+00**	**7.85E-01**						**5.21E+00**	**9.35E+00**					
Total Activity Sum	**1.23E+01**	**1.86E+00**						**1.33E+01**	**9.50E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.90E+01	7.20E+00					J	**1.47**	**(from gamma)**		**80.3**			
Gross Beta	1.77E+01	4.80E+00					J	**2.77**	**1.19**		**123**			
Total Activity	3.37E+01	7.20E+00						**2.87**	**1.71**		**92.7**			

G01070031-13A			TLF-0786					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.30E-01					U
Ra-226	2.86E+00	6.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.91E+00	4.30E-01												
Th-230	1.80E+00	4.10E-01												
Th-232	1.60E+00	3.70E-01												
U-234	2.09E+00	5.20E-01												
U-235	1.14E-01	9.30E-02						1.70E-01	3.40E-01					U
U-238	1.82E+00	4.70E-01												
Total U Alpha	**4.02E+00**	**7.07E-01**												
Alpha Sum	**1.21E+01**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.82E+00	4.70E-01						3.50E+00	1.40E+00					
Pa-234m (Assumed from U-238)	1.82E+00	4.70E-01						1.30E+00	7.90E+00					U
Ac-227														
Ra-228	1.38E+00	4.30E-01												
Pa-231	-1.00E-01	1.10E+00					U							
Beta Sum	**5.01E+00**	**8.03E-01**						**6.17E+00**	**8.04E+00**					
Total Activity Sum	**1.71E+01**	**1.72E+00**						**1.83E+01**	**8.18E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.18E+01	9.70E+00					J	**2.01**	**(from gamma)**		**89.7**			
Gross Beta	1.54E+01	4.80E+00					J	**2.14**	**0.99**		**102**			
Total Activity	3.75E+01	7.80E+00						**2.55**	**1.70**		**74.7**			

G01070031-14A			TLF-0787					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.30E-01					U
Ra-226	1.04E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.30E-01												
Th-230	9.60E-01	2.50E-01												
Th-232	9.20E-01	2.40E-01												
U-234	7.10E-01	2.80E-01					J							
U-235	1.30E-01	1.10E-01					J	1.30E-01	3.40E-01					U
U-238	8.30E-01	3.10E-01					J							
Total U Alpha	**1.67E+00**	**4.32E-01**												
Alpha Sum	**4.97E+00**	**1.67E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	3.10E-01						1.10E+00	6.90E-01					
Pa-234m (Assumed from U-238)	8.30E-01	3.10E-01						-2.50E-01	3.50E-01					UJ
Ac-227														
Ra-228	9.40E-01	3.20E-01												
Pa-231	-5.00E-01	1.70E+00					U							
Beta Sum	**2.54E+00**	**5.80E-01**						**1.73E+00**	**8.62E-01**					
Total Activity Sum	**7.51E+00**	**1.77E+00**						**6.70E+00**	**1.88E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.18E+01	5.60E+00					J	**1.17**	**(from gamma)**		**81.5**			
Gross Beta	2.28E+01	5.50E+00					J	**3.66**	**3.78**		**160**			
Total Activity	2.78E+01	6.70E+00						**2.93**	**3.03**		**115**			

G01070031-15A			TLF-0780					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.20E-01					U
Ra-226	9.70E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.30E-01												
Th-230	9.60E-01	2.40E-01												
Th-232	9.00E-01	2.20E-01												
U-234	8.90E-01	3.10E-01												
U-235	5.00E-02	7.10E-02					U	-1.00E-02	3.20E-01					U
U-238	1.01E+00	3.30E-01												
Total U Alpha	**1.95E+00**	**4.58E-01**												
Alpha Sum	**5.51E+00**	**1.34E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.01E+00	3.30E-01						3.40E+00	1.60E+00					
Pa-234m (Assumed from U-238)	1.01E+00	3.30E-01						-1.00E+00	1.90E+01					UJ
Ac-227														
Ra-228	7.60E-01	3.20E-01												
Pa-231	-2.00E-01	1.30E+00					U							
Beta Sum	**2.76E+00**	**5.87E-01**						**3.14E+00**	**1.91E+01**					
Total Activity Sum	**8.27E+00**	**1.47E+00**						**8.65E+00**	**1.91E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.98E+01	6.70E+00					J	**2.09**	**(from gamma)**		**113**			
Gross Beta	1.89E+01	4.80E+00					J	**3.34**	**0.80**		**149**			
Total Activity	3.51E+01	7.40E+00						**3.56**	**1.29**		**124**			

G01070031-16A			TLF-0781					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.70E-01					U
Ra-226	8.50E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.10E-01												
Th-230	8.50E-01	2.20E-01												
Th-232	7.80E-01	2.00E-01												
U-234	7.80E-01	3.00E-01					J							
U-235	4.60E-02	8.40E-02					UJ	1.30E-01	3.80E-01					U
U-238	6.80E-01	2.70E-01					J							
Total U Alpha	**1.51E+00**	**4.12E-01**												
Alpha Sum	**5.89E+00**	**1.73E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.80E-01	2.70E-01						9.80E-01	7.10E-01					
Pa-234m (Assumed from U-238)	6.80E-01	2.70E-01						1.00E+00	1.00E+01					U
Ac-227														
Ra-228	6.80E-01	3.40E-01												
Pa-231	1.20E+00	1.80E+00					U							
Beta Sum	**2.18E+00**	**5.55E-01**						**2.80E+00**	**1.00E+01**					
Total Activity Sum	**8.07E+00**	**1.82E+00**						**8.69E+00**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.60E+00	5.50E+00					J	**0.64**	**(from gamma)**		**48.0**			
Gross Beta	1.83E+01	4.50E+00					J	**3.55**	**1.41**		**157**			
Total Activity	3.17E+01	6.80E+00						**3.36**	**1.88**		**119**			

G01070031-17A			TLF-0783					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.20E-01					U
Ra-226	1.42E+00	3.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.31E+00	3.20E-01												
Th-230	1.51E+00	3.50E-01												
Th-232	1.13E+00	2.80E-01												
U-234	1.35E+00	4.00E-01					J							
U-235	6.40E-02	7.30E-02					J	1.90E-01	3.70E-01					U
U-238	1.71E+00	4.70E-01					J							
Total U Alpha	**3.12E+00**	**6.21E-01**												
Alpha Sum	**8.49E+00**	**1.34E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.71E+00	4.70E-01						1.20E+00	1.00E+00					
Pa-234m (Assumed from U-238)	1.71E+00	4.70E-01						2.30E+00	8.60E+00					U
Ac-227														
Ra-228	1.50E+00	3.90E-01												
Pa-231	0.00E+00	1.10E+00					U							
Beta Sum	**4.92E+00**	**7.82E-01**						**5.00E+00**	**8.67E+00**					
Total Activity Sum	**1.34E+01**	**1.55E+00**						**1.35E+01**	**8.77E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.00E+01	8.20E+00					J	**1.38**	**(from gamma)**		**80.8**			
Gross Beta	1.66E+01	4.40E+00					J	**2.61**	**1.19**		**109**			
Total Activity	2.85E+01	7.30E+00						**2.02**	**1.32**		**72.0**			

G01070031-18A			TLF-0784					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	3.60E-01					U
Ra-226	7.50E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	2.40E-01												
Th-230	8.00E-01	2.10E-01												
Th-232	9.30E-01	2.30E-01												
U-234	7.00E-01	2.80E-01					J							
U-235	1.20E-01	1.10E-01					J	3.00E-02	2.90E-01					U
U-238	9.30E-01	3.30E-01					J							
Total U Alpha	**1.75E+00**	**4.47E-01**												
Alpha Sum	**5.12E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	3.30E-01						1.26E+00	6.70E-01					
Pa-234m (Assumed from U-238)	9.30E-01	3.30E-01						-2.00E+00	1.00E+01					UJ
Ac-227														
Ra-228	6.90E-01	2.80E-01												
Pa-231	-1.00E-01	1.60E+00					U							
Beta Sum	**2.54E+00**	**5.77E-01**						**-6.20E-02**	**1.00E+01**					
Total Activity Sum	**7.66E+00**	**1.68E+00**						**5.06E+00**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.40E+00	4.70E+00					J	**0.86**	**(from gamma)**		**59.0**			
Gross Beta	1.90E+01	4.40E+00					J	**3.71**	**1.74**		**153**			
Total Activity	2.62E+01	6.50E+00						**2.76**	**1.75**		**110**			

G01070031-19A			TLF-0868					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.50E-01					U
Ra-226	1.28E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	2.10E-01												
Th-230	9.80E-01	2.20E-01												
Th-232	9.20E-01	2.20E-01												
U-234	7.00E-01	2.60E-01												
U-235	7.30E-02	8.50E-02						1.90E-01	3.40E-01					U
U-238	8.10E-01	2.90E-01												
Total U Alpha	**1.58E+00**	**3.99E-01**												
Alpha Sum	**5.55E+00**	**1.66E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E-01	2.90E-01						2.80E+00	1.00E+00					
Pa-234m (Assumed from U-238)	8.10E-01	2.90E-01						0.00E+00	1.10E+02					UJ
Ac-227														
Ra-228	9.40E-01	3.90E-01												
Pa-231	-1.00E-01	1.70E+00					U							
Beta Sum	**2.55E+00**	**6.02E-01**						**3.73E+00**	**1.10E+02**					
Total Activity Sum	**8.10E+00**	**1.76E+00**						**9.28E+00**	**1.10E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.77E+01	6.50E+00					J	**1.81**	**(from gamma)**		**104**			
Gross Beta	1.75E+01	4.60E+00					J	**3.22**	**0.13**		**149**			
Total Activity	3.36E+01	7.10E+00						**3.49**	**0.22**		**122**			

G01070031-20A			TLF-0869					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.50E-01	1.90E-01					U
Ra-226	1.04E+00	2.60E-01	1.02E+00	2.70E-01	**0.05**	**1.94**								
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.10E-01	8.70E-01	2.30E-01	**0.13**	**4.71**								
Th-230	8.00E-01	2.00E-01	7.90E-01	2.20E-01	**0.03**	**1.26**								
Th-232	8.50E-01	2.10E-01	9.60E-01	2.50E-01	**0.34**	**12.2**								
U-234	1.00E+00	3.50E-01	9.00E-01	3.20E-01	**0.21**	**10.5**	J							
U-235	4.80E-02	6.70E-02	1.90E-01	1.30E-01	**0.97**	**119**	UJ	-1.20E-01	8.20E-01					U
U-238	9.40E-01	3.30E-01	1.00E+00	3.30E-01	**0.13**	**6.19**	J							
Total U Alpha	**1.99E+00**	**4.86E-01**	**2.09E+00**	**4.78E-01**										
Alpha Sum	**7.15E+00**	**1.11E+00**	**5.73E+00**	**6.82E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.40E-01	3.30E-01	1.00E+00	3.30E-01	**0.13**	**6.19**		1.10E+00	1.20E+00					
Pa-234m (Assumed from U-238)	9.40E-01	3.30E-01	1.00E+00	3.30E-01	**0.13**	**6.19**		-2.00E+00	1.40E+01					UJ
Ac-227														
Ra-228	5.80E-01	3.30E-01												
Pa-231	1.82E+00	9.90E-01												
Beta Sum	**2.68E+00**	**5.84E-01**	**2.00E+00**	**4.67E-01**				**-1.02E-01**	**1.41E+01**					
Total Activity Sum	**9.82E+00**	**1.25E+00**	**7.73E+00**	**8.26E-01**				**7.04E+00**	**1.41E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.52E+01	6.10E+00	9.60E+00	4.80E+00	**0.72**	**45.2**	J	**1.30**	**(from gamma)**		**72.1**			
Gross Beta	2.42E+01	5.50E+00	9.80E+00	3.60E+00	**2.19**	**84.7**	J	**3.89**	**1.61**		**160**			
Total Activity	3.42E+01	7.20E+00	3.19E+01	7.20E+00	**0.23**	**6.96**		**3.34**	**1.72**		**111**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070034

This sample delivery group (SDG) contained sixteen individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0754	G01070034-01A
TLF-0755	G01070034-02A
TLF-0758	G01070034-03A
TLF-0759	G01070034-04A
TLF-0760	G01070034-05A
TLF-0761	G01070034-06A
TLF-9546	G01070034-07A
TLF-0732	G01070034-08A
TLF-0733	G01070034-09A
TLF-0502	G01070034-10A
TLF-0503	G01070034-11A
TLF-0734	G01070034-12A
TLF-0735	G01070034-13A
TLF-0736	G01070034-14A
TLF-0737	G01070034-15A
TLF-0738	G01070034-16A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\mathrm{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was indication of blank contamination in the method blank for ^{234}Th. All samples with results less than 5 times the method blank for ^{234}Th should be qualified as estimated. **Therefore, it is recommended that ^{234}Th results for all samples be qualified as estimated (J).**

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. Based on assumed sample and rinsate sizes, all sample results for ^{228}Ra analyses are greater than 5 times the rinsate blank. **However, samples TLF-0754, TLF-0755, TLF-0758, TLF-0760, TLF-0761, TLF-9546, TLF-0732, TLF-0733, TLF-0502, TLF-0734, TLF-0735, TLF-0736, TLF-0736 (laboratory duplicate), and TLF-0738 for ^{234}Th, and TLF-0755, TLF-0761, TLF-0732, and TLF-0502 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in all but three (TLF-0761, TLF-9546, and TLF-0735) of the samples above the required DL (1.65*TPU). The activity range for ^{40}K was 8.55 " 1.65 pCi/g to 22.19 " 2.99 pCi/g, which are normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0755 and TLF-0738 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.081 " 0.074 pCi/g to 0.102 " 0.067 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{228}Th and ^{232}Th analyses. All samples with ^{228}Th and ^{230}Th results less than 5 times the blank should be qualified as estimated (J). All of the results for ^{228}Th and ^{232}Th were greater than 5 times the method blank. Therefore, no qualification of the ^{228}Th and ^{232}Th results is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 42.15% for all samples for the alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0758, TLF-9546, TLF-0502, TLF-0736, TLF-0736, TLF-0738, and TLF-0738 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.85 " 0.22 to 1.23 " 0.27 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0758, TLF-9546, TLF-0502, TLF-0736, TLF-0738, and TLF-0738 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 85.9%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha and beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha and gross beta LCSs were within acceptable limits.

Duplicate Analysis:

The duplicate DER (1.31) for the gross beta analyses is outside acceptable limits. The RPD (53.5%) is also outside acceptable limits**. Therefore, it is recommended that the gross beta results for all samples be qualified as estimated (J).**

Matrix Spike Sample:

The matrix spike sample (MSS) recovery for the gross alpha/beta analyses were within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. All samples are in agreement within the uncertainties. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0738. This difference is most likely due sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0754 (1.42), TLF-0755 (1.63), TLF-0758 (1.75), TLF-0759 (1.83), TLF-0760 (1.48), TLF-0761 (1.98), TLF-9546 (1.43), TLF-0733 (2.25), TLF-0503 (1.78), TLF-0734 (1.39), TLF-0735 (1.57), TLF-0736 (1.93), and TLF-0737 (1.45) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (84.3%, 103%, 88.6%, 106%, 92.1%, 113%, 73.6%, 133%, 105%, 84.2%, 97.6%, 88.3%, and 89.7% respectfully) also exceed acceptable limits. The samples have a gross alpha result greater than the sum of the alphas by factors ranging from 1.3 to 5.0. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-0754, TLF-0755, TLF-0758, TLF-0759, TLF-0760, TLF-0761, TLF-9546, TLF-0733, TLF-0503, TLF-0734, TLF-0735, TLF-0736, and TLF-0737 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0754 (3.39), TLF-0755 (2.02), TLF-0758 (3.76), TLF-759 (3.37), TLF-0760 (3.47), TLF-0761 (3.65), TLF-9546 (4.16), TLF-0732 (3.43), TLF-0733 (3.52), TLF-0502 (4.00), TLF-0503 (4.05), TLF-0734 (3.23), TLF-0735 (3.48), TLF-0736 (3.02), TLF-0737 (3.06), and TLF-0738 (2.03) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (155%, 129%, 160%, 163%, 158%, 162%, 163%, 160%, 164%, 167%, 162%, 148%, 162%, 141%, 151%, and 110%, respectfully) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 3.5 to 11.1. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for all samples except TLF-0761, TLF-9546, and TLF-0735. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for all samples be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99%

confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for samples TLF-0754 (2.65), TLF-0755 (2.11), TLF-0758 (3.78), TLF-759 (3.49), TLF-0760 (3.20), TLF-0761 (3.42), TLF-9546 (3.77), TLF-0732 (3.40), TLF-0733 (3.30), TLF-0502 (3.41), TLF-0503 (3.65), TLF-0734 (2.07), TLF-0735 (2.96), TLF-0736 (3.24), TLF-0737 (2.50), and TLF-0738 (1.96) were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs (105%, 94.7%, 129%, 131%, 121%, 125%, 124%, 130%, 131%, 124%, 84.9%, 119%, 112%, 104%, and 65.0%) for these samples also exceed acceptable limits. The samples have a total activity result greater than the total activity sum by factors ranging from 2.0 to 4.8. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0 had been reported from the gamma, the DERs and RPDs for total activity results would be within limits for all samples except TLF-0761, TLF-9546, and TLF-0735 which still contain a positive bias for total activity. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possible missing activity be investigated in the future. Therefore, it is recommended that the total activity results for all samples be qualified as estimated (J).**

G01070034-01A			TLF-0754					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.10E-01					U
Ra-226	1.02E+00	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	2.20E-01												
Th-230	1.21E+00	3.10E-01												
Th-232	7.30E-01	2.20E-01												
U-234	7.90E-01	2.30E-01												
U-235	3.70E-02	5.10E-02					U	3.70E-01	3.10E-01					
U-238	8.00E-01	2.30E-01												
Total U Alpha	**1.63E+00**	**3.29E-01**												
Alpha Sum	**5.13E+00**	**1.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.30E-01						1.60E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	8.00E-01	2.30E-01						-2.00E+00	5.80E+01					U
Ac-227														
Ra-228	6.80E-01	3.00E-01												
Pa-231	-2.00E-01	1.30E+00					U							
Beta Sum	**2.26E+00**	**4.69E-01**						**2.56E-01**	**5.80E+01**					
Total Activity Sum	**7.38E+00**	**1.40E+00**						**5.38E+00**	**5.80E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.26E+01	5.10E+00					J	**1.42**	**(from gamma)**		**84.3**			
Gross Beta	1.76E+01	4.50E+00					J	**3.39**	**0.30**		**155**			
Total Activity	2.37E+01	6.00E+00					J	**2.65**	**0.31**		**105**			

G01070034-02A			TLF-0755					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.90E-01					U
Ra-226	9.80E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	2.30E-01												
Th-230	9.60E-01	2.90E-01												
Th-232	7.60E-01	2.50E-01												
U-234	8.80E-01	2.50E-01												
U-235	1.23E-01	8.40E-02						-1.70E-01	4.90E-01					U
U-238	8.00E-01	2.30E-01												
Total U Alpha	**1.80E+00**	**3.50E-01**												
Alpha Sum	**4.89E+00**	**1.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.30E-01						4.20E-01	9.10E-01					UJ
Pa-234m (Assumed from U-238)	8.00E-01	2.30E-01						7.00E-01	7.40E+00					UJ
Ac-227														
Ra-228	4.00E-01	2.30E-01												
Pa-231	-3.00E-01	1.70E+00					U							
Beta Sum	**1.96E+00**	**4.48E-01**						**1.48E+00**	**7.46E+00**					
Total Activity Sum	**6.86E+00**	**1.71E+00**						**6.38E+00**	**7.64E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.52E+01	6.10E+00					J	**1.63**	**(from gamma)**		**103**			
Gross Beta	9.10E+00	3.50E+00					J	**2.02**	**0.92**		**129**			
Total Activity	1.92E+01	5.60E+00					J	**2.11**	**1.35**		**94.7**			

G01070034-03A			TLF-0758					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.60E-01					U
Ra-226	1.02E+00	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.08E+00	2.50E-01												
Th-230	1.15E+00	2.60E-01					J							
Th-232	1.16E+00	2.60E-01												
U-234	9.20E-01	2.50E-01												
U-235	3.40E-02	4.80E-02					U	8.00E-02	3.90E-01					U
U-238	1.02E+00	2.60E-01												
Total U Alpha	**1.97E+00**	**3.64E-01**												
Alpha Sum	**6.02E+00**	**1.74E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.02E+00	2.60E-01						3.30E+00	1.50E+00					J
Pa-234m (Assumed from U-238)	1.02E+00	2.60E-01						0.00E+00	1.20E+01					U
Ac-227														
Ra-228	6.30E-01	3.60E-01												
Pa-231	-4.00E-01	1.80E+00					U							
Beta Sum	**2.62E+00**	**5.58E-01**						**3.88E+00**	**1.21E+01**					
Total Activity Sum	**8.65E+00**	**1.82E+00**						**9.91E+00**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.56E+01	5.20E+00					J	**1.75**	**(from gamma)**		**88.6**			
Gross Beta	2.38E+01	5.60E+00					J	**3.76**	**1.49**		**160**			
Total Activity	4.00E+01	8.10E+00					J	**3.78**	**2.05**		**129**			

G01070034-04A			TLF-0759					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.70E-01					U
Ra-226	7.60E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	2.50E-01												
Th-230	7.30E-01	2.20E-01												
Th-232	9.30E-01	2.50E-01												
U-234	6.70E-01	2.10E-01												
U-235	8.50E-02	7.10E-02						7.00E-02	3.40E-01					U
U-238	6.00E-01	1.90E-01												
Total U Alpha	**1.36E+00**	**2.92E-01**												
Alpha Sum	**4.75E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.00E-01	1.90E-01						9.60E-01	6.80E-01					J
Pa-234m (Assumed from U-238)	6.00E-01	1.90E-01						2.50E+00	8.10E+00					U
Ac-227														
Ra-228	5.30E-01	2.60E-01												
Pa-231	1.00E-01	1.60E+00					U							
Beta Sum	**1.74E+00**	**4.20E-01**						**4.00E+00**	**8.13E+00**					
Total Activity Sum	**6.49E+00**	**1.60E+00**						**8.75E+00**	**8.28E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.54E+01	5.60E+00					J	**1.83**	**(from gamma)**		**106**			
Gross Beta	1.73E+01	4.60E+00					J	**3.37**	**1.42**		**163**			
Total Activity	3.09E+01	6.80E+00					J	**3.49**	**2.07**		**131**			

G01070034-05A			TLF-0760					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.30E-01					U
Ra-226	1.05E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.30E-01												
Th-230	9.50E-01	2.60E-01												
Th-232	7.50E-01	2.30E-01												
U-234	6.50E-01	2.00E-01												
U-235	4.50E-02	4.50E-02						1.20E-01	3.70E-01					U
U-238	7.40E-01	2.10E-01												
Total U Alpha	**1.44E+00**	**2.93E-01**												
Alpha Sum	**5.03E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.10E-01						1.59E+00	7.30E-01					J
Pa-234m (Assumed from U-238)	7.40E-01	2.10E-01						0.00E+00	1.60E+01					U
Ac-227														
Ra-228	7.90E-01	3.70E-01												
Pa-231	1.00E-01	1.60E+00					U							
Beta Sum	**2.28E+00**	**5.12E-01**						**2.39E+00**	**1.60E+01**					
Total Activity Sum	**7.31E+00**	**1.63E+00**						**7.42E+00**	**1.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	5.60E+00					J	**1.48**	**(from gamma)**		**92.1**			
Gross Beta	1.97E+01	5.00E+00					J	**3.47**	**1.03**		**158**			
Total Activity	2.97E+01	6.80E+00					J	**3.20**	**1.28**		**121**			

G01070034-06A			TLF-0761					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01					U
Ra-226	7.90E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.30E-01												
Th-230	8.10E-01	2.30E-01												
Th-232	9.90E-01	2.60E-01												
U-234	7.20E-01	2.20E-01												
U-235	6.80E-02	6.80E-02						5.00E-02	3.60E-01					U
U-238	5.80E-01	1.90E-01												
Total U Alpha	**1.37E+00**	**2.99E-01**												
Alpha Sum	**4.48E+00**	**1.22E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.80E-01	1.90E-01						5.30E-01	8.80E-01					UJ
Pa-234m (Assumed from U-238)	5.80E-01	1.90E-01						0.00E+00	9.80E+00					UJ
Ac-227														
Ra-228	8.30E-01	2.90E-01												
Pa-231	-3.00E-01	1.20E+00					U							
Beta Sum	**1.95E+00**	**4.21E-01**						**1.32E+00**	**9.84E+00**					
Total Activity Sum	**6.43E+00**	**1.29E+00**						**5.80E+00**	**9.92E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.60E+01	5.70E+00					J	**1.98**	**(from gamma)**		**113**			
Gross Beta	1.88E+01	4.60E+00					J	**3.65**	**1.61**		**162**			
Total Activity	2.81E+01	6.20E+00					J	**3.42**	**1.91**		**125**			

G01070034-07A			TLF-9546					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.20E-01					U
Ra-226	1.29E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.15E+00	2.60E-01												
Th-230	1.23E+00	2.70E-01					J							
Th-232	1.07E+00	2.50E-01												
U-234	7.10E-01	2.00E-01												
U-235	4.70E-02	4.70E-02						9.00E-02	3.70E-01					U
U-238	8.30E-01	2.20E-01												
Total U Alpha	**1.59E+00**	**3.01E-01**												
Alpha Sum	**6.24E+00**	**1.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.30E-01	2.20E-01						3.20E+00	1.20E+00					J
Pa-234m (Assumed from U-238)	8.30E-01	2.20E-01						0.00E+00	1.00E+01					U
Ac-227														
Ra-228	1.03E+00	3.80E-01												
Pa-231	-1.00E-01	1.30E+00					U							
Beta Sum	**2.68E+00**	**5.15E-01**						**4.22E+00**	**1.01E+01**					
Total Activity Sum	**8.92E+00**	**1.43E+00**						**1.05E+01**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.35E+01	4.90E+00					J	**1.43**	**(from gamma)**		**73.6**			
Gross Beta	2.65E+01	5.70E+00					J	**4.16**	**1.92**		**163**			
Total Activity	3.77E+01	7.50E+00					J	**3.77**	**2.16**		**124**			

G01070034-08A			TLF-0732					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01					U
Ra-226	1.03E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.80E-01	2.20E-01												
Th-230	7.20E-01	2.30E-01												
Th-232	7.80E-01	2.40E-01												
U-234	5.90E-01	2.00E-01												
U-235	5.20E-02	6.50E-02					U	7.00E-02	3.20E-01					U
U-238	5.90E-01	1.90E-01												
Total U Alpha	**1.23E+00**	**2.83E-01**												
Alpha Sum	**4.62E+00**	**1.63E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.90E-01	1.90E-01						6.70E-01	9.30E-01					UJ
Pa-234m (Assumed from U-238)	5.90E-01	1.90E-01						0.00E+00	4.00E+01					UJ
Ac-227														
Ra-228	7.10E-01	2.70E-01												
Pa-231	2.00E-01	1.70E+00					U							
Beta Sum	**1.91E+00**	**4.32E-01**						**1.40E+00**	**4.00E+01**					
Total Activity Sum	**6.54E+00**	**1.69E+00**						**6.03E+00**	**4.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.12E+01	5.00E+00						**1.25**	**(from gamma)**		**83.2**			
Gross Beta	1.74E+01	4.50E+00					J	**3.43**	**0.40**		**160**			
Total Activity	3.07E+01	6.90E+00					J	**3.40**	**0.61**		**130**			

G01070034-09A			TLF-0733					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.20E-01					U
Ra-226	6.40E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.40E-01												
Th-230	7.00E-01	2.10E-01												
Th-232	7.50E-01	2.20E-01												
U-234	4.30E-01	1.70E-01												
U-235	1.27E-01	8.10E-02						4.00E-02	2.80E-01					U
U-238	6.70E-01	2.10E-01												
Total U Alpha	**1.23E+00**	**2.82E-01**												
Alpha Sum	**3.70E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.70E-01	2.10E-01						1.84E+00	8.30E-01					J
Pa-234m (Assumed from U-238)	6.70E-01	2.10E-01						-4.00E+00	2.80E+01					U
Ac-227														
Ra-228	4.40E-01	3.80E-01												
Pa-231	-5.00E-01	1.60E+00					U							
Beta Sum	**1.72E+00**	**5.19E-01**						**-1.78E+00**	**2.80E+01**					
Total Activity Sum	**5.42E+00**	**1.62E+00**						**1.92E+00**	**2.81E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.85E+01	6.40E+00					J	**2.25**	**(from gamma)**		**133**			
Gross Beta	1.73E+01	4.40E+00					J	**3.52**	**0.67**		**164**			
Total Activity	2.59E+01	6.00E+00					J	**3.30**	**0.84**		**131**			

G01070034-10A			TLF-0502					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.50E-01					U
Ra-226	1.11E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	2.50E-01												
Th-230	9.20E-01	2.30E-01					J							
Th-232	8.80E-01	2.30E-01												
U-234	9.70E-01	2.60E-01												
U-235	1.30E-01	8.00E-02						2.20E-01	4.00E-01					U
U-238	7.20E-01	2.10E-01												
Total U Alpha	**1.82E+00**	**3.44E-01**												
Alpha Sum	**4.90E+00**	**1.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.10E-01						7.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	7.20E-01	2.10E-01						-1.00E+00	1.90E+01					UJ
Ac-227														
Ra-228	5.80E-01	3.40E-01												
Pa-231	-9.00E-01	1.70E+00					U							
Beta Sum	**1.91E+00**	**4.95E-01**						**1.72E-01**	**1.90E+01**					
Total Activity Sum	**6.81E+00**	**1.72E+00**						**5.07E+00**	**1.91E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.11E+01	5.40E+00						**1.10**	**(from gamma)**		**77.5**			
Gross Beta	2.12E+01	4.80E+00					J	**4.00**	**1.07**		**167**			
Total Activity	2.91E+01	6.30E+00					J	**3.41**	**1.19**		**124**			

G01070034-11A			TLF-0503					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.20E-01					U
Ra-226	7.90E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.30E-01												
Th-230	8.30E-01	2.20E-01												
Th-232	7.20E-01	2.00E-01												
U-234	8.00E-01	2.20E-01												
U-235	6.00E-02	5.40E-02						2.80E-01	2.80E-01					
U-238	7.80E-01	2.20E-01												
Total U Alpha	**1.64E+00**	**3.16E-01**												
Alpha Sum	**4.67E+00**	**1.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.20E-01						1.43E+00	6.50E-01					J
Pa-234m (Assumed from U-238)	7.80E-01	2.20E-01						4.00E+00	2.70E+01					U
Ac-227														
Ra-228	7.70E-01	4.40E-01												
Pa-231	-2.00E-01	1.30E+00					U							
Beta Sum	**2.31E+00**	**5.61E-01**						**6.18E+00**	**2.70E+01**					
Total Activity Sum	**6.98E+00**	**1.41E+00**						**1.08E+01**	**2.70E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.49E+01	5.60E+00					J	**1.78**	**(from gamma)**		**105**			
Gross Beta	2.19E+01	4.80E+00					J	**4.05**	**0.57**		**162**			
Total Activity	2.95E+01	6.00E+00					J	**3.65**	**0.67**		**124**			

G01070034-12A			TLF-0734					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	2.30E+00					U
Ra-226	1.00E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.60E-01	1.90E-01												
Th-230	9.50E-01	2.60E-01												
Th-232	6.80E-01	2.10E-01												
U-234	8.20E-01	2.20E-01												
U-235	5.40E-02	4.80E-02						0.00E+00	3.80E-01					U
U-238	9.00E-01	2.40E-01												
Total U Alpha	**1.77E+00**	**3.29E-01**												
Alpha Sum	**5.50E+00**	**1.63E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.40E-01						1.50E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	9.00E-01	2.40E-01						-3.00E+00	1.30E+01					U
Ac-227														
Ra-228	7.00E-01	3.30E-01												
Pa-231	6.00E-01	1.70E+00					U							
Beta Sum	**2.57E+00**	**5.15E-01**						**-7.28E-01**	**1.31E+01**					
Total Activity Sum	**8.08E+00**	**1.71E+00**						**4.78E+00**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.35E+01	5.50E+00					J	**1.39**	**(from gamma)**		**84.2**			
Gross Beta	1.72E+01	4.50E+00					J	**3.23**	**1.30**		**148**			
Total Activity	2.00E+01	5.50E+00					J	**2.07**	**1.07**		**84.9**			

G01070034-13A			TLF-0735					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.10E-01					U
Ra-226	7.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	2.10E-01												
Th-230	9.30E-01	2.40E-01												
Th-232	6.60E-01	1.90E-01												
U-234	8.40E-01	2.40E-01												
U-235	5.90E-02	5.30E-02						-7.00E-02	3.40E-01					U
U-238	7.30E-01	2.10E-01												
Total U Alpha	**1.63E+00**	**3.23E-01**												
Alpha Sum	**4.68E+00**	**1.38E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.10E-01						2.00E+00	7.60E-01					J
Pa-234m (Assumed from U-238)	7.30E-01	2.10E-01						-1.00E+00	1.80E+01					U
Ac-227														
Ra-228	6.40E-01	2.80E-01												
Pa-231	0.00E+00	1.40E+00					U							
Beta Sum	**2.10E+00**	**4.41E-01**						**1.64E+00**	**1.80E+01**					
Total Activity Sum	**6.78E+00**	**1.44E+00**						**6.32E+00**	**1.81E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	5.50E+00					J	**1.57**	**(from gamma)**		**97.6**			
Gross Beta	1.99E+01	5.10E+00					J	**3.48**	**0.98**		**162**			
Total Activity	2.68E+01	6.60E+00					J	**2.96**	**1.06**		**119**			

G01070034-14A			TLF-0736					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	1.80E-01	-0.01	0.16	**0.42**	**167**	U
Ra-226	1.40E+00	3.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.50E-01	2.00E-01												
Th-230	9.90E-01	2.20E-01					J							
Th-232	8.40E-01	2.00E-01												
U-234	1.13E+00	2.70E-01												
U-235	1.41E-01	7.70E-02						0.00E+00	0.00E+00	1.80E-01	4.30E-01	**0.42**	**200**	
U-238	9.80E-01	2.40E-01												
Total U Alpha	**2.25E+00**	**3.69E-01**												
Alpha Sum	**6.24E+00**	**1.74E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.80E-01	2.40E-01						9.20E-01	8.60E-01	1.88E+00	8.90E-01	**0.78**	**68.6**	J
Pa-234m (Assumed from U-238)	9.80E-01	2.40E-01						-1.00E+00	1.70E+01	-1.00E+00	7.90E+01	**0.00**	**0.00**	U
Ac-227														
Ra-228	7.80E-01	3.50E-01	6.20E-01	3.80E-01	**0.31**	**22.9**								
Pa-231	-1.00E-01	1.80E+00	-6.00E-01	2.20E+00	**0.18**	**143**	U							
Beta Sum	**2.73E+00**	**5.33E-01**						**6.88E-01**	**1.70E+01**	**1.43E+00**	**7.90E+01**			
Total Activity Sum	**8.97E+00**	**1.82E+00**						**6.93E+00**	**1.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	4.80E+00					J	**1.93**	**(from gamma)**		**88.3**			
Gross Beta	1.58E+01	4.30E+00					J	**3.02**	**0.86**		**141**			
Total Activity	3.18E+01	6.80E+00					J	**3.24**	**1.35**		**112**			

G01070034-15A			TLF-0737					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.10E-01					U
Ra-226	9.40E-01	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.70E-01	1.90E-01												
Th-230	7.70E-01	2.10E-01												
Th-232	7.00E-01	1.90E-01												
U-234	6.40E-01	2.00E-01												
U-235	1.15E-01	7.80E-02						-1.00E-01	3.20E-01					U
U-238	7.60E-01	2.20E-01												
Total U Alpha	**1.52E+00**	**3.07E-01**												
Alpha Sum	**4.69E+00**	**1.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.60E-01	2.20E-01						1.43E+00	7.10E-01					J
Pa-234m (Assumed from U-238)	7.60E-01	2.20E-01						3.60E+00	8.90E+00					U
Ac-227														
Ra-228	8.10E-01	3.10E-01												
Pa-231	1.00E-01	1.20E+00					U							
Beta Sum	**2.34E+00**	**4.62E-01**						**5.85E+00**	**8.93E+00**					
Total Activity Sum	**7.03E+00**	**1.30E+00**						**1.05E+01**	**9.02E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.23E+01	5.10E+00					J	**1.45**	**(from gamma)**		**89.7**			
Gross Beta	1.68E+01	4.70E+00					J	**3.06**	**1.08**		**151**			
Total Activity	2.24E+01	6.00E+00					J	**2.50**	**1.10**		**104**			

G01070034-16A			TLF-0738					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.80E-01					U
Ra-226	1.18E+00	3.10E-01	7.70E-01	2.40E-01	**1.05**	**42.1**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	2.30E-01	9.30E-01	2.40E-01	**0.09**	**3.28**								
Th-230	1.05E+00	2.60E-01	8.50E-01	2.20E-01	**0.59**	**21.1**	J							
Th-232	9.60E-01	2.40E-01	8.30E-01	2.20E-01	**0.40**	**14.5**								
U-234	6.40E-01	1.90E-01	6.20E-01	1.90E-01	**0.07**	**3.17**								
U-235	2.10E-02	3.80E-02	1.02E-01	6.80E-02	**1.04**	**132**	U	-1.10E-01	6.10E-01					U
U-238	9.20E-01	2.40E-01	7.50E-01	2.10E-01	**0.53**	**20.4**								
Total U Alpha	**1.58E+00**	**3.08E-01**	**1.47E+00**	**2.91E-01**										
Alpha Sum	**1.05E+01**	**1.99E+00**	**4.85E+00**	**5.45E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E-01	2.40E-01	7.50E-01	2.10E-01	**0.53**	**20.4**		8.80E-01	9.90E-01					J
Pa-234m (Assumed from U-238)	9.20E-01	2.40E-01	7.50E-01	2.10E-01	**0.53**	**20.4**		1.40E+00	9.70E+00					U
Ac-227														
Ra-228	8.30E-01	3.60E-01												
Pa-231	5.40E+00	2.10E+00												
Beta Sum	**3.32E+00**	**5.55E-01**	**1.50E+00**	**2.97E-01**				**3.76E+00**	**9.76E+00**					
Total Activity Sum	**1.38E+01**	**2.06E+00**	**6.35E+00**	**6.21E-01**				**1.43E+01**	**9.96E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.35E+01	4.70E+00	1.73E+01	5.40E+00	**0.53**	**24.7**		**0.58**	**(from gamma)**		**24.7**			
Gross Beta	1.15E+01	4.00E+00	1.99E+01	5.00E+00	**1.31**	**53.5**	J	**2.03**	**0.73**		**110**			
Total Activity	2.72E+01	6.50E+00	2.86E+01	6.70E+00	**0.15**	**5.02**	J	**1.96**	**1.09**		**65.0**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070035

This sample delivery group (SDG) contained one soil sample from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0739	G01070035-01A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th. All samples with results less than 5 times the rinsate blank in equivalent units for ^{228}Ra and ^{234}Th should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the results for ^{228}Ra and ^{234}Th were greater than 5 times the rinsate blank. Therefore, no qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified but not reported in the samples above the required DL (1.65*TPU). The activity for ^{40}K was 10.1 "2.0 pCi/g which is within normal levels for ^{40}K naturally found in soil.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{230}Th analyses. All samples with ^{230}Th results less than 5 times the blank should be qualified as estimated (J). The result for ^{230}Th was greater than 5 times the method blank. Therefore, no qualification of the ^{230}Th result is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and RPDs are within acceptable limits for all the alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 22.0% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th. However, there is approximately 20% (2F) unecrtainty in the U alpha spectrometry analyses for both the sample and the duplicate. **Therefore, it is recommended that the ^{234}U, ^{235}U, and ^{238}U results for all alpha spectrometry samples be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the alpha spectra. The isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis (2.35) is outside acceptable limits. The RPD (81.2%) is also outside acceptable limits. **Therefore, it is recommended that the ^{226}Ra results be qualified as estimated (J).**

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 80%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was an indication of blank contamination in the gross alpha and gross beta analysis. All samples with gross alpha and gross beta results less than 5 times the blank should be qualified as estimated (J). The result for gross alpha and gross beta were greater than 5 times the method blank. Therefore, no qualification of the gross alpha and gross beta results is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for the gross alpha/beta MSS is within acceptable limits for the gross alpha/beta analyses.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

5.0 TOTAL ACTIVITY:

Method Blank:

There was an indication of blank contamination in the method blank for total activity analysis. All samples with total activity results less than 5 times the blank should be qualified as estimated (J). All of the results for total activity were greater than 5 times the method blank. Therefore, no qualification of the total activity results is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The ^{238}U results are in agreement with the corresponding ^{234}Th results within the uncertainties.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs were within acceptable limits and therefore, no qualification is necessary.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs were within acceptable limits and therefore, no qualification is necessary.

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were were within acceptable limits and therefore, no qualification is necessary.

G01070035-01A			TLF-0739					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.70E+00	1.10E+00					U
Ra-226	1.06E+00	2.80E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	5.80E-01	5.00E-01												
Th-230	7.50E+00	1.80E+00												
Th-232	4.00E-01	3.40E-01												
U-234	3.49E+02	7.80E+01					J							
U-235	1.93E+01	6.30E+00					J	2.10E+01	3.70E+00					
U-238	3.57E+02	8.00E+01					J							
Total U Alpha	**7.25E+02**	**1.12E+02**												
Alpha Sum	**7.35E+02**	**1.12E+02**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
K-40														
Co-60														
Cs-137														
Tc-99														
Th-234 (Assumed from U-238)	3.57E+02	8.00E+01						2.91E+02	5.10E+01					
Pa-234m (Assumed from U-238)	3.57E+02	8.00E+01						4.53E+02	8.10E+01					
Ac-227														
Ra-228	4.10E-01	2.20E-01												
Pa-231	-1.00E-01	1.60E+00					U							
Beta Sum	**7.14E+02**	**1.13E+02**						**7.44E+02**	**9.57E+01**					
Total Activity Sum	**1.45E+03**	**1.59E+02**						**1.48E+03**	**1.47E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.30E+02	1.30E+02						**0.56**	**(from gamma)**		**12.2**			
Gross Beta	6.00E+02	1.30E+02					J	**0.66**	**0.89**		**17.4**			
Total Activity	1.80E+03	2.60E+02						**1.15**	**1.07**		**21.6**			

Chemical Analytical Data Verification Comments on Data for Tonawanda Landfill, SDG G01070037

Data for four soil samples were reported in these data packages. The soil samples were analyzed by Acculabs Inc. laboratory for polychlorinated biphenyls (PCBs), pesticides, volatile organics analysis (VOAs), base neutral/acid extractables (BNAs), total metals, total cyanide, and percent moisture as requested in the SAP. The analytical data were evaluated according to the guidance provided in the referenced methods from SW-846[1], ASTM[2], and the sampling and analysis plan (SAP)[3]. The groundwater samples have the following ID numbers:

Client Sample ID	Laboratory Sample ID
TLF-0661	G01070037-01
TLF-9716	G01070037-02
TLF-0668	G01070037-03
TLF-0677	G01070037-04

Total PCBs

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total PCBs.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met. No qualification of data is necessary.

Blanks

No blank contamination was detected. No qualification of data is necessary.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

---

1 "EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition.

2 "American Society of Testing and Materials Standards".

3 "Statement of Work for Radiological and Chemical Analytical Laboratory Services, Town of Tonawanda Landfill, Vicinity FUSRAP Property, Tonawanda, NY," April 2001.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS recoveries for Aroclor 1016 (23%, 25%), and Aroclor 1260 (67%, 67%) were outside the QC limits of 70-130%. **The Aroclor 1016 results for samples TLF-0661 and TLF-9716, and the Aroclor 1260 result for sample TLF-0677 should be qualified as estimated (J), and the remaining Aroclor results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) due to low MS recoveries.**

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

Total Pesticides

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total pesticides.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met except for the initial calibration relative standard deviation (RSD) for delta-BHC (20.77%) associated with samples TLF-0661, TLF-9716, and TLF-0668, which was greater than the QC limit of 20%. **The delta-BHC results for samples TLF-0661, TLF-9716, and TLF-0668 should be qualified as not detected at an estimated detection limit (UJ) due to high initial calibration RSD.**

Blanks

No blank contamination was detected. No qualification of data is necessary.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS/MSD recoveries could not be evaluated due to the ten-fold dilution required by high sample pesticide concentrations. The dilution reduced the concentrations of the spiked analytes to levels too low to allow accurate quantitation. Based on professional judgment and the intended use of the data, no qualification of data is recommended.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

GC column percent difference (%D)

The GC column %Ds were acceptable except for the 4,4'-DDD %D (29%) for sample TLF-0661, the 4,4'-DDD %D (34%) for sample TLF-9716, the 4,4'-DDD %D (33%) and

4,4'-DDT %D (70%) for sample TLF-0668, and the 4,4'-DDD %D (86%) for sample TLF-0661, which were greater than the QC limit of 25%. **The 4,4'-DDD results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 and the 4,4'-DDT result for sample TLF-0668 should be qualified as estimated (J) due to high GC column %D.**

Endrin and 4,4'-DDT Breakdown

The endrin and 4,4'-DDT percent breakdown results were acceptable. No qualification of data is necessary.

Total VOAs

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total VOAs.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

GC/MS Tune

The GC/MS tuning requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration results were acceptable except for the initial calibration relative standard deviation (RSD) for bromomethane (32.9%), which was greater than the QC limit of 30%. **The bromomethane results for samples TLF-0661 and TLF-9716 should be qualified as estimated (J), and the bromomethane results for samples TLF-0668 and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) due to high initial calibration RSD.**

Blanks

No blank contamination was detected. No qualification of data is necessary.

Internal Standard (IS) Area

The IS percent recoveries and retention times were acceptable except for the IS2 (25.4%) and IS3 (15.0%) recoveries for sample TLF-0661, the IS2 (36.9%) and IS3 (24.3%) recoveries for sample TLF-9716, the IS3 (42.7%) recovery for sample TLF-0668, and the IS2 (38.8%) and IS3 (28.5%) recoveries for sample TLF-0677, which were outside the QC limits of 50-200%. **The chlorobenzene, ethylbenzene, m,p-xylene, o-xylene, styrene, bromoform, 1,1,2,2-tetrachloroethane, 1,3-dichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dibromo-3-chloropropane results for samples TLF-0661, TLF-9716, and TLF-0677, and the 1,2-dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dibromo-3-chloropropane results for sample TLF-0668 should be qualified as undetected at an estimated detection limit (UJ) for non-detected results and as estimated (J) for detected results due to low IS recovery.**

Surrogate Recovery

The surrogate recoveries were acceptable except for the toluene-d8 (63%) and 4-bromofluorobenzene (66%) recoveries associated with sample TLF-0661, the toluene-d8 (67%) and 4-bromofluorobenzene (65%) recoveries associated with sample TLF-9716, and the 4-bromofluorobenzene (64%) recovery associated with sample TLF-0677, which were outside the QC limits of 70-130%. **All of the VOA results for samples TLF-0661, TLF-9716, and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) for non-detected results and as estimated (J) for detected results due to low surrogate recoveries.**

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS samples were not prepared due to a lack of sample. Since the LCS recoveries were acceptable, no qualification of data is recommended.

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable. No qualification of data is necessary.

Total BNAs

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total BNAs.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

GC/MS Tune

The GC/MS tuning requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration results were acceptable except for the initial calibration relative standard deviations (RSDs) for 4-chloroaniline (32.4%), 3-nitroaniline (38.2%), 2,4-dinitrophenol (36.0%), and 3,3'-dichlorobenzidine (32.8%), which were greater than the QC limit of 30%, and the continuing calibration percent difference (%D) for 3-nitroaniline 31.7%(UJ), which was greater than the QC limit of 25%. **The 4-chloroaniline, 3-nitroaniline, 2,4-dinitrophenol, and 3,3'-dichlorobenzidine results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) due to high initial calibration RSD or high continuing calibration %D.**

Blanks

Method blank contamination was not detected. No qualification of data is necessary.

Internal Standard (IS) Areas

The IS percent recoveries and retention times were acceptable except for the IS6 (22.1%) recovery for sample TLH-9716, the IS6 (27.8%) recovery for sample TLH-0668, and the IS6 (22.6%) recovery for sample TLH-0677, which were outside the QC limits of 50-200%. **The di-n-octyl phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene,**

indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene results for samples TLF-9716, TLF-0668, and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) for non-detected results and as estimated (J) for detected results due to low IS recovery.

Surrogate Recovery

The surrogate recoveries were acceptable. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS/MSD recoveries and RPDs were acceptable except for the MS recoveries and RPDs for 2,4-dinitrotoluene (91%, QC limits 28-89%) and pyrene (172%/40% RPD, QC limits 35-142%/36% RPD), which were outside QC limits. **The 2,4-dinitrotoluene results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677, and the pyrene results for sample TLF-0668 should be qualified as undetected at an estimated detection limit (UJ), and the pyrene results for samples TLF-0661, TLF-9716, and TLF-0677 should be qualified as estimated (J) due to MS recoveries or RPDs outside QC limits.**

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable except for the LCS recoveries for phenol (94%, QC limits 16-90%) and 2,4-dinitrotoluene (109%, QC limits 28-89%), which were outside the QC limits. **The phenol and 2,4-dinitrotoluene results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as undetected at an estimated detection limit (UJ) due to LCS recoveries outside QC limits.**

Total Metals

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total metals.

Holding Times

The holding time requirements were met. No qualification of data is necessary.

Calibration

The initial and continuing calibration criteria were met. No qualification of data is necessary.

Blanks

No blank contamination requiring qualification of data was detected. No qualification of data is necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The MS/MSD recoveries were acceptable except for the MS recoveries for arsenic (53%), cadmium (69%), manganese (140%), potassium (186%), and zinc (53%), which were outside the QC limits of 75-125%. **The arsenic, cadmium, manganese, potassium, and zinc results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as estimated (J) due to MS recovery outside QC limits.**

Laboratory Control Sample (LCS)

The LCS recoveries were acceptable except for the antimony LCS recovery (56.3%), which was outside the QC limits of 80-120%. **The antimony results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as estimated (J) due to low LCS recovery.**

Laboratory Duplicate RPD

The laboratory duplicate RPD results were acceptable except for the duplicate RPD for lead (56%), which was greater than the QC limit of 35% for soils. **The lead results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as estimated (J) due to high laboratory duplicate RPD.**

Serial Dilution

The serial dilution RPD results were acceptable except for the serial dilution RPDs for aluminum (18%), calcium (22%), copper (21%), iron (22%), magnesium (20%), manganese (28%), potassium (20%), zinc (31%), which were greater than the QC limit of 10%. **The aluminum, calcium, copper, iron, magnesium, manganese, potassium, and zinc results for samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 should be qualified as estimated (J) due to high serial dilution RPD.**

Interference Check Standard

The interference check standard results were acceptable. No qualification of data is necessary.

Wet Chemistry

Samples TLF-0661, TLF-9716, TLF-0668, and TLF-0677 were analyzed for total cyanide and percent moisture. The results were evaluated for holding times, calibration, blank contamination, matrix spike recovery, laboratory control sample recovery, and duplicate RPD where applicable. The QC results were acceptable. No qualification of data is necessary.

Radiological Analytical Data Verification
Comments on Data for SDG G01070038

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting of all samples. All analyses requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-9550	G01070038-01A
TLF-0598	G01070038-02A
TLF-0599	G01070038-03A
TLF-0596	G01070038-04A
TLF-9608	G01070038-05A
TLF-0597	G01070038-06A
TLF-0470	G01070038-07A
TLF-0471	G01070038-08A
TLF-9468	G01070038-09A
TLF-9469	G01070038-10A
TLF-0464	G01070038-11A
TLF-0542	G01070038-12A
TLF-0543	G01070038-13A
TLF-0871	G01070038-14A
TLF-0872	G01070038-15A
TLF-0604	G01070038-16A
TLF-0605	G01070038-17A
TLF-0600	G01070038-18A
TLF-0601	G01070038-19A
TLF-0524	G01070038-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

The gamma spectrometry method blank contained ^{234}Th. Sample results less than 5 times the method blank value ^{234}Th should be qualified as estimated (J). All ^{234}Th sample results were less than 5 times the method blank value; **therefore the ^{234}Th results for all gamma spectrometry samples should be qualified as estimated (J).**

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated (J). All of the ^{228}Ra sample results are greater than 5 times the rinsate blank activity. As noted in the gamma spectrometry method blank section, all of the ^{234}Th results have been qualified as estimated (J). **The following ^{234m}Pa sample results contain less than 5 times the equipment rinsate blank value and should be qualified as estimated (J)**: **TLF-9550, TLF-0599, TLF-0596, TLF-9608, TLF-0597, TLF-0471, TLF-9468, TLF-0543, TLF-0871, TLF-0604, TLF-0605, TLF-0600, TLF-0601, and TLF-0524.**

Laboratory Control Sample:

The percent recoveries for the laboratory control samples (LCS) were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for all gamma spectrometry duplicate analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported. The laboratory was instructed to report any radioisotopes detected above the DL (1.65*TPU). Based on data review, ^{40}K and ^{137}Cs were identified in several samples. Gamma spectrometry samples TLF-0597 (0.19 pCi/g) and TLF-0604 (0.64 pCi/g) contained ^{137}Cs above the DL. The following samples contained ^{40}K above the DL: TLF-9550, TLF-0598, TLF-0599, TLF-9608, TLF-0470, TLF-0471, TLF-0464, TLF-0543, TLF-0871, TLF-0600, TLF-0601, and TLF-0524. The activity range for ^{40}K was approximately 13 – 19 pCi/g, within the normal range of naturally radioactive potassium found in soils. **Since ^{40}K and ^{137}Cs are beta emitters, the activities should have been reported in order to account for total beta activity.**

Two samples, TLF-0599 and TLF-0597, have improperly identified ^{231}Pa. The gamma spectral data revealed that these two samples were identified using one gamma energy and no correlated energies. In the identification process, we expect that corroborating data should support the results. **We recommend that the ^{231}Pa results for samples TLF-0599 and TLF-0597 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{228}Th, ^{230}Th, and ^{234}Th. All associated sample results less than 5 times the method blank values for ^{228}Th, ^{230}Th, and ^{234}Th should be qualified as estimated (J). All of the sample results exceeded 5 times the method blank values, therefore no qualification of the data is necessary.

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). All of the sample ^{234}U results were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits. The recoveries were 91% for Th and 88% and 91% for U. An Acculabs chemical yield flag was noted for the Th LCS. The chemical yield (71%) was acceptable for solid samples.

Duplicate Analysis:

The DERs were within acceptable limits for the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries of all samples were within acceptable limits for isotopic Th and isotopic U.

Spectral Analysis:

Several of the isotopic thorium alpha spectra indicated two extra peaks. These peaks were in the 5.8 MeV and 6.3 MeV, regions. We assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There was no indication of interference with the isotopic thorium results. In a few instances, ^{224}Ra was identified in the instrumental spectral analysis. The data were not reported. Upon data review, it is probable that the peak data could be attributed to the presence of ^{224}Ra as progeny of ^{228}Th or the occasional mis-identification of ^{224}Ra in the presence of ^{225}Ac (noted above). The presence of ^{224}Ra does not interfere with Th and U isotopic data. Therefore, no qualification was necessary.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

Contamination was indicated in the rinsate blank for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the sample results were greater than 5 times the rinsate blank result; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DERs for ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for ^{226}Ra analyses ranged from 58 – 92%. The percent recovery values were within acceptable limits.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated in the gross alpha or gross beta method blanks.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery value for the gross alpha LCS (145%) exceeded the high limit. **This may have indicated a high bias in the gross alpha results. Therefore, all gross alpha sample results have been qualified as estimated (J).**

The gross beta LCS value was within acceptable limits.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.

Matrix Spike Sample:

The MSS percent recovery value for gross alpha matrix spike sample (125%), although high, was within acceptable limits for solid samples. The possibility that gross alpha results may exhibit a high bias correlates with the gross alpha LCS.

The gross beta matrix spike value (95%) was within acceptable limits.

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL), stated in the SOW, for the gross alpha/beta analyses was 1.0 pCi/g. None of the gross alpha/beta analyses met the required MDL indicating that the laboratory may not have met the project DQO for these samples.

5.0 TOTAL ACTIVITY:

Method Blank:

No blank contamination was indicated for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS (92%) was within acceptable limits.

Duplicate Analysis:

The DERs for total activity duplicate analysis was within acceptable limits.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. For most of the sample results, the ^{228}Ra results agree with the ^{232}Th results within the uncertainties. Sample TLF-0464 had a ^{232}Th value approximately 3 times greater than the ^{228}Ra value. This may indicate sample heterogeneity.

^{231}Pa Gamma to ^{235}U Alpha:

Comparing the ^{231}Pa activity to the ^{235}U activity, most sample results agree within the respective uncertainties. When comparing samples TLF-0599 and TLF-0597, the ^{231}Pa result and the ^{235}U result were not in agreement. As noted in the Gamma Spectrometry section, the data results for samples TLF-0599 and TLF-0597 have been qualified as estimated (J), therefore agreement between ^{231}Pa results and ^{235}U results may not be expected. No further qualification is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-9550 (1.90), TLF-0598 (1.78), TLF-0596 (1.53), TLF-9608 (1.68), TLF-0470 (1.55), TLF-9468 (1.59), TLF-9469 (1.58), TLF-0464 (2.22), TLF-0542 (1.31), TLF-0871 (1.89), TLF-0872 1.48), TLF-0604 (2.14), TLF-0600 (1.38), TLF-0601 (1.69), and TLF-0524 (1.36) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The correlated RPD values for those sample range from 82 – 115%, also exceeding acceptable limits. All samples have a gross alpha result greater than the sum of the alphas. In the gross alpha section, it was noted that both the gross alpha LCS and Matrix Spike Sample results may have indicated the possibility of high bias. However, for all samples, the total activity analysis results and the sum of gross alpha and gross beta data are in excellent agreement. This may be an indication of other activity in the samples that was not specifically analyzed for. **It is recommended that the possibility of missing activity be investigated in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for all samples (2.64 – 3.91) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The correlated RPD values for those sample range from 110 - 170%, also exceeding acceptable limits. All samples have gross beta results greater than the sum of the betas. If the ^{40}K results had been reported from the gamma spectrometry data, the DERs for most samples would be within limits. Due to the weight of the beta emitting radionuclides on the total activity values, inclusion of the ^{40}K data would be highly valuable in data comparison. **We recommend that the laboratory report all gamma results above the DL.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER values (1.80 – 3.60) for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPD values (35.3 – 153) for all samples also exceed acceptable limits. All samples have total activity results greater than the total activity sums. If the ^{40}K results had been reported

from the gamma and included in the sums, most DERs would be within acceptable limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be investigated in the future. No qualification of the data is necessary since the total activity analysis is for comparison purposes only.**

G01070038-01A			TLF-9550					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	1.80E-01					U
Ra-226	1.54E+00	3.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	2.50E-01												
Th-230	1.37E+00	3.10E-01												
Th-232	1.08E+00	2.60E-01												
U-234	1.11E+00	2.70E-01												
U-235	4.20E-02	4.90E-02						6.00E-02	4.60E-01					U
U-238	9.60E-01	2.50E-01												
Total U Alpha	**2.11E+00**	**3.71E-01**												
Alpha Sum	**6.76E+00**	**2.02E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.60E-01	2.50E-01						1.64E+00	9.40E-01					
Pa-234m (Assumed from U-238)	9.60E-01	2.50E-01						0.00E+00	2.00E+02					UJ
Ac-227														
Ra-228	1.13E+00	3.80E-01												
Pa-231	-4.00E-01	2.10E+00					U							
Beta Sum	**3.00E+00**	**5.77E-01**						**2.72E+00**	**2.00E+02**					
Total Activity Sum	**9.76E+00**	**2.10E+00**						**9.48E+00**	**2.00E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.86E+01	5.90E+00					J	**1.90**	**(from gamma)**		**93.4**			
Gross Beta	1.90E+01	4.90E+00					J	**3.24**	**0.08**		**145**			
Total Activity	4.35E+01	8.50E+00					J	**3.85**	**0.17**		**127**			

G01070038-02A			TLF-0598					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.30E-01					U
Ra-226	1.29E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	3.00E-01												
Th-230	6.50E-01	2.70E-01												
Th-232	7.10E-01	2.60E-01												
U-234	2.48E+00	4.90E-01												
U-235	1.68E-01	8.60E-02						1.10E-01	3.90E-01					U
U-238	2.35E+00	4.70E-01												
Total U Alpha	**5.00E+00**	**6.84E-01**												
Alpha Sum	**8.02E+00**	**1.93E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.35E+00	4.70E-01						4.50E+00	1.70E+00					J
Pa-234m (Assumed from U-238)	2.35E+00	4.70E-01						4.00E+00	1.30E+01					U
Ac-227														
Ra-228	7.50E-01	3.90E-01												
Pa-231	-6.00E-01	1.90E+00					U							
Beta Sum	**5.38E+00**	**8.04E-01**						**9.18E+00**	**1.31E+01**					
Total Activity Sum	**1.34E+01**	**2.09E+00**						**1.72E+01**	**1.33E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.04E+01	6.70E+00					J	**1.78**	**(from gamma)**		**87.1**			
Gross Beta	1.85E+01	4.90E+00					J	**2.64**	**0.67**		**110**			
Total Activity	3.95E+01	7.90E+00					J	**3.19**	**1.45**		**98.7**			

G01070038-03A			TLF-0599					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	1.70E-01					U
Ra-226	8.40E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	2.10E-01												
Th-230	8.00E-01	2.20E-01												
Th-232	6.50E-01	1.90E-01												
U-234	6.90E-01	2.00E-01												
U-235	1.00E-02	2.80E-02					U	-6.00E-02	9.40E-01					U
U-238	6.20E-01	1.80E-01												
Total U Alpha	**1.32E+00**	**2.71E-01**												
Alpha Sum	**8.87E+00**	**1.87E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.20E-01	1.80E-01						1.21E+00	8.20E-01					J
Pa-234m (Assumed from U-238)	6.20E-01	1.80E-01						-5.00E+00	2.10E+01					UJ
Ac-227														
Ra-228	7.00E-01	3.30E-01												
Pa-231	5.00E+00	2.00E+00												
Beta Sum	**2.54E+00**	**4.81E-01**						**-2.49E+00**	**2.10E+01**					
Total Activity Sum	**1.14E+01**	**1.93E+00**						**6.38E+00**	**2.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.54E+01	5.70E+00					J	**1.09**	**(from gamma)**		**53.8**			
Gross Beta	1.74E+01	4.70E+00					J	**3.15**	**0.92**		**149**			
Total Activity	3.21E+01	7.10E+00					J	**2.81**	**1.16**		**95.1**			

G01070038-04A			TLF-0596					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	1.40E-01					U
Ra-226	9.60E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.80E-01												
Th-230	1.04E+00	3.50E-01												
Th-232	7.40E-01	2.70E-01												
U-234	5.70E-01	1.80E-01												
U-235	3.50E-02	4.10E-02						1.20E-01	3.30E-01					U
U-238	7.40E-01	2.00E-01												
Total U Alpha	**1.35E+00**	**2.72E-01**												
Alpha Sum	**4.52E+00**	**1.83E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.00E-01						1.88E+00	7.70E-01					J
Pa-234m (Assumed from U-238)	7.40E-01	2.00E-01						-3.00E+00	8.50E+01					UJ
Ac-227														
Ra-228	5.40E-01	6.20E-01												
Pa-231	-4.00E-01	1.90E+00					U							
Beta Sum	**1.97E+00**	**7.19E-01**						**-6.28E-01**	**8.50E+01**					
Total Activity Sum	**6.49E+00**	**1.97E+00**						**3.89E+00**	**8.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.37E+01	5.70E+00					J	**1.53**	**(from gamma)**		**101**			
Gross Beta	2.17E+01	5.00E+00					J	**3.91**	**0.26**		**167**			
Total Activity	3.52E+01	7.20E+00					J	**3.85**	**0.37**		**138**			

G01070038-05A			TLF-9608					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.30E-01					U
Ra-226	6.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.70E-01												
Th-230	9.00E-01	2.90E-01												
Th-232	8.10E-01	2.60E-01												
U-234	7.00E-01	2.00E-01												
U-235	5.00E-03	3.40E-02					U	2.30E-01	3.40E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.44E+00**	**2.85E-01**												
Alpha Sum	**3.71E+00**	**1.98E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						9.40E-01	6.00E-01					J
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						-1.30E+00	1.30E+00					UJ
Ac-227														
Ra-228	7.00E-01	3.30E-01												
Pa-231	-1.00E+00	2.10E+00					U							
Beta Sum	**2.04E+00**	**5.02E-01**						**2.20E-01**	**1.49E+00**					
Total Activity Sum	**5.75E+00**	**2.04E+00**						**3.93E+00**	**2.48E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.37E+01	5.60E+00					J	**1.68**	**(from gamma)**		**115**			
Gross Beta	2.13E+01	5.10E+00					J	**3.76**	**3.97**		**165**			
Total Activity	3.46E+01	7.30E+00					J	**3.81**	**3.98**		**143**			

G01070038-06A			TLF-0597					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.10E-01					U
Ra-226	8.00E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.80E-01	1.80E-01												
Th-230	5.70E-01	1.80E-01												
Th-232	5.40E-01	1.70E-01												
U-234	7.00E-01	1.90E-01												
U-235	7.70E-02	5.40E-02						-1.00E-01	1.40E+00					U
U-238	6.60E-01	1.80E-01												
Total U Alpha	**1.44E+00**	**2.67E-01**												
Alpha Sum	**6.09E+00**	**1.68E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.60E-01	1.80E-01						1.76E+00	7.00E-01					J
Pa-234m (Assumed from U-238)	6.60E-01	1.80E-01						0.00E+00	1.10E+01					UJ
Ac-227														
Ra-228	5.00E-01	3.70E-01												
Pa-231	2.40E+00	1.80E+00												
Beta Sum	**2.11E+00**	**4.98E-01**						**2.55E+00**	**1.10E+01**					
Total Activity Sum	**8.20E+00**	**1.76E+00**						**8.64E+00**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.60E+00	3.90E+00					J	**0.36**	**(from gamma)**		**22.1**			
Gross Beta	1.26E+01	3.90E+00					J	**2.67**	**0.86**		**143**			
Total Activity	1.61E+01	5.10E+00					J	**1.47**	**0.61**		**65.1**			

G01070038-07A			TLF-0470					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	1.50E-01					U
Ra-226	1.41E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	2.40E-01												
Th-230	9.50E-01	2.60E-01												
Th-232	5.80E-01	1.90E-01												
U-234	7.20E-01	2.10E-01												
U-235	5.30E-02	5.30E-02						0.00E+00	5.00E-01					U
U-238	1.05E+00	2.70E-01												
Total U Alpha	**1.82E+00**	**3.46E-01**												
Alpha Sum	**5.29E+00**	**1.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.05E+00	2.70E-01						8.70E-01	7.30E-01					J
Pa-234m (Assumed from U-238)	1.05E+00	2.70E-01						2.00E+00	1.00E+01					U
Ac-227														
Ra-228	3.50E-01	3.50E-01												
Pa-231	-4.00E-01	2.10E+00					U							
Beta Sum	**2.40E+00**	**5.76E-01**						**3.17E+00**	**1.00E+01**					
Total Activity Sum	**7.70E+00**	**2.07E+00**						**8.47E+00**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.45E+01	5.60E+00					J	**1.55**	**(from gamma)**		**93.0**			
Gross Beta	1.56E+01	4.40E+00					J	**2.97**	**1.13**		**147**			
Total Activity	2.97E+01	6.80E+00					J	**3.10**	**1.73**		**118**			

G01070038-08A			TLF-0471					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.20E-01	1.30E-01					
Ra-226	7.30E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.80E-01												
Th-230	7.20E-01	2.20E-01												
Th-232	6.40E-01	2.00E-01												
U-234	7.50E-01	2.00E-01												
U-235	6.80E-02	5.60E-02						-1.00E-01	6.10E+00					U
U-238	7.50E-01	2.00E-01												
Total U Alpha	**1.57E+00**	**2.88E-01**												
Alpha Sum	**5.10E+00**	**1.71E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.00E-01						2.56E+00	8.80E-01					J
Pa-234m (Assumed from U-238)	7.50E-01	2.00E-01						-1.40E+00	6.30E+00					UJ
Ac-227														
Ra-228	5.10E-01	7.00E-01					U							
Pa-231	5.00E-01	1.80E+00					U							
Beta Sum	**2.07E+00**	**7.85E-01**						**1.73E+00**	**6.40E+00**					
Total Activity Sum	**7.17E+00**	**1.88E+00**						**6.83E+00**	**6.63E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.10E+01	5.00E+00					J	**1.12**	**(from gamma)**		**73.3**			
Gross Beta	2.05E+01	5.00E+00					J	**3.64**	**2.31**		**163**			
Total Activity	3.19E+01	7.10E+00					J	**3.37**	**2.58**		**127**			

G01070038-09A			TLF-9468					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.20E-01	2.00E-01					
Ra-226	1.06E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	1.90E-01												
Th-230	9.20E-01	2.40E-01												
Th-232	5.90E-01	1.80E-01												
U-234	8.10E-01	2.20E-01												
U-235	5.80E-02	5.20E-02						1.50E-01	3.80E-01					U
U-238	8.70E-01	2.30E-01												
Total U Alpha	**1.74E+00**	**3.22E-01**												
Alpha Sum	**4.67E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.70E-01	2.30E-01						8.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	8.70E-01	2.30E-01						0.00E+00	8.40E+03					UJ
Ac-227														
Ra-228	8.60E-01	3.70E-01												
Pa-231	-3.00E-01	1.90E+00					U							
Beta Sum	**2.56E+00**	**5.43E-01**						**1.62E+00**	**8.40E+03**					
Total Activity Sum	**7.23E+00**	**1.88E+00**						**6.29E+00**	**8.40E+03**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.54E+01	6.50E+00					J	**1.59**	**(from gamma)**		**107**			
Gross Beta	1.22E+01	3.50E+00					J	**2.72**	**0.00**		**131**			
Total Activity	2.91E+01	6.20E+00					J	**3.38**	**0.00**		**120**			

G01070038-10A			TLF-9469					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.50E-01					U
Ra-226	1.03E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	2.30E-01												
Th-230	7.30E-01	2.10E-01												
Th-232	6.50E-01	1.90E-01												
U-234	6.40E-01	1.80E-01												
U-235	4.90E-02	4.30E-02						1.90E-01	3.30E-01					U
U-238	6.10E-01	1.80E-01												
Total U Alpha	**1.30E+00**	**2.58E-01**												
Alpha Sum	**5.04E+00**	**1.96E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.10E-01	1.80E-01						1.60E+00	1.20E+00					J
Pa-234m (Assumed from U-238)	6.10E-01	1.80E-01						2.00E+00	1.00E+01					U
Ac-227														
Ra-228	6.30E-01	3.70E-01												
Pa-231	5.00E-01	2.10E+00					U							
Beta Sum	**1.91E+00**	**5.15E-01**						**4.29E+00**	**1.01E+01**					
Total Activity Sum	**6.95E+00**	**2.03E+00**						**9.33E+00**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.38E+01	5.20E+00					J	**1.58**	**(from gamma)**		**93.0**			
Gross Beta	1.42E+01	4.00E+00					J	**3.05**	**0.91**		**153**			
Total Activity	2.96E+01	6.40E+00					J	**3.37**	**1.68**		**124**			

G01070038-11A			TLF-0464					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.40E-01					U
Ra-226	1.38E+00	3.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	2.70E-01												
Th-230	1.20E+00	3.50E-01												
Th-232	7.70E-01	2.60E-01												
U-234	6.70E-01	1.90E-01												
U-235	3.90E-02	3.90E-02						5.00E-02	3.30E-01					U
U-238	7.30E-01	2.00E-01												
Total U Alpha	**1.44E+00**	**2.79E-01**												
Alpha Sum	**5.92E+00**	**1.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.00E-01						4.20E-01	7.70E-01					UJ
Pa-234m (Assumed from U-238)	7.30E-01	2.00E-01						4.00E+00	1.70E+01					U
Ac-227														
Ra-228	2.50E-01	1.40E-01												
Pa-231	4.00E-01	1.80E+00					U							
Beta Sum	**1.76E+00**	**3.82E-01**						**4.72E+00**	**1.70E+01**					
Total Activity Sum	**7.68E+00**	**1.80E+00**						**1.06E+01**	**1.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.15E+01	6.80E+00					J	**2.22**	**(from gamma)**		**114**			
Gross Beta	1.55E+01	4.70E+00					J	**2.91**	**0.61**		**159**			
Total Activity	3.40E+01	7.30E+00					J	**3.50**	**1.26**		**126**			

G01070038-12A			TLF-0542					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.20E-01					U
Ra-226	8.10E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	2.80E-01												
Th-230	8.60E-01	2.80E-01												
Th-232	7.00E-01	2.40E-01												
U-234	5.10E-01	1.90E-01												
U-235	6.40E-02	5.80E-02						2.10E-01	3.20E-01					U
U-238	6.20E-01	1.90E-01												
Total U Alpha	**1.19E+00**	**2.75E-01**												
Alpha Sum	**3.70E+00**	**1.89E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.20E-01	1.90E-01						1.60E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	6.20E-01	1.90E-01						2.00E+00	9.30E+00					U
Ac-227														
Ra-228	4.90E-01	3.00E-01												
Pa-231	-8.00E-01	2.00E+00					U							
Beta Sum	**1.63E+00**	**4.69E-01**						**3.99E+00**	**9.37E+00**					
Total Activity Sum	**5.34E+00**	**1.95E+00**						**7.70E+00**	**9.56E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.07E+01	5.00E+00					J	**1.31**	**(from gamma)**		**97.1**			
Gross Beta	2.04E+01	5.00E+00					J	**3.74**	**1.54**		**170**			
Total Activity	2.97E+01	6.80E+00					J	**3.44**	**1.88**		**139**			

G01070038-13A			TLF-0543					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.60E-01	-1.00E-02	1.70E-01	**0.30**	**280**	U
Ra-226	7.40E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.24E+00	3.50E-01												
Th-230	8.70E-01	2.70E-01												
Th-232	8.50E-01	2.60E-01												
U-234	7.90E-01	2.20E-01												
U-235	1.17E-01	7.50E-02						1.50E-01	4.30E-01	-2.00E-01	1.40E+00	**0.24**	**1400**	U
U-238	9.00E-01	2.40E-01												
Total U Alpha	**1.81E+00**	**3.34E-01**												
Alpha Sum	**4.70E+00**	**2.60E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.40E-01						5.40E-01	4.10E-01	1.41E+00	8.90E-01	**0.89**	**89.2**	J
Pa-234m (Assumed from U-238)	9.00E-01	2.40E-01						0.00E+00	1.20E+01	2.00E+00	1.40E+01	**0.11**	**200**	UJ
Ac-227														
Ra-228	5.40E-01	4.60E-01	1.00E+00	5.10E-01	**0.67**	**59.7**								
Pa-231	-9.00E-01	2.80E+00	3.00E-01	2.30E+00	**0.33**	**-400**	U							
Beta Sum	**2.23E+00**	**6.63E-01**						**9.72E-01**	**1.20E+01**	**4.45E+00**	**1.40E+01**			
Total Activity Sum	**6.93E+00**	**2.68E+00**						**5.67E+00**	**1.23E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.20E+00	4.30E+00					J	**0.70**	**(from gamma)**		**54.3**			
Gross Beta	1.75E+01	4.50E+00					J	**3.36**	**1.29**		**155**			
Total Activity	3.81E+01	7.80E+00					J	**3.78**	**2.23**		**138**			

G01070038-14A			TLF-0871					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.80E-01					U
Ra-226	3.91E+00	8.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.70E-01												
Th-230	8.20E-01	2.60E-01												
Th-232	8.50E-01	2.60E-01												
U-234	7.90E-01	2.20E-01												
U-235	5.30E-02	5.40E-02						2.00E-02	4.70E-01					U
U-238	8.60E-01	2.30E-01												
Total U Alpha	**1.70E+00**	**3.23E-01**												
Alpha Sum	**7.43E+00**	**2.21E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	2.30E-01						1.30E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	8.60E-01	2.30E-01						-1.20E+00	1.00E+00					UJ
Ac-227														
Ra-228	6.70E-01	3.10E-01												
Pa-231	-8.00E-01	2.20E+00					U							
Beta Sum	**2.29E+00**	**5.21E-01**						**6.74E-01**	**1.77E+00**					
Total Activity Sum	**9.73E+00**	**2.27E+00**						**8.11E+00**	**2.83E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.15E+01	7.10E+00					J	**1.89**	**(from gamma)**		**97.2**			
Gross Beta	1.77E+01	4.80E+00					J	**3.19**	**3.33**		**154**			
Total Activity	3.90E+01	7.80E+00					J	**3.60**	**3.72**		**120**			

G01070038-15A			TLF-0872					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.30E-01					U
Ra-226	1.23E+00	3.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	3.00E-01												
Th-230	9.40E-01	3.00E-01												
Th-232	8.90E-01	2.90E-01												
U-234	8.00E-01	2.20E-01												
U-235	7.90E-02	6.60E-02						2.60E-01	3.90E-01					U
U-238	1.00E+00	2.50E-01												
Total U Alpha	**1.88E+00**	**3.39E-01**												
Alpha Sum	**5.73E+00**	**1.69E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.00E+00	2.50E-01						4.50E+00	2.00E+00					J
Pa-234m (Assumed from U-238)	1.00E+00	2.50E-01						3.00E+00	1.20E+01					U
Ac-227														
Ra-228	8.70E-01	4.10E-01												
Pa-231	-1.00E-01	1.70E+00					U							
Beta Sum	**2.86E+00**	**5.79E-01**						**8.36E+00**	**1.22E+01**					
Total Activity Sum	**8.59E+00**	**1.78E+00**						**1.41E+01**	**1.23E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.45E+01	5.70E+00					J	**1.48**	**(from gamma)**		**86.7**			
Gross Beta	2.60E+01	5.90E+00					J	**3.90**	**1.30**		**160**			
Total Activity	3.62E+01	7.60E+00					J	**3.54**	**1.53**		**123**			

G01070038-16A			TLF-0604					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	2.00E-01					U
Ra-226	1.83E+00	4.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.45E+00	3.70E-01												
Th-230	1.53E+00	3.80E-01												
Th-232	1.42E+00	3.60E-01												
U-234	1.99E+00	3.80E-01												
U-235	8.60E-02	5.60E-02						4.00E-01	4.30E-01					
U-238	1.96E+00	3.80E-01												
Total U Alpha	**4.04E+00**	**5.40E-01**												
Alpha Sum	**1.02E+01**	**1.22E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.96E+00	3.80E-01						2.10E+00	1.00E+00					J
Pa-234m (Assumed from U-238)	1.96E+00	3.80E-01						-1.00E+00	3.90E+01					UJ
Ac-227														
Ra-228	1.02E+00	4.80E-01												
Pa-231	-5.00E-02	8.80E-01					U							
Beta Sum	**4.93E+00**	**7.28E-01**						**2.11E+00**	**3.90E+01**					
Total Activity Sum	**1.52E+01**	**1.42E+00**						**1.23E+01**	**3.90E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.54E+01	7.00E+00					J	**2.14**	**(from gamma)**		**85.2**			
Gross Beta	1.89E+01	4.60E+00					J	**3.00**	**0.43**		**117**			
Total Activity	4.29E+01	7.80E+00					J	**3.50**	**0.77**		**95.6**			

G01070038-17A			TLF-0605					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.30E-01					U
Ra-226	1.04E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.06E+00	2.70E-01												
Th-230	7.70E-01	2.10E-01												
Th-232	7.00E-01	1.90E-01												
U-234	7.00E-01	2.00E-01												
U-235	1.10E-01	7.10E-02						6.00E-02	3.80E-01					U
U-238	7.90E-01	2.20E-01												
Total U Alpha	**1.60E+00**	**3.06E-01**												
Alpha Sum	**5.44E+00**	**1.38E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.90E-01	2.20E-01						1.32E+00	7.50E-01					J
Pa-234m (Assumed from U-238)	7.90E-01	2.20E-01						-1.30E+00	2.90E+00					UJ
Ac-227														
Ra-228	7.20E-01	4.40E-01												
Pa-231	3.00E-01	1.40E+00					U							
Beta Sum	**2.34E+00**	**5.64E-01**						**7.76E-01**	**3.03E+00**					
Total Activity Sum	**7.78E+00**	**1.49E+00**						**6.22E+00**	**3.33E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.60E+00	4.60E+00					J	**0.66**	**(from gamma)**		**45.0**			
Gross Beta	1.78E+01	4.50E+00					J	**3.41**	**3.14**		**154**			
Total Activity	2.96E+01	6.70E+00					J	**3.18**	**3.12**		**117**			

G01070038-18A			TLF-0600					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.60E-01					U
Ra-226	8.70E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.60E-01	3.10E-01					J							
Th-230	1.11E+00	3.30E-01					J							
Th-232	6.80E-01	2.40E-01					J							
U-234	6.20E-01	1.70E-01												
U-235	7.20E-02	5.90E-02						1.80E-01	1.70E-01					
U-238	5.90E-01	1.70E-01												
Total U Alpha	**1.28E+00**	**2.48E-01**												
Alpha Sum	**4.72E+00**	**1.90E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.90E-01	1.70E-01						1.60E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	5.90E-01	1.70E-01						-3.00E+00	3.50E+01					UJ
Ac-227														
Ra-228	8.60E-01	3.60E-01												
Pa-231	-2.00E-01	2.00E+00					U							
Beta Sum	**2.02E+00**	**4.95E-01**						**-5.64E-01**	**3.50E+01**					
Total Activity Sum	**6.74E+00**	**1.97E+00**						**4.16E+00**	**3.51E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.20E+01	4.90E+00					J	**1.38**	**(from gamma)**		**87.0**			
Gross Beta	1.61E+01	4.40E+00					J	**3.18**	**0.47**		**155**			
Total Activity	3.34E+01	7.10E+00					J	**3.62**	**0.82**		**133**			

G01070038-19A			TLF-0601					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.40E-01					U
Ra-226	1.31E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	2.70E-01					J							
Th-230	1.32E+00	3.80E-01					J							
Th-232	1.08E+00	3.30E-01					J							
U-234	1.85E+00	3.90E-01												
U-235	8.20E-02	7.20E-02						3.00E-02	3.70E-01					U
U-238	1.63E+00	3.50E-01												
Total U Alpha	**3.56E+00**	**5.29E-01**												
Alpha Sum	**7.59E+00**	**1.45E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.63E+00	3.50E-01						2.50E+00	1.30E+00					J
Pa-234m (Assumed from U-238)	1.63E+00	3.50E-01						0.00E+00	1.30E+01					UJ
Ac-227														
Ra-228	9.60E-01	4.50E-01												
Pa-231	-5.00E-01	1.30E+00					U							
Beta Sum	**4.16E+00**	**6.87E-01**						**3.40E+00**	**1.31E+01**					
Total Activity Sum	**1.18E+01**	**1.60E+00**						**1.10E+01**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.82E+01	6.10E+00					J	**1.69**	**(from gamma)**		**82.3**			
Gross Beta	1.93E+01	4.70E+00					J	**3.19**	**1.14**		**129**			
Total Activity	3.74E+01	7.40E+00					J	**3.39**	**1.75**		**104**			

G01070038-20A			TLF-0524					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.70E-01					U
Ra-226	8.10E-01	2.40E-01	9.60E-01	2.80E-01	**0.41**	**17**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	3.00E-01	7.60E-01	2.70E-01	**0.47**	**22.2**								
Th-230	7.10E-01	2.50E-01	6.90E-01	2.50E-01	**0.06**	**2.86**								
Th-232	1.02E+00	3.10E-01	8.00E-01	2.70E-01	**0.54**	**24.2**								
U-234	6.20E-01	1.90E-01	6.20E-01	1.70E-01	**0.00**	**0.00**								
U-235	2.30E-02	5.00E-02	4.50E-02	4.90E-02	**0.31**	**64.7**	U	-9.00E-02	7.70E-01					U
U-238	8.90E-01	2.40E-01	7.60E-01	1.90E-01	**0.42**	**15.8**								
Total U Alpha	**1.53E+00**	**3.10E-01**	**1.43E+00**	**2.60E-01**										
Alpha Sum	**5.02E+00**	**5.62E+00**	**4.64E+00**	**5.95E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.90E-01	2.40E-01	7.60E-01	1.90E-01	**0.42**	**15.8**		3.00E+00	1.80E+00					J
Pa-234m (Assumed from U-238)	8.90E-01	2.40E-01	7.60E-01	1.90E-01	**0.42**	**15.8**		0.00E+00	1.30E+01					UJ
Ac-227														
Ra-228	9.00E-01	3.60E-01												
Pa-231	0.00E+00	6.20E+00					U							
Beta Sum	**2.68E+00**	**8.93E-01**	**1.52E+00**	**2.69E-01**				**3.90E+00**	**1.32E+01**					
Total Activity Sum	**7.70E+00**	**5.69E+00**	**6.16E+00**	**6.53E-01**				**8.92E+00**	**1.43E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.64E+01	6.20E+00	1.39E+01	5.60E+00	**0.30**	**16.5**	J	**1.36**	**(from gamma)**		**106**			
Gross Beta	2.08E+01	5.10E+00	2.49E+01	5.70E+00	**0.54**	**17.9**	J	**3.50**	**1.20**		**154**			
Total Activity	3.53E+01	7.40E+00	3.68E+01	7.70E+00	**0.14**	**4.16**	J	**2.96**	**1.64**		**128**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070039

This sample delivery group (SDG) contained twenty (20) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting of all samples. All analyses requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-9549	G01070039-01A
TLF-0525	G01070039-02A
TLF-0465	G01070039-03A
TLF-0581	G01070039-04A
TLF-0580	G01070039-05A
TLF-0466	G01070039-06A
TLF-0467	G01070039-07A
TLF-0472	G01070039-08A
TLF-0473	G01070039-09A
TLF-0520	G01070039-10A
TLF-0521	G01070039-11A
TLF-0522	G01070039-12A
TLF-0523	G01070039-13A
TLF-0764	G01070039-14A
TLF-0765	G01070039-15A
TLF-0478	G01070039-16A
TLF-0479	G01070039-17A
TLF-0484	G01070039-18A
TLF-0485	G01070039-19A
TLF-0486	G01070039-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of ^{234}Th contamination in the gamma spectrometry method blank contained. Sample results less than 5 times the method blank ^{234}Th value should be qualified as estimated (J). All ^{234}Th sample results were less than 5 times the method blank value. **Therefore, it is recommended that the ^{234}Th results for all gamma spectrometry samples be qualified as estimated (J).**

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the ^{228}Ra sample results are greater than 5 times the rinsate blank activity. **Therefore, it is recommended that ^{234}Th results for samples TLF-0478 and ^{234m}Pa results for samples**: **TLF-9549, TLF-0580, TLF-0467, TLF-0472, TLF-0473, TLF-0484, and TLF-0485 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control samples (LCS) were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for all gamma spectrometry duplicate analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported. The laboratory was instructed to report any radioisotopes detected above the DL (1.65*TPU). Based on data review, ^{40}K was identified in samples TLF-0525, TLF-0465, TLF-0581, TLF-0580, TLF-0466, TLF-0467, TLF-0472, TLF-0520, TLF-0522, TLF-0764, TLF-0765, TLF-0478, TLF-0484, TLF-0485, and TLF-0486 (laboratory duplicate). The activity range for ^{40}K was approximately 5.99 " 1.60 to 24.26 " 4.96 pCi/g, which is within normal levels for ^{40}K naturally found in soil. Since ^{40}K also a beta emitter, it should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{228}Th and ^{230}Th. All associated sample results less than 5 times the method blank values for ^{228}Th and ^{230}Th should be qualified as estimated (J). All of the ^{228}Th sample results were greater than 5 times the method blank values. The ^{230}Th results for all samples were also greater 5 times the method blank results, except for samples TLF-0473, TLF-0523, TLF-0764, TLF-0479, and TLF-0485. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0473, TLF-0523, TLF-0764, TLF-0479, and TLF-0485 be qualified as extimated (J).**

Equipment Rinsate Blanks:

There was an indication of ^{234}U contamination in the rinsate blank. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the sample ^{234}U results were greater than 5 times the rinsate blank; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The sample tracer recoveries were greater than 53.26% and were within acceptable limits for all for isotopic Th and isotopic U alpha spectrometry analyses.

The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-9549, TLF-0525, TLF-0580, TLF-0466, TLF-0467, TLF-0472, TLF-0521, TLF-0523, TLF-0764, TLF0765, TLF-0478, TLF-0479, TLF-0486, and TLF-0486 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.74 " 0.18 to 1.35 " 0.27 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-9549, TLF-0525, TLF-0580, TLF-0466, TLF-0467, TLF-0472, TLF-0521, TLF-0523, TLF-0764, TLF-0765, TLF-0478, TLF-0479, TLF-0486, and TLF-0486 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

Contamination was indicated in the rinsate blank for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the sample results were greater than 5 times the rinsate blank result; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DERs for ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for ^{226}Ra analyses were greater than 60.1% for all analyses and were within acceptable limits.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated in the gross beta method blank. However, contamination was indicated for the gross alpha method blank. Samples with results less than 5 times the gross alpha method blank should be qualified as estimated. **Therefore, it is recommended that the gross beta results for samples TLF-0467, TLF-0473, TLF-0479, and TLF-0484 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery value for the gross alpha LCS (137%) was outside the acceptable limit. This may indicate a high bias in the gross alpha results. **Therefore, it is recommended that all gross alpha sample results be qualified as estimated (J).**

The gross beta LCS value was within acceptable limits.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.

Matrix Spike Sample:

The MSS percent recoveries for gross alpha and gross beta matrix spike samples were within acceptable limits.

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since gross alpha/beta analyses are qualitative analyses, no additional qualification is necessary.

5.0 TOTAL ACTIVITY:

Method Blank:

No blank contamination was indicated for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was within acceptable limits.

Duplicate Analysis:

The DERs for total activity duplicate analysis was within acceptable limits.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The U alpha data and U gamma data were in agreement within the uncertainties. No further qualification of the results is necessary.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The results for all samples agree within the uncertainties. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that most results agree within the uncertainty with one another except for samples TLF-0525, TLF-0581, TLF-0580, TLF-0472, TLF-0523, and TLF-0486 (laboratory duplicate). These differences are most likely due to disequilibrium from the uranium processing at the site or possibly sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-9549 (1.41), TLF-0525 (2.41), TLF-0465 (1.72), TLF-0581 (1.53), TLF-0466 (1.55), TLF-0472 (2.20), TLF-0473 (1.35), TLF-0520 (1.89), TLF-0521 (1.56), TLF-0523 (2.23), TLF-0764 (1.41), TLF0765 (1.96), TLF-0478 (2.06), TLF-0485 (1.36), and TLF-0486 (1.38) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (91.0%, 97.4%, 103%, 72.9%, 102%, 115%, 95.3%, 112%, 107%, 133%, 81.7%, 108%, 119%, 76.7%, and 85.0%, respectfully) also exceed acceptable limits. The samples have gross alpha results greater than the sum of the alphas by factors ranging from 1.8 to 4.9. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-9549, TLF-0525, TLF-0465, TLF-0581, TLF-0466, TLF-0472, TLF-0473, TLF-0520, TLF-0521, TLF-0523, TLF-0764, TLF0765, TLF-0478, TLF-0485, and TLF-0486 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs (1.40 to 3.98) for all samples were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (91.0% to 174%) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 3.4 to 14.5. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for samples TLF-0525, TLF-0465, TLF-0581, TLF-0580, TLF-0466, TLF-0472, TLF-0473, TLF-0520, TLF-0522, TLF-0764, TLF0765, TLF-0478, TLF-0484, and TLF-0485. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for all samples be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (2.13 to 3.78) for all samples were greater than 1.29 indicating that the total activity analyses were not in agreement with the total activity sums for those samples. The RPDs (86.8%, to 139%) for these samples also exceed acceptable limits. The samples have total activity results greater than the total activity sums by an approximate factor ranging from 2.5 to 5.6. This may be an indication of other activity in the sample that was not specifically analyzed for. . Also, if the ^{40}K results, as discussed in Section 1.0 had been reported from the gamma, the DERs and RPDs would be within limits for samples TLF-0581, TLF-0580, TLF-0466, TLF-0472, TLF-0473, TLF-0520, TLF-0522, TLF-0764, TLF0765, and TLF-0478. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for all samples be qualified as estimated (J).**

G01070039-01A			TLF-9549					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-01	1.30E-01					U
Ra-226	9.90E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.20E-01												
Th-230	7.70E-01	1.90E-01					J							
Th-232	7.90E-01	1.90E-01												
U-234	7.70E-01	2.60E-01												
U-235	1.02E-01	8.20E-02						-2.00E-02	3.90E-01					U
U-238	7.60E-01	2.50E-01												
Total U Alpha	**1.63E+00**	**3.70E-01**												
Alpha Sum	**5.09E+00**	**1.64E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.60E-01	2.50E-01						3.30E+00	2.20E+00					J
Pa-234m (Assumed from U-238)	7.60E-01	2.50E-01						-2.30E+00	2.20E+00					UJ
Ac-227														
Ra-228	6.60E-01	5.60E-01												
Pa-231	0.00E+00	1.70E+00					U							
Beta Sum	**2.18E+00**	**6.93E-01**						**1.66E+00**	**3.17E+00**					
Total Activity Sum	**7.27E+00**	**1.78E+00**						**6.75E+00**	**3.57E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	5.80E+00					J	**1.41**	**(from gamma)**		**91.0**			
Gross Beta	2.19E+01	4.90E+00					J	**3.98**	**3.47**		**164**			
Total Activity	3.26E+01	6.80E+00					J	**3.60**	**3.37**		**127**			

G01070039-02A			TLF-0525					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.80E-01					U
Ra-226	1.04E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.20E+00	2.50E-01												
Th-230	1.35E+00	2.70E-01					J							
Th-232	1.43E+00	2.80E-01												
U-234	1.06E+00	3.10E-01												
U-235	1.60E-02	5.90E-02					U	2.50E-01	3.50E-01					U
U-238	8.70E-01	2.70E-01												
Total U Alpha	**1.95E+00**	**4.15E-01**												
Alpha Sum	**8.73E+00**	**9.28E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.70E-01	2.70E-01						1.89E+00	8.30E-01					J
Pa-234m (Assumed from U-238)	8.70E-01	2.70E-01						3.00E-01	9.60E+00					U
Ac-227														
Ra-228	1.31E+00	4.10E-01												
Pa-231	1.96E+00	6.90E-01												
Beta Sum	**3.29E+00**	**5.66E-01**						**3.74E+00**	**9.64E+00**					
Total Activity Sum	**1.20E+01**	**1.09E+00**						**1.25E+01**	**9.69E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.53E+01	6.80E+00					J	**2.41**	**(from gamma)**		**97.4**			
Gross Beta	2.04E+01	5.10E+00					J	**3.34**	**1.53**		**145**			
Total Activity	4.33E+01	8.20E+00					J	**3.78**	**2.43**		**113**			

G01070039-03A			TLF-0465					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.20E-01					U
Ra-226	7.60E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	2.20E-01												
Th-230	8.90E-01	2.20E-01												
Th-232	9.20E-01	2.20E-01												
U-234	7.30E-01	2.50E-01												
U-235	4.30E-02	6.70E-02					U	-1.30E-01	3.70E-01					U
U-238	5.70E-01	2.10E-01												
Total U Alpha	**1.34E+00**	**3.33E-01**												
Alpha Sum	**4.53E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.70E-01	2.10E-01						1.60E+00	1.00E+00					J
Pa-234m (Assumed from U-238)	5.70E-01	2.10E-01						1.30E+00	8.90E+00					U
Ac-227														
Ra-228	4.70E-01	3.80E-01												
Pa-231	-3.00E-01	1.80E+00					U							
Beta Sum	**1.57E+00**	**5.28E-01**						**3.33E+00**	**8.97E+00**					
Total Activity Sum	**6.11E+00**	**1.80E+00**						**7.87E+00**	**9.13E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.41E+01	5.30E+00					J	**1.72**	**(from gamma)**		**103**			
Gross Beta	2.28E+01	5.50E+00					J	**3.84**	**1.85**		**174**			
Total Activity	3.40E+01	7.50E+00					J	**3.62**	**2.21**		**139**			

G01070039-04A			TLF-0581					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.90E-01					U
Ra-226	1.01E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.31E+00	2.70E-01												
Th-230	1.10E+00	2.40E-01												
Th-232	9.90E-01	2.20E-01												
U-234	8.20E-01	2.50E-01												
U-235	5.00E-02	5.40E-02						0.00E+00	1.70E+00					U
U-238	6.40E-01	2.10E-01												
Total U Alpha	**1.51E+00**	**3.31E-01**												
Alpha Sum	**8.71E+00**	**1.73E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.40E-01	2.10E-01						8.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	6.40E-01	2.10E-01						4.60E+00	9.80E+00					U
Ac-227														
Ra-228	6.80E-01	2.90E-01												
Pa-231	3.10E+00	1.80E+00												
Beta Sum	**2.33E+00**	**4.68E-01**						**6.45E+00**	**9.87E+00**					
Total Activity Sum	**1.10E+01**	**1.79E+00**						**1.52E+01**	**1.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.87E+01	6.30E+00					J	**1.53**	**(from gamma)**		**72.9**			
Gross Beta	1.89E+01	4.90E+00					J	**3.37**	**1.13**		**156**			
Total Activity	4.07E+01	8.20E+00					J	**3.53**	**1.97**		**115**			

G01070039-05A			TLF-0580					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.10E-01					U
Ra-226	9.10E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.10E-01												
Th-230	8.00E-01	2.00E-01					J							
Th-232	7.00E-01	1.80E-01												
U-234	6.00E-01	2.10E-01												
U-235	4.90E-02	5.90E-02						2.40E-01	3.00E-01					U
U-238	7.90E-01	2.50E-01												
Total U Alpha	**1.44E+00**	**3.32E-01**												
Alpha Sum	**6.92E+00**	**1.05E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.90E-01	2.50E-01						1.11E+00	8.90E-01					J
Pa-234m (Assumed from U-238)	7.90E-01	2.50E-01						0.00E+00	1.00E+02					UJ
Ac-227														
Ra-228	1.16E+00	3.50E-01												
Pa-231	2.50E+00	1.00E+00												
Beta Sum	**3.04E+00**	**5.12E-01**						**2.57E+00**	**1.00E+02**					
Total Activity Sum	**9.96E+00**	**1.17E+00**						**9.49E+00**	**1.00E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.21E+01	5.10E+00					J	**0.99**	**(from gamma)**		**54.5**			
Gross Beta	1.55E+01	4.20E+00					J	**2.94**	**0.13**		**134**			
Total Activity	3.30E+01	7.10E+00					J	**3.20**	**0.23**		**107**			

G01070039-06A			TLF-0466					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.40E-02	8.60E-02					U
Ra-226	1.10E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.80E-01	1.80E-01												
Th-230	1.04E+00	2.60E-01					J							
Th-232	4.00E-01	1.40E-01												
U-234	1.11E+00	3.30E-01												
U-235	3.60E-02	6.50E-02					U	2.00E-01	2.50E-01					U
U-238	9.40E-01	3.00E-01												
Total U Alpha	**2.09E+00**	**4.51E-01**												
Alpha Sum	**4.94E+00**	**1.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.40E-01	3.00E-01						3.50E+00	1.60E+00					J
Pa-234m (Assumed from U-238)	9.40E-01	3.00E-01						3.40E+00	5.40E+00					U
Ac-227														
Ra-228	4.60E-01	1.90E-01												
Pa-231	-3.00E-01	1.20E+00					U							
Beta Sum	**2.30E+00**	**4.87E-01**						**7.32E+00**	**5.64E+00**					
Total Activity Sum	**7.24E+00**	**1.35E+00**						**1.23E+01**	**5.78E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.52E+01	6.50E+00					J	**1.55**	**(from gamma)**		**102**			
Gross Beta	9.20E+00	3.60E+00					J	**1.90**	**0.28**		**120**			
Total Activity	1.95E+01	5.60E+00					J	**2.13**	**0.90**		**91.7**			

G01070039-07A			TLF-0467					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01					U
Ra-226	1.09E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	1.90E-01												
Th-230	8.30E-01	2.10E-01					J							
Th-232	8.60E-01	2.10E-01												
U-234	9.10E-01	2.90E-01												
U-235	1.10E-01	9.30E-02						0.00E+00	2.80E-01					U
U-238	6.10E-01	2.30E-01												
Total U Alpha	**1.63E+00**	**3.82E-01**												
Alpha Sum	**5.22E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.10E-01	2.30E-01						1.51E+00	7.40E-01					J
Pa-234m (Assumed from U-238)	6.10E-01	2.30E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	5.90E-01	3.70E-01												
Pa-231	1.00E-01	1.60E+00					U							
Beta Sum	**1.82E+00**	**5.29E-01**						**2.11E+00**	**1.20E+01**					
Total Activity Sum	**7.04E+00**	**1.65E+00**						**7.33E+00**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.20E+00	4.00E+00					J	**0.69**	**(from gamma)**		**44.4**			
Gross Beta	1.56E+01	4.40E+00					J	**3.11**	**1.05**		**158**			
Total Activity	3.04E+01	7.10E+00					J	**3.20**	**1.64**		**125**			

G01070039-08A			TLF-0472					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	2.80E-01					U
Ra-226	7.90E-01	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.20E-01	1.90E-01												
Th-230	9.10E-01	2.30E-01					J							
Th-232	6.00E-01	1.80E-01												
U-234	5.60E-01	2.00E-01												
U-235	1.28E-01	9.00E-02						-1.00E-01	5.20E-01					U
U-238	9.30E-01	2.70E-01												
Total U Alpha	**1.62E+00**	**3.48E-01**												
Alpha Sum	**5.63E+00**	**7.54E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	2.70E-01						6.30E-01	3.10E-01					J
Pa-234m (Assumed from U-238)	9.30E-01	2.70E-01						-1.00E+00	1.10E+01					UJ
Ac-227														
Ra-228	5.60E-01	2.40E-01												
Pa-231	1.21E+00	5.40E-01												
Beta Sum	**2.57E+00**	**4.56E-01**						**3.35E-01**	**1.10E+01**					
Total Activity Sum	**8.19E+00**	**8.81E-01**						**5.96E+00**	**1.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.09E+01	6.90E+00					J	**2.20**	**(from gamma)**		**115**			
Gross Beta	1.41E+01	4.20E+00					J	**2.73**	**1.17**		**138**			
Total Activity	2.18E+01	5.80E+00					J	**2.32**	**1.27**		**90.7**			

G01070039-09A			TLF-0473					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-03	9.60E-02					U
Ra-226	5.80E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	1.90E-01												
Th-230	6.30E-01	1.60E-01					J							
Th-232	6.70E-01	1.60E-01												
U-234	7.00E-01	2.40E-01												
U-235	5.00E-03	3.70E-02					U	1.70E-01	2.70E-01					U
U-238	5.80E-01	2.00E-01												
Total U Alpha	**1.29E+00**	**3.15E-01**												
Alpha Sum	**3.73E+00**	**1.52E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.80E-01	2.00E-01						1.43E+00	9.40E-01					J
Pa-234m (Assumed from U-238)	5.80E-01	2.00E-01						1.00E-01	9.70E+00					UJ
Ac-227														
Ra-228	3.70E-01	3.70E-01												
Pa-231	-3.00E-01	1.60E+00					U							
Beta Sum	**1.49E+00**	**5.04E-01**						**1.86E+00**	**9.75E+00**					
Total Activity Sum	**5.22E+00**	**1.61E+00**						**5.59E+00**	**9.87E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.05E+01	4.80E+00					J	**1.35**	**(from gamma)**		**95.3**			
Gross Beta	1.34E+01	3.80E+00					J	**3.11**	**1.10**		**160**			
Total Activity	1.92E+01	5.30E+00					J	**2.52**	**1.21**		**115**			

G01070039-10A			TLF-0520					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.70E-01					U
Ra-226	1.14E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	2.00E-01												
Th-230	8.60E-01	2.20E-01												
Th-232	6.90E-01	1.90E-01												
U-234	8.90E-01	2.60E-01												
U-235	1.40E-02	3.90E-02					U	6.00E-02	2.80E-01					U
U-238	7.70E-01	2.40E-01												
Total U Alpha	**1.67E+00**	**3.56E-01**												
Alpha Sum	**5.09E+00**	**1.25E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	2.40E-01						1.22E+00	5.70E-01					J
Pa-234m (Assumed from U-238)	7.70E-01	2.40E-01						2.50E+00	7.40E+00					U
Ac-227														
Ra-228	5.80E-01	2.70E-01												
Pa-231	0.00E+00	1.20E+00					U							
Beta Sum	**2.12E+00**	**4.57E-01**						**4.30E+00**	**7.43E+00**					
Total Activity Sum	**7.21E+00**	**1.33E+00**						**9.39E+00**	**7.53E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.80E+01	6.70E+00					J	**1.89**	**(from gamma)**		**112**			
Gross Beta	7.20E+00	3.60E+00					J	**1.40**	**0.35**		**109**			
Total Activity	1.93E+01	5.80E+00					J	**2.03**	**1.04**		**91.2**			

G01070039-11A			TLF-0521					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.30E-01					U
Ra-226	5.60E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.30E-01												
Th-230	9.10E-01	2.10E-01					J							
Th-232	9.00E-01	2.10E-01												
U-234	8.20E-01	2.50E-01												
U-235	4.40E-02	5.00E-02						-4.00E-02	3.80E-01					U
U-238	6.40E-01	2.10E-01												
Total U Alpha	**1.50E+00**	**3.30E-01**												
Alpha Sum	**4.59E+00**	**3.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.40E-01	2.10E-01						2.57E+00	8.40E-01					J
Pa-234m (Assumed from U-238)	6.40E-01	2.10E-01						9.00E-01	8.60E+00					U
Ac-227														
Ra-228	7.80E-01	4.00E-01												
Pa-231	-3.00E-01	4.20E+00					U							
Beta Sum	**2.02E+00**	**7.09E-01**						**4.21E+00**	**8.66E+00**					
Total Activity Sum	**6.62E+00**	**3.89E+00**						**8.81E+00**	**9.47E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.52E+01	5.60E+00					J	**1.56**	**(from gamma)**		**107**			
Gross Beta	1.84E+01	4.80E+00					J	**3.38**	**1.43**		**160**			
Total Activity	3.28E+01	7.30E+00					J	**3.17**	**2.01**		**133**			

G01070039-12A			TLF-0522					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	1.20E-01					U
Ra-226	1.07E+00	4.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.00E-01	2.30E-01												
Th-230	8.80E-01	2.40E-01												
Th-232	8.00E-01	2.30E-01												
U-234	6.80E-01	2.30E-01												
U-235	1.03E-01	8.30E-02						1.90E-01	1.80E-01					
U-238	7.00E-01	2.30E-01												
Total U Alpha	**1.48E+00**	**3.36E-01**												
Alpha Sum	**4.76E+00**	**1.37E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.00E-01	2.30E-01						1.19E+00	9.20E-01					J
Pa-234m (Assumed from U-238)	7.00E-01	2.30E-01						2.30E+00	8.70E+00					U
Ac-227														
Ra-228	5.40E-01	2.40E-01												
Pa-231	-3.00E-01	1.30E+00					U							
Beta Sum	**1.90E+00**	**4.33E-01**						**3.99E+00**	**8.75E+00**					
Total Activity Sum	**6.67E+00**	**1.43E+00**						**8.76E+00**	**8.86E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.35E+01	8.30E+00					J	**2.23**	**(from gamma)**		**133**			
Gross Beta	1.50E+01	4.50E+00					J	**2.90**	**1.12**		**155**			
Total Activity	2.36E+01	6.20E+00					J	**2.66**	**1.37**		**112**			

G01070039-13A			TLF-0523					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01					U
Ra-226	8.20E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	1.70E-01												
Th-230	7.60E-01	1.80E-01					J							
Th-232	6.60E-01	1.60E-01												
U-234	1.00E+00	3.00E-01												
U-235	3.80E-02	5.70E-02					U	2.90E-01	3.20E-01					
U-238	7.20E-01	2.40E-01												
Total U Alpha	**1.76E+00**	**3.88E-01**												
Alpha Sum	**7.48E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	2.40E-01						2.08E+00	6.70E-01					J
Pa-234m (Assumed from U-238)	7.20E-01	2.40E-01						1.90E+00	8.00E+00					U
Ac-227														
Ra-228	6.90E-01	3.10E-01												
Pa-231	3.10E+00	1.80E+00												
Beta Sum	**2.50E+00**	**5.08E-01**						**5.04E+00**	**8.04E+00**					
Total Activity Sum	**9.98E+00**	**1.79E+00**						**1.25E+01**	**8.22E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.10E+01	4.80E+00					J	**0.69**	**(from gamma)**		**38.1**			
Gross Beta	1.49E+01	4.00E+00					J	**3.07**	**1.10**		**142**			
Total Activity	2.53E+01	6.10E+00					J	**2.41**	**1.25**		**86.8**			

G01070039-14A			TLF-0764					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.20E-01					U
Ra-226	1.05E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E+00	2.50E-01												
Th-230	7.80E-01	2.00E-01					J							
Th-232	6.00E-01	1.70E-01												
U-234	8.70E-01	2.80E-01												
U-235	-6.00E-03	4.80E-02					U	3.00E-02	2.80E-01					U
U-238	7.30E-01	2.50E-01												
Total U Alpha	**1.59E+00**	**3.78E-01**												
Alpha Sum	**5.58E+00**	**1.32E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	2.50E-01						4.40E-01	2.20E-01					J
Pa-234m (Assumed from U-238)	7.30E-01	2.50E-01						3.30E+00	7.70E+00					U
Ac-227														
Ra-228	7.30E-01	2.80E-01												
Pa-231	6.00E-01	1.30E+00					U							
Beta Sum	**2.26E+00**	**4.77E-01**						**4.54E+00**	**7.71E+00**					
Total Activity Sum	**7.85E+00**	**1.41E+00**						**1.01E+01**	**7.82E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.33E+01	5.30E+00					J	**1.41**	**(from gamma)**		**81.7**			
Gross Beta	1.47E+01	4.30E+00					J	**2.87**	**1.15**		**147**			
Total Activity	3.22E+01	7.00E+00					J	**3.41**	**2.10**		**122**			

G01070039-15A			TLF-0765					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.20E-01					U
Ra-226	7.90E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	1.90E-01												
Th-230	9.00E-01	2.00E-01					J							
Th-232	8.00E-01	1.90E-01												
U-234	5.10E-01	2.00E-01												
U-235	1.12E-01	8.50E-02						2.00E-02	3.30E-01					U
U-238	6.10E-01	2.20E-01												
Total U Alpha	**1.23E+00**	**3.09E-01**												
Alpha Sum	**4.60E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.10E-01	2.20E-01						4.20E+00	1.80E+00					J
Pa-234m (Assumed from U-238)	6.10E-01	2.20E-01						2.00E+00	1.00E+01					U
Ac-227														
Ra-228	9.80E-01	5.10E-01												
Pa-231	1.00E-01	1.80E+00					U							
Beta Sum	**2.21E+00**	**6.35E-01**						**7.19E+00**	**1.02E+01**					
Total Activity Sum	**6.81E+00**	**1.82E+00**						**1.18E+01**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.55E+01	5.30E+00					J	**1.96**	**(from gamma)**		**108**			
Gross Beta	1.89E+01	4.70E+00					J	**3.52**	**1.04**		**158**			
Total Activity	3.32E+01	7.20E+00					J	**3.55**	**1.70**		**132**			

G01070039-16A			TLF-0478					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	1.40E-01					U
Ra-226	6.90E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	1.90E-01												
Th-230	7.90E-01	2.00E-01					J							
Th-232	8.20E-01	2.00E-01												
U-234	7.10E-01	2.40E-01												
U-235	4.60E-02	6.30E-02					U	-7.00E-02	7.30E-01					U
U-238	6.20E-01	2.10E-01												
Total U Alpha	**1.38E+00**	**3.25E-01**												
Alpha Sum	**4.24E+00**	**1.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.20E-01	2.10E-01						1.40E-01	8.90E-01					UJ
Pa-234m (Assumed from U-238)	6.20E-01	2.10E-01						4.50E+00	7.40E+00					U
Ac-227														
Ra-228	7.10E-01	2.90E-01												
Pa-231	-2.00E-01	1.40E+00					U							
Beta Sum	**1.93E+00**	**4.48E-01**						**5.33E+00**	**7.46E+00**					
Total Activity Sum	**6.16E+00**	**1.43E+00**						**9.56E+00**	**7.58E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.67E+01	5.90E+00					J	**2.06**	**(from gamma)**		**119**			
Gross Beta	1.94E+01	4.90E+00					J	**3.55**	**1.58**		**164**			
Total Activity	2.80E+01	6.70E+00					J	**3.19**	**1.82**		**128**			

G01070039-17A			TLF-0479					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.20E-01					U
Ra-226	8.70E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	1.90E-01												
Th-230	7.40E-01	1.80E-01					J							
Th-232	7.70E-01	1.80E-01												
U-234	5.90E-01	2.20E-01												
U-235	1.10E-02	4.40E-02					U	0.00E+00	3.50E-01					U
U-238	8.80E-01	2.70E-01												
Total U Alpha	**1.48E+00**	**3.51E-01**												
Alpha Sum	**4.65E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.80E-01	2.70E-01						3.20E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	8.80E-01	2.70E-01						2.00E+00	1.00E+01					U
Ac-227														
Ra-228	6.50E-01	3.00E-01												
Pa-231	0.00E+00	1.60E+00					U							
Beta Sum	**2.41E+00**	**5.22E-01**						**5.85E+00**	**1.01E+01**					
Total Activity Sum	**7.06E+00**	**1.62E+00**						**1.05E+01**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.60E+00	5.20E+00					J	**0.91**	**(from gamma)**		**69.5**			
Gross Beta	1.53E+01	4.20E+00					J	**3.05**	**0.86**		**146**			
Total Activity	3.10E+01	7.10E+00					J	**3.29**	**1.65**		**126**			

G01070039-18A			TLF-0484					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.40E-01					U
Ra-226	8.40E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.10E-01	1.80E-01												
Th-230	8.40E-01	2.00E-01												
Th-232	8.00E-01	1.90E-01												
U-234	7.80E-01	2.50E-01												
U-235	3.10E-02	4.40E-02					U	-7.00E-02	6.00E-01					U
U-238	6.20E-01	2.20E-01												
Total U Alpha	**1.43E+00**	**3.36E-01**												
Alpha Sum	**4.35E+00**	**1.37E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.20E-01	2.20E-01						1.00E+00	8.50E-01					J
Pa-234m (Assumed from U-238)	6.20E-01	2.20E-01						-1.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	8.20E-01	3.10E-01												
Pa-231	-3.00E-01	1.40E+00					U							
Beta Sum	**2.02E+00**	**4.70E-01**						**7.84E-01**	**1.20E+01**					
Total Activity Sum	**6.38E+00**	**1.45E+00**						**5.14E+00**	**1.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.40E+00	4.20E+00					J	**1.14**	**(from gamma)**		**73.4**			
Gross Beta	1.63E+01	4.30E+00					J	**3.30**	**1.21**		**156**			
Total Activity	3.34E+01	7.10E+00					J	**3.73**	**2.01**		**136**			

G01070039-19A			TLF-0485					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								7.00E-02	1.10E-01					U
Ra-226	9.60E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.09E+00	2.40E-01												
Th-230	7.80E-01	1.90E-01					J							
Th-232	8.30E-01	2.00E-01												
U-234	6.50E-01	2.20E-01												
U-235	4.70E-02	5.40E-02						3.40E-01	3.20E-01					
U-238	8.10E-01	2.60E-01												
Total U Alpha	**1.51E+00**	**3.45E-01**												
Alpha Sum	**5.08E+00**	**1.22E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E-01	2.60E-01						1.90E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	8.10E-01	2.60E-01						-2.00E+00	7.60E+01					UJ
Ac-227														
Ra-228	4.20E-01	3.20E-01												
Pa-231	-1.00E-01	1.20E+00					U							
Beta Sum	**2.03E+00**	**5.08E-01**						**3.08E-01**	**7.60E+01**					
Total Activity Sum	**7.11E+00**	**1.32E+00**						**5.39E+00**	**7.60E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.14E+01	4.50E+00					J	**1.36**	**(from gamma)**		**76.7**			
Gross Beta	1.44E+01	4.30E+00					J	**2.86**	**0.19**		**151**			
Total Activity	2.74E+01	6.70E+00					J	**2.97**	**0.29**		**118**			

G01070039-20A			TLF-0486					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01	-1.00E-01	1.40E-01	**0.73**	**371**	U
Ra-226	7.80E-01	2.30E-01	9.00E-01	2.60E-01	**0.35**	**14.3**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	2.60E-01	8.20E-01	2.10E-01	**0.54**	**19.8**								
Th-230	8.40E-01	2.30E-01	9.90E-01	2.30E-01	**0.46**	**16.4**	J							
Th-232	7.30E-01	2.00E-01	6.80E-01	1.80E-01	**0.19**	**7.09**								
U-234	6.20E-01	2.30E-01	5.00E-01	2.10E-01	**0.39**	**21.4**								
U-235	9.20E-02	8.60E-02	8.80E-02	7.80E-02	**0.03**	**4.44**		1.50E-01	3.00E-01	1.50E-01	3.10E-01	**0.00**	**0.00**	U
U-238	6.60E-01	2.30E-01	7.10E-01	2.50E-01	**0.15**	**7.30**								
Total U Alpha	**1.37E+00**	**3.36E-01**	**1.30E+00**	**3.36E-01**										
Alpha Sum	**4.72E+00**	**1.22E+00**	**6.00E+00**	**9.39E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.60E-01	2.30E-01	7.10E-01	2.50E-01	**0.15**	**7.30**		7.00E-01	4.40E-01	1.14E+00	8.60E-01	**0.46**	**47.8**	J
Pa-234m (Assumed from U-238)	6.60E-01	2.30E-01	7.10E-01	2.50E-01	**0.15**	**7.30**		2.00E-01	7.80E+00	0.00E+00	1.80E+01	**0.01**	**200**	U
Ac-227														
Ra-228	7.30E-01	2.70E-01	7.70E-01	2.70E-01	**0.10**	**5.33**								
Pa-231	0.00E+00	1.20E+00	1.46E+00	8.40E-01	**1.00**	**200**	U							
Beta Sum	**2.05E+00**	**4.47E-01**	**2.37E+00**	**4.56E-01**				**1.63E+00**	**7.82E+00**	**2.09E+00**	**1.80E+01**			
Total Activity Sum	**6.77E+00**	**1.30E+00**	**8.37E+00**	**1.04E+00**				**6.35E+00**	**7.91E+00**	**8.09E+00**	**1.80E+01**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.17E+01	4.90E+00	1.09E+01	4.20E+00	**0.12**	**7.08**	J	**1.38**	**(from gamma)**		**85.0**			
Gross Beta	1.68E+01	4.50E+00	1.71E+01	4.50E+00	**0.05**	**1.77**	J	**3.26**	**1.68**		**156**			
Total Activity	2.74E+01	6.50E+00	3.74E+01	7.80E+00	**0.98**	**30.9**	J	**3.11**	**2.06**		**121**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070040

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0518	G01070040-01A
TLF-0519	G01070040-02A
TLF-9547	G01070040-03A
TLF-9548	G01070040-04A
TLF-0740	G01070040-05A
TLF-0745	G01070040-06A
TLF-0746	G01070040-07A
TLF-0747	G01070040-08A
TLF-0482	G01070040-09A
TLF-0483	G01070040-10A
TLF-9488	G01070040-11A
TLF-0504	G01070040-12A
TLF-0505	G01070040-13A
TLF-0506	G01070040-14A
TLF-0507	G01070040-15A
TLF-0508	G01070040-16A
TLF-0509	G01070040-17A
TLF-0570	G01070040-18A
TLF-0571	G01070040-19A
TLF-0572	G01070040-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in the gamma spectrometry method blank for ^{234}Th. All samples with results less than 5 times the blank for ^{234}Th should be qualified as estimated. **Therefore, it is recommended that the ^{234}Th results for all samples be qualified as estimated (J).**

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. All sample results for ^{228}Ra were greater than 5 times the rinsate blank; therefore, no qualification of the ^{228}Ra results is necessary. **However, it is recommended that samples TLF-0482, TLF-9488, TLF0509 (laboratory duplicate), and TLF-0572 for ^{234}Th, and TLF-0518, TLF-9548, TLF-0740, TLF-0745, TLF-0746, TLF-0747, TLF-9488, TLF-0504, TLF-0505, TLF-0506, TLF-0507, TLF-0508, TLF-0509, TLF-0570, TLF-0571, and TLF-0572 for ^{234}Pa be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analyses for all gamma spectrometry analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The software calculates the uncertainty for a positive result in the same manner. Therefore it is acceptable for the laboratory to report the absolute value of the negative uncertainty.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in fifteen of the samples above the DL. The activity range for ^{40}K was 7.94E0 pCi/g to 2.19E1 pCi/g, which are normal levels for ^{40}K naturally found in soil. Also, ^{137}Cs was identified in four of the samples above the DL. The activity range for ^{137}Cs was 8.59E-2 pCi/g to 2.71E-1 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the $^{228/230}$Th and ^{234}U analyses. All samples with $^{228/230}$Th and ^{234}U results less than 5 times the blank should be qualified as estimated. All sample results for ^{228}Th were greater than 5 times the rinsate blank; therefore, no qualification of the ^{228}Th results is necessary. **However, it is recommended that the ^{230}Th results for samples TLF-0519, TLF-0747, TLF-0482, TLF-0483, TLF-0505, TLF-0507, TLF-0509, and TLF-0572, and the ^{234}U results for samples TLF-0519, TLF-9547, TLF-9548, TLF-0740, TLF-0745, TLF-0746, TLF-0747, TLF-0482, TLF-0483, TLF-9488, TLF-0507, TLF-0509, TLF-0570, TLF-0571, and TLF-0572 be qualified as estimated (J).**

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 24% for all samples for the alpha analyses. The associated uncertainties in the recoveries were all less than 10%; therefore, no qualification is necessary.

Spectral Analysis:

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.8 MeV and 6.3 MeV, regions. It is assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was an indication of blank contamination in the ^{226}Ra analysis. All samples with ^{226}Ra results less than 5 times the blank should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 77%. No qualification of the data is necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha analyses. There was an indication of blank contamination in the gross beta analyses. All samples with gross beta results less than 5 times the blank should be qualified as estimated. **Therefore, it is recommended that the gross beta results for samples TLF-0518, TLF-9547, TLF-0746, TLF-0747, TLF-0504, TLF-0507, TLF-0508, TLF-0509, TLF-0570, TLF-0571, TLF-0572 (laboratory duplicate) be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recoveries for the gross alpha/beta LCSs are within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The MS recoveries for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results did not meet the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra results for TLF-0747 are not in agreement with the ^{232}Th results. Since the ^{228}Th and the ^{232}Th are in equilibrium, it appears the disagreement is due to sample heterogeneity.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF-9547 and TLF-0572. These differences are most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0518 (1.92), TLF-0519 (1.68), TLF-9547 (1.35), TLF-0740 (1.76), TLF-0745 (1.56), TLF-0746 (2.15), TLF-0747 (1.62), TLF-0483 (2.10), TLF-9488 (1.56), TLF-0504 (2.04), TLF-0505 (1.33), TLF-0508 (1.53), TLF-0509 (1.75), TLF-0570 (1.70), and TLF-0572 (1.86) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (109%, 94.7%, 64.7%, 105%, 84.8%, 111%, 91.3%, 112%, 103%, 83.8%, 89.6%, 64.7%, 103%, 114%, and 102%, respectfully) also exceed acceptable limits. The samples have gross alpha results that are 2 to 4 times greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possibility of missing activity be looked into in the future, and the gross alpha results for all samples be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs (1.56 to 4.07) for all samples were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (127% to 184%) for all samples also exceed acceptable limits. The samples have gross beta results 4 to 24 times greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity DERs for samples TLF-0518 (3.24), TLF-0519 (3.37), TLF-9547 (2.54), TLF-9548 (3.45), TLF-0740 (3.37), TLF-0745 (3.70), TLF-0746 (3.64), TLF-0747 (3.30), TLF-0482 (3.44), TLF-0483 (3.68), TLF-9488 (3.24), TLF-0504 (3.52), TLF-0505 (3.39), TLF-0506 (3.72), TLF-0508 (3.12), TLF-0509 (3.01), TLF-0570 (3.70), TLF-0571 (3.04), and TLF-0572 (3.54) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (124%, 130%, 89.4%, 116%, 132%, 131%, 128%, 122%, 130%, 127%, 132%, 107%, 128%, 122%, 97.3%, 128%, 143%, 122%, and 119%, respectfully) also exceed acceptable limits. The samples have a total activity result 3 to 7 times greater than the sum of the alpha and beta emitters. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be looked into in the future. No qualification of the data is necessary since the total activity analysis is for comparison purposes.**

G01070040-01A			TLF-0518					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.40E-01					U
Ra-226	7.50E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.70E-01												
Th-230	1.02E+00	2.80E-01												
Th-232	7.50E-01	2.30E-01												
U-234	9.90E-01	2.30E-01												
U-235	3.10E-02	4.20E-02					U	-8.00E-02	6.40E-01					U
U-238	7.20E-01	1.90E-01												
Total U Alpha	**1.74E+00**	**3.01E-01**												
Alpha Sum	**4.76E+00**	**1.90E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E-01	1.90E-01						1.22E+00	7.10E-01					J
Pa-234m (Assumed from U-238)	7.20E-01	1.90E-01						0.00E+00	3.30E+02					UJ
Ac-227														
Ra-228	7.40E-01	3.60E-01												
Pa-231	-5.00E-01	2.00E+00					U							
Beta Sum	**2.12E+00**	**5.09E-01**						**1.90E+00**	**3.30E+02**					
Total Activity Sum	**6.88E+00**	**1.96E+00**						**6.66E+00**	**3.30E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	5.60E+00					J	**1.92**	**(from gamma)**		**109**			
Gross Beta	1.55E+01	4.30E+00					J	**3.09**	**0.04**		**152**			
Total Activity	2.95E+01	6.70E+00						**3.24**	**0.07**		**124**			

G01070040-02A			TLF-0519					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.30E-01					U
Ra-226	9.90E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	2.50E-01												
Th-230	7.80E-01	2.20E-01					J							
Th-232	8.90E-01	2.30E-01												
U-234	7.50E-01	2.10E-01					J							
U-235	6.60E-02	6.20E-02						-1.00E-02	4.90E-01					U
U-238	7.30E-01	7.10E-02												
Total U Alpha	**1.55E+00**	**2.30E-01**												
Alpha Sum	**5.04E+00**	**2.05E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E-01	7.10E-02						1.69E+00	7.90E-01					J
Pa-234m (Assumed from U-238)	7.30E-01	7.10E-02						3.00E+00	1.10E+01					U
Ac-227														
Ra-228	5.70E-01	3.90E-01												
Pa-231	-1.00E-01	2.20E+00					U							
Beta Sum	**2.02E+00**	**4.82E-01**						**5.25E+00**	**1.10E+01**					
Total Activity Sum	**7.05E+00**	**2.11E+00**						**1.03E+01**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.41E+01	5.00E+00					J	**1.68**	**(from gamma)**		**94.7**			
Gross Beta	2.05E+01	5.20E+00					J	**3.54**	**1.25**		**164**			
Total Activity	3.30E+01	7.40E+00						**3.37**	**1.69**		**130**			

G01070040-03A			TLF-9547					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.30E-01					U
Ra-226	1.14E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.70E-01												
Th-230	1.10E+00	3.00E-01												
Th-232	7.50E-01	2.40E-01												
U-234	7.60E-01	1.80E-01					J							
U-235	3.00E-02	3.40E-02						8.00E-02	3.20E-01					U
U-238	8.60E-01	1.90E-01												
Total U Alpha	**1.65E+00**	**2.64E-01**												
Alpha Sum	**7.87E+00**	**1.03E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E-01	1.90E-01						9.60E-01	6.80E-01					J
Pa-234m (Assumed from U-238)	8.60E-01	1.90E-01						1.00E+00	8.80E+00					U
Ac-227														
Ra-228	6.10E-01	3.50E-01												
Pa-231	2.58E+00	9.20E-01												
Beta Sum	**2.64E+00**	**4.55E-01**						**2.88E+00**	**8.83E+00**					
Total Activity Sum	**1.05E+01**	**1.13E+00**						**1.08E+01**	**8.89E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.54E+01	5.50E+00					J	**1.35**	**(from gamma)**		**64.7**			
Gross Beta	1.49E+01	4.40E+00					J	**2.77**	**1.22**		**140**			
Total Activity	2.75E+01	6.60E+00						**2.54**	**1.51**		**89.4**			

G01070040-04A			TLF-9548					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.20E-01					U
Ra-226	7.50E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.14E+00	2.80E-01												
Th-230	8.40E-01	2.30E-01												
Th-232	9.10E-01	2.40E-01												
U-234	8.50E-01	2.10E-01					J							
U-235	7.50E-02	6.00E-02						-3.00E-02	7.60E-01					U
U-238	8.00E-01	2.00E-01												
Total U Alpha	**1.73E+00**	**2.96E-01**												
Alpha Sum	**5.55E+00**	**1.47E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.00E-01						1.52E+00	9.70E-01					J
Pa-234m (Assumed from U-238)	8.00E-01	2.00E-01						-1.00E+00	5.20E+01					UJ
Ac-227														
Ra-228	1.48E+00	4.70E-01												
Pa-231	2.00E-01	1.50E+00					U							
Beta Sum	**3.10E+00**	**5.77E-01**						**2.02E+00**	**5.20E+01**					
Total Activity Sum	**8.65E+00**	**1.58E+00**						**7.57E+00**	**5.20E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.19E+01	4.90E+00					J	**1.24**	**(from gamma)**		**72.9**			
Gross Beta	2.16E+01	4.90E+00					J	**3.75**	**0.37**		**150**			
Total Activity	3.27E+01	6.80E+00						**3.45**	**0.48**		**116**			

G01070040-05A			TLF-0740					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	1.40E-01					U
Ra-226	7.30E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.70E-01	2.00E-01												
Th-230	8.70E-01	2.20E-01												
Th-232	6.90E-01	1.80E-01												
U-234	8.50E-01	2.10E-01					J							
U-235	6.40E-02	5.30E-02						1.40E-01	5.20E-01					U
U-238	7.40E-01	1.90E-01												
Total U Alpha	**1.65E+00**	**2.88E-01**												
Alpha Sum	**4.26E+00**	**1.96E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	1.90E-01						1.05E+00	6.50E-01					J
Pa-234m (Assumed from U-238)	7.40E-01	1.90E-01						0.00E+00	8.60E+00					UJ
Ac-227														
Ra-228	8.00E-01	3.50E-01												
Pa-231	-5.00E-01	2.10E+00					U							
Beta Sum	**2.22E+00**	**5.08E-01**						**1.79E+00**	**8.64E+00**					
Total Activity Sum	**6.48E+00**	**2.03E+00**						**6.05E+00**	**8.86E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.37E+01	5.00E+00					J	**1.76**	**(from gamma)**		**105**			
Gross Beta	2.29E+01	5.40E+00					J	**3.81**	**2.07**		**165**			
Total Activity	3.14E+01	7.10E+00						**3.37**	**2.23**		**132**			

G01070040-06A			TLF-0745					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.20E-01					U
Ra-226	9.40E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.30E-01												
Th-230	9.40E-01	2.30E-01												
Th-232	7.30E-01	1.90E-01												
U-234	7.00E-01	2.00E-01					J							
U-235	2.50E-02	4.50E-02					U	2.00E-02	3.00E-01					U
U-238	7.80E-01	2.00E-01												
Total U Alpha	**1.51E+00**	**2.86E-01**												
Alpha Sum	**5.06E+00**	**1.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.00E-01						1.40E+00	1.00E+00					J
Pa-234m (Assumed from U-238)	7.80E-01	2.00E-01						-2.00E+00	4.20E+01					UJ
Ac-227														
Ra-228	6.70E-01	3.40E-01												
Pa-231	0.00E+00	1.30E+00					U							
Beta Sum	**2.23E+00**	**4.69E-01**						**7.00E-02**	**4.20E+01**					
Total Activity Sum	**7.29E+00**	**1.37E+00**						**5.13E+00**	**4.20E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.25E+01	4.60E+00					J	**1.56**	**(from gamma)**		**84.8**			
Gross Beta	1.84E+01	4.80E+00					J	**3.35**	**0.43**		**157**			
Total Activity	3.48E+01	7.30E+00						**3.70**	**0.70**		**131**			

G01070040-07A			TLF-0746					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.30E-01					U
Ra-226	1.03E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	2.40E-01												
Th-230	9.10E-01	2.30E-01												
Th-232	9.80E-01	2.40E-01												
U-234	6.30E-01	1.70E-01					J							
U-235	6.30E-02	5.00E-02						1.30E-01	3.20E-01					U
U-238	6.80E-01	1.80E-01												
Total U Alpha	**1.37E+00**	**2.53E-01**												
Alpha Sum	**4.94E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.80E-01	1.80E-01						1.70E+00	6.90E-01					J
Pa-234m (Assumed from U-238)	6.80E-01	1.80E-01						0.00E+00	1.40E+02					UJ
Ac-227														
Ra-228	9.90E-01	3.30E-01												
Pa-231	-3.00E-01	1.90E+00					U							
Beta Sum	**2.31E+00**	**4.75E-01**						**2.65E+00**	**1.40E+02**					
Total Activity Sum	**7.26E+00**	**1.86E+00**						**7.60E+00**	**1.40E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.72E+01	5.40E+00					J	**2.15**	**(from gamma)**		**111**			
Gross Beta	1.70E+01	4.40E+00					J	**3.32**	**0.10**		**152**			
Total Activity	3.33E+01	6.90E+00						**3.64**	**0.18**		**128**			

G01070040-08A			TLF-0747					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01					U
Ra-226	8.60E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.80E-01	2.00E-01												
Th-230	7.00E-01	1.90E-01					J							
Th-232	8.60E-01	2.10E-01												
U-234	8.90E-01	2.10E-01					J							
U-235	5.30E-02	4.90E-02						-1.00E-02	3.60E-01					U
U-238	6.90E-01	1.80E-01												
Total U Alpha	**1.63E+00**	**2.81E-01**												
Alpha Sum	**4.92E+00**	**1.45E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	1.80E-01						3.10E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	6.90E-01	1.80E-01						-2.10E+00	7.80E+00					UJ
Ac-227														
Ra-228	3.40E-01	2.60E-01												
Pa-231	1.00E-01	1.50E+00					U							
Beta Sum	**1.73E+00**	**4.06E-01**						**1.35E+00**	**7.93E+00**					
Total Activity Sum	**6.66E+00**	**1.50E+00**						**6.28E+00**	**8.06E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.32E+01	4.90E+00					J	**1.62**	**(from gamma)**		**91.3**			
Gross Beta	1.58E+01	4.10E+00					J	**3.41**	**1.62**		**160**			
Total Activity	2.74E+01	6.10E+00						**3.30**	**2.09**		**122**			

G01070040-09A			TLF-0482					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.30E-01					U
Ra-226	8.50E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.10E-01												
Th-230	6.60E-01	1.70E-01					J							
Th-232	6.90E-01	1.70E-01												
U-234	5.20E-01	1.70E-01					J							
U-235	3.20E-02	4.30E-02					U	1.40E-01	3.20E-01					U
U-238	8.00E-01	2.10E-01												
Total U Alpha	**1.35E+00**	**2.74E-01**												
Alpha Sum	**4.69E+00**	**1.44E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.10E-01						5.00E-01	1.00E+00					UJ
Pa-234m (Assumed from U-238)	8.00E-01	2.10E-01						2.00E+00	7.50E+00					U
Ac-227														
Ra-228	3.80E-01	2.70E-01												
Pa-231	3.00E-01	1.50E+00					U							
Beta Sum	**2.02E+00**	**4.40E-01**						**2.92E+00**	**7.57E+00**					
Total Activity Sum	**6.71E+00**	**1.50E+00**						**7.61E+00**	**7.71E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.06E+01	5.10E+00					J	**1.11**	**(from gamma)**		**77.3**			
Gross Beta	2.06E+01	5.00E+00					J	**3.70**	**1.95**		**164**			
Total Activity	3.17E+01	7.10E+00						**3.44**	**2.30**		**130**			

G01070040-10A			TLF-0483					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.10E-01					U
Ra-226	8.60E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.00E-01												
Th-230	8.10E-01	2.10E-01					J							
Th-232	8.00E-01	2.00E-01												
U-234	7.30E-01	1.90E-01					J							
U-235	5.80E-02	4.30E-02						2.40E-01	3.00E-01					U
U-238	6.80E-01	1.80E-01												
Total U Alpha	**1.47E+00**	**2.65E-01**												
Alpha Sum	**4.69E+00**	**1.36E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.80E-01	1.80E-01						1.91E+00	7.10E-01					J
Pa-234m (Assumed from U-238)	6.80E-01	1.80E-01						1.80E+00	8.10E+00					U
Ac-227														
Ra-228	4.20E-01	3.80E-01												
Pa-231	0.00E+00	1.40E+00					U							
Beta Sum	**1.78E+00**	**4.87E-01**						**4.13E+00**	**8.14E+00**					
Total Activity Sum	**6.47E+00**	**1.44E+00**						**8.82E+00**	**8.25E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.66E+01	5.50E+00					J	**2.10**	**(from gamma)**		**112**			
Gross Beta	2.06E+01	4.60E+00					J	**4.07**	**1.76**		**168**			
Total Activity	2.88E+01	5.90E+00						**3.68**	**1.97**		**127**			

G01070040-11A			TLF-9488					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.50E-01	1.20E-01					
Ra-226	9.10E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.40E-01	1.90E-01												
Th-230	9.50E-01	2.40E-01												
Th-232	7.00E-01	2.00E-01												
U-234	5.40E-01	1.60E-01					J							
U-235	6.70E-02	5.00E-02						5.00E-02	3.20E-01					U
U-238	6.90E-01	1.80E-01												
Total U Alpha	**1.30E+00**	**2.46E-01**												
Alpha Sum	**3.78E+00**	**2.05E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	1.80E-01						1.30E-01	8.80E-01					UJ
Pa-234m (Assumed from U-238)	6.90E-01	1.80E-01						6.00E-01	8.30E+00					UJ
Ac-227														
Ra-228	9.50E-01	3.10E-01												
Pa-231	-8.00E-01	2.20E+00					U							
Beta Sum	**2.23E+00**	**4.80E-01**						**1.58E+00**	**8.36E+00**					
Total Activity Sum	**6.01E+00**	**2.10E+00**						**5.36E+00**	**8.60E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.18E+01	4.70E+00					J	**1.56**	**(from gamma)**		**103**			
Gross Beta	2.27E+01	5.40E+00					J	**3.78**	**2.12**		**164**			
Total Activity	2.94E+01	6.90E+00						**3.24**	**2.18**		**132**			

G01070040-12A			TLF-0504					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.30E-01					U
Ra-226	1.12E+00	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.80E-01												
Th-230	1.09E+00	2.10E-01												
Th-232	7.00E-01	1.50E-01												
U-234	1.14E+00	2.40E-01												
U-235	5.00E-02	4.00E-02						1.10E-01	4.20E-02					
U-238	1.14E+00	2.40E-01												
Total U Alpha	**2.33E+00**	**3.42E-01**												
Alpha Sum	**7.94E+00**	**1.88E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.14E+00	2.40E-01						2.67E+00	9.20E-01					J
Pa-234m (Assumed from U-238)	1.14E+00	2.40E-01						0.00E+00	1.10E+01					UJ
Ac-227														
Ra-228	5.90E-01	3.40E-01												
Pa-231	2.00E+00	2.00E+00												
Beta Sum	**3.11E+00**	**5.37E-01**						**3.50E+00**	**1.10E+01**					
Total Activity Sum	**1.11E+01**	**1.96E+00**						**1.14E+01**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.94E+01	5.30E+00					J	**2.04**	**(from gamma)**		**83.8**			
Gross Beta	1.56E+01	4.10E+00					J	**3.02**	**1.03**		**134**			
Total Activity	3.63E+01	6.90E+00						**3.52**	**1.89**		**107**			

G01070040-13A			TLF-0505					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.90E-01					U
Ra-226	8.20E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.07E+00	2.80E-01												
Th-230	7.80E-01	2.40E-01					J							
Th-232	8.40E-01	2.30E-01												
U-234	1.12E+00	2.40E-01												
U-235	9.20E-02	5.70E-02						-2.20E-01	6.30E-01					U
U-238	9.50E-01	2.10E-01												
Total U Alpha	**2.16E+00**	**3.24E-01**												
Alpha Sum	**5.49E+00**	**3.65E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.50E-01	2.10E-01						1.44E+00	9.50E-01					J
Pa-234m (Assumed from U-238)	9.50E-01	2.10E-01						0.00E+00	1.70E+02					UJ
Ac-227														
Ra-228	7.80E-01	3.60E-01												
Pa-231	-2.00E-01	4.00E+00					U							
Beta Sum	**2.66E+00**	**6.69E-01**						**2.20E+00**	**1.70E+02**					
Total Activity Sum	**8.15E+00**	**3.71E+00**						**7.69E+00**	**1.70E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.44E+01	5.60E+00					J	**1.33**	**(from gamma)**		**89.6**			
Gross Beta	2.23E+01	5.30E+00					J	**3.68**	**0.12**		**157**			
Total Activity	3.74E+01	7.80E+00						**3.39**	**0.17**		**128**			

G01070040-14A			TLF-0506					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.10E-01					U
Ra-226	8.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.80E-01	1.90E-01												
Th-230	9.60E-01	2.20E-01												
Th-232	8.90E-01	2.10E-01												
U-234	1.04E+00	2.40E-01												
U-235	1.22E-01	6.60E-02						3.40E-01	3.50E-01					
U-238	1.11E+00	2.50E-01												
Total U Alpha	**2.27E+00**	**3.53E-01**												
Alpha Sum	**6.17E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.11E+00	2.50E-01						3.90E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	1.11E+00	2.50E-01						-4.00E+00	3.70E+01					UJ
Ac-227														
Ra-228	7.90E-01	5.40E-01												
Pa-231	6.00E-01	1.60E+00					U							
Beta Sum	**3.08E+00**	**6.73E-01**						**7.62E-01**	**3.70E+01**					
Total Activity Sum	**9.25E+00**	**1.69E+00**						**6.93E+00**	**3.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.28E+01	4.90E+00					J	**1.29**	**(from gamma)**		**69.9**			
Gross Beta	1.90E+01	4.70E+00					J	**3.35**	**0.49**		**144**			
Total Activity	3.82E+01	7.60E+00						**3.72**	**0.83**		**122**			

G01070040-15A			TLF-0507					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	9.50E-02					U
Ra-226	9.00E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.50E-01	1.40E-01												
Th-230	5.70E-01	1.20E-01					J							
Th-232	4.70E-01	1.10E-01												
U-234	6.10E-01	1.70E-01					J							
U-235	3.40E-02	3.40E-02						4.00E-02	2.50E-01					U
U-238	5.40E-01	1.60E-01												
Total U Alpha	**1.18E+00**	**2.36E-01**												
Alpha Sum	**3.86E+00**	**1.16E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.40E-01	1.60E-01						9.00E-01	5.00E-01					J
Pa-234m (Assumed from U-238)	5.40E-01	1.60E-01						3.00E-01	6.90E+00					UJ
Ac-227														
Ra-228	3.10E-01	2.70E-01												
Pa-231	1.00E-01	1.20E+00					U							
Beta Sum	**1.40E+00**	**3.81E-01**						**1.52E+00**	**6.92E+00**					
Total Activity Sum	**5.27E+00**	**1.22E+00**						**5.39E+00**	**7.02E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.10E+00	3.10E+00					J	**1.28**	**(from gamma)**		**70.8**			
Gross Beta	6.60E+00	3.30E+00					J	**1.56**	**0.66**		**130**			
Total Activity	9.70E+00	4.90E+00						**0.88**	**0.50**		**59.3**			

G01070040-16A			TLF-0508					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.40E-01					U
Ra-226	2.17E+00	5.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.10E-01	2.30E-01												
Th-230	1.43E+00	3.10E-01												
Th-232	9.60E-01	2.30E-01												
U-234	1.45E+00	2.80E-01												
U-235	7.60E-02	4.50E-02						2.00E-02	3.90E-01					U
U-238	1.43E+00	2.80E-01												
Total U Alpha	**2.96E+00**	**3.99E-01**												
Alpha Sum	**8.34E+00**	**1.80E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.43E+00	2.80E-01						2.86E+00	9.50E-01					J
Pa-234m (Assumed from U-238)	1.43E+00	2.80E-01						0.00E+00	1.80E+02					UJ
Ac-227														
Ra-228	6.70E-01	7.90E-01												
Pa-231	-1.00E-01	1.80E+00					U							
Beta Sum	**3.52E+00**	**9.10E-01**						**3.52E+00**	**1.80E+02**					
Total Activity Sum	**1.19E+01**	**2.02E+00**						**1.19E+01**	**1.80E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.63E+01	4.90E+00					J	**1.53**	**(from gamma)**		**64.7**			
Gross Beta	1.57E+01	4.20E+00					J	**2.83**	**0.07**		**127**			
Total Activity	3.43E+01	6.90E+00						**3.12**	**0.12**		**97.3**			

G01070040-17A			TLF-0509					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.10E-01	5.60E-02	9.60E-02	**0.59**	**662**	U
Ra-226	6.80E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	2.40E-01												
Th-230	7.60E-01	2.30E-01					J							
Th-232	6.10E-01	2.00E-01												
U-234	4.90E-01	1.50E-01					J							
U-235	5.70E-02	5.20E-02						2.60E-01	2.70E-01	-1.00E-01	1.70E+00	**0.21**	**450**	
U-238	4.90E-01	1.50E-01												
Total U Alpha	**1.04E+00**	**2.18E-01**												
Alpha Sum	**4.01E+00**	**1.19E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.90E-01	1.50E-01						1.22E+00	6.00E-01	4.60E-01	2.50E-01	**1.17**	**90.5**	J
Pa-234m (Assumed from U-238)	4.90E-01	1.50E-01						8.00E-01	8.40E+00	7.90E+00	9.20E+00	**0.57**	**163**	UJ
Ac-227														
Ra-228	5.60E-01	2.60E-01	5.70E-01	3.30E-01	**0.02**	**1.77**								
Pa-231	2.00E-01	1.20E+00	-1.00E-01	1.30E+00	**0.17**	**600**	U							
Beta Sum	**1.56E+00**	**3.65E-01**						**2.60E+00**	**8.43E+00**	**8.92E+00**	**9.21E+00**			
Total Activity Sum	**5.57E+00**	**1.25E+00**						**6.61E+00**	**8.51E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.25E+01	4.70E+00					J	**1.75**	**(from gamma)**		**103**			
Gross Beta	1.59E+01	4.50E+00					J	**3.18**	**1.39**		**164**			
Total Activity	2.55E+01	6.50E+00						**3.01**	**1.76**		**128**			

G01070040-18A			TLF-0570					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.40E-01					U
Ra-226	7.70E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.30E-01												
Th-230	8.30E-01	2.30E-01												
Th-232	8.90E-01	2.40E-01												
U-234	7.90E-01	1.90E-01					J							
U-235	4.80E-02	4.20E-02						-1.30E-01	4.90E-01					U
U-238	6.70E-01	1.70E-01												
Total U Alpha	**1.51E+00**	**2.58E-01**												
Alpha Sum	**3.11E+00**	**2.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.70E-01	1.70E-01						1.40E+00	1.00E+00					J
Pa-234m (Assumed from U-238)	6.70E-01	1.70E-01						-3.00E+00	3.20E+01					UJ
Ac-227														
Ra-228	1.29E+00	3.90E-01												
Pa-231	-1.90E+00	2.50E+00					U							
Beta Sum	**2.40E+00**	**5.48E-01**						**-5.38E-01**	**3.20E+01**					
Total Activity Sum	**5.51E+00**	**2.38E+00**						**2.57E+00**	**3.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.14E+01	4.30E+00					J	**1.70**	**(from gamma)**		**114**			
Gross Beta	1.70E+01	4.40E+00					J	**3.29**	**0.54**		**150**			
Total Activity	3.29E+01	7.00E+00						**3.70**	**0.92**		**143**			

G01070040-19A			TLF-0571					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.40E-01					U
Ra-226	8.00E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	2.00E-01												
Th-230	9.00E-01	2.30E-01												
Th-232	8.20E-01	2.10E-01												
U-234	5.70E-01	1.70E-01					J							
U-235	2.60E-02	4.50E-02					U	1.00E-01	3.50E-01					U
U-238	5.60E-01	1.70E-01												
Total U Alpha	**1.16E+00**	**2.45E-01**												
Alpha Sum	**5.27E+00**	**1.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.60E-01	1.70E-01						1.53E+00	7.00E-01					J
Pa-234m (Assumed from U-238)	5.60E-01	1.70E-01						0.00E+00	1.30E+01					UJ
Ac-227														
Ra-228	4.40E-01	4.00E-01												
Pa-231	1.00E+00	1.60E+00					U							
Beta Sum	**1.68E+00**	**5.05E-01**						**2.09E+00**	**1.30E+01**					
Total Activity Sum	**6.95E+00**	**1.61E+00**						**7.36E+00**	**1.31E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.08E+01	4.30E+00					J	**1.21**	**(from gamma)**		**68.9**			
Gross Beta	1.33E+01	4.10E+00					J	**2.81**	**0.82**		**155**			
Total Activity	2.85E+01	6.90E+00						**3.04**	**1.43**		**122**			

G01070040-20A			TLF-0572					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.40E-01					U
Ra-226	6.80E-01	2.40E-01	9.80E-01	3.10E-01	**0.77**	**36.1**								
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	2.60E-01	9.00E-01	2.30E-01	**0.14**	**5.41**								
Th-230	6.90E-01	2.10E-01	1.06E+00	2.50E-01	**1.13**	**42.3**	J							
Th-232	9.30E-01	2.50E-01	9.70E-01	2.30E-01	**0.12**	**4.21**								
U-234	7.50E-01	1.80E-01	7.10E-01	1.80E-01	**0.16**	**5.48**	J							
U-235	1.00E-02	2.40E-02	7.00E-03	3.40E-02	**0.07**	**35.3**	U	8.00E-02	3.90E-01					U
U-238	7.50E-01	1.90E-01	5.90E-01	1.70E-01	**0.63**	**23.9**								
Total U Alpha	**1.51E+00**	**2.63E-01**	**1.31E+00**	**2.50E-01**										
Alpha Sum	**6.74E+00**	**1.21E+00**	**5.22E+00**	**5.72E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	1.90E-01	5.90E-01	1.70E-01	**0.63**	**23.9**		6.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	7.50E-01	1.90E-01	5.90E-01	1.70E-01	**0.63**	**23.9**		0.00E+00	1.90E+01					UJ
Ac-227														
Ra-228	8.40E-01	3.40E-01												
Pa-231	2.20E+00	1.20E+00												
Beta Sum	**2.60E+00**	**4.57E-01**	**1.18E+00**	**2.40E-01**				**1.70E+00**	**1.90E+01**					
Total Activity Sum	**9.34E+00**	**1.29E+00**	**6.40E+00**	**6.20E-01**				**8.44E+00**	**1.91E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.47E+01	5.10E+00	1.55E+01	5.10E+00	**0.11**	**5.30**	J	**1.52**	**(from gamma)**		**74.3**			
Gross Beta	2.00E+01	5.00E+00	1.73E+01	4.60E+00	**0.40**	**14.5**	J	**3.46**	**0.93**		**154**			
Total Activity	3.70E+01	7.70E+00	3.20E+01	7.00E+00	**0.48**	**14.5**		**3.54**	**1.39**		**119**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070041

This sample delivery group (SDG) contained twenty individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0487	G01070041-01A
TLF-0651	G01070041-02A
TLF-0652	G01070041-03A
TLF-0653	G01070041-04A
TLF-0661	G01070041-05A
TLF-9716	G01070041-06A
TLF-0668	G01070041-07A
TLF-0677	G01070041-08A
TLF-0480	G01070041-09A
TLF-0481	G01070041-10A
TLF-0647	G01070041-11A
TLF-0648	G01070041-12A
TLF-9714	G01070041-13A
TLF-9715	G01070041-14A
TLF-0649	G01070041-15A
TLF-0650	G01070041-16A
TLF-0654	G01070041-17A
TLF-0655	G01070041-18A
TLF-0656	G01070041-19A
TLF-0657	G01070041-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. . All of the results for ^{228}Ra were greater than 5 times the rinsate blank. **Therefore, samples TLF-0661, TLF-0480, TLF-0481, TLF-0647, TLF-9714, and TLF-0654 for ^{234}Th; and TLF-0487, TLF-0661, TLF-0677, TLF-0480, TLF-0481, TLF-0647, TLF-9715, TLF-0649, and TLF-0656 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified but not reported in nineteen of the samples above the required DL (1.65*TPU). The activity range for ^{40}K was 6.36 "1.61 pCi/g to 16.8 " 2.75 pCi/g, which are normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0651, TLF-9716, TLF-0647, TLF-9714, and TLF-0654 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.281 " 0.125 pCi/g to 0.377 " 0.142 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{230}Th analyses. All samples with ^{230}Th results less than 5 times the blank should be qualified as estimated (J). All of the results for ^{230}Th were greater than 5 times the method blank. Therefore, no qualification of the ^{230}Th results is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DER (1.82) was outside acceptable limits for the duplicate analysis for ^{230}Th alpha spectrometry analyses. The RPD (44.2%) was also outside acceptable limits**. Therefore, it is recommended that the ^{230}Th results for all alpha spectrometry samples be qualified as estimated (J).**

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 37.46% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0487, TLF-0652, TLF-0661, TLF-0480, TLF-0648, TLF-0649, TLF-0650, TLF-0654, TLF-0655, TLF-0656, and TLF-0657 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.80 " 0.19 to 6.49 " 0.97 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0487, TLF-0652, TLF-0661, TLF-0480, TLF-0648, TLF-0649, TLF-0650, TLF-0654, TLF-0655, TLF-0656, and TLF-0657 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 61.96%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha or gross beta analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for the gross alpha/beta MSS is within acceptable limits for the gross alpha/beta analyses.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these

samples may not have met the project data quality objectives (DQOs). Since the gross alpha/beta analyses are just estimates, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

There was an indication of blank contamination in the method blank for total activity analysis. All samples with total activity results less than 5 times the blank should be qualified as estimated (J). All of the results for total activity were greater than 5 times the method blank. Therefore, no qualification of the total activity results is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The ^{238}U results for samples TLF-0653, TLF-0661, and TLF-0654 are not in agreement with the corresponding ^{234}Th results within the uncertainties. In each case, the alpha spectrometry results are greater than the gamma spectrometry results by a factor of approximately 2. These differences are most likely due to sample heterogeneity or a disruption of radioactive equilibrium. **Therefore, it is recommended that the ^{238}U alpha spectrometry and ^{234}Th gamma spectrometry results for samples TLF-0653, TLF-0661, and TLF-0654 be qualified as estimated (J).**

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0668. This difference is most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0487 (1.50), TLF-0652 (1.80), TLF-0661 (1.56), TLF-9716 (1.41), TLF-0677 (1.72), TLF-0481 (1.41), TLF-0647 (1.41), TLF-9714 (2.01), TLF-9715 (1.58), TLF-0649 (1.42), TLF-0650 (1.92), TLF-0654 (2.00), TLF-0656 (1.53), TLF-0657 (1.90), and TLF-0653 (1.55) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (80.1%, 79.9%, 71.9%, 71.2%, 94.8%, 86.7%, 77.4%, 101%, 60.0%, 40.6%, 58.1%, 105%, 45.7%, and 63.4%) also exceed acceptable limits. However, the RPD (33.2%) for sample TLF-0653 was within acceptable limits and therefore, no qualification is necessary. The samples have gross alpha results ranging from factors of 1.5 to 3 greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the missing activity be investigated and the gross alpha results for samples TLF-0487, TLF-0652, TLF-0653, TLF-0661, TLF-9716, TLF-0677, TLF-0481, TLF-0647, TLF-9714, TLF-9715, TLF-0649, TLF-0650, TLF-0654, TLF-0656, and TLF-0657 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0487 (2.27), TLF-0651 (3.05), TLF-0652 (2.66), TLF-0661 (2.34), TLF-9716 (2.08), TLF-0677 (3.39), TLF-0480 (2.55), TLF-0481 (3.84), TLF-0647 (2.77), TLF-0648 (2.25), TLF-9714 (2.91), TLF-9715 (2.12), TLF-0654 (2.57), TLF-0656 (1.58), and TLF-0657 (1.69) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (132%, 133%, 112%, 101%, 93.9%, 145%, 136%, 169%, 131%, 78.4%, 137%, 80.2%, 125%, 45.6%, and 56.4% respectfully) also exceed acceptable limits. The samples have gross beta results ranging from factors of 2.7 to 12 greater than the sum of the betas. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K

and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Since the gross beta results have been qualified for other reasons, no further qualification is necessary.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs for these samples also exceed acceptable limits. The samples have total activity results ranging from a factor of 1.3 to 4.1 greater than the total activity sum. This may be an indication of other activity in the sample that was not specifically analyzed. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0 had been reported from the gamma, the DERs and RPDs would be within limits for all samples except TLF-0487, TLF-0652, TLF-0653, TLF-0661, TLF-9716, TLF-0677, TLF-0647, TLF-0648, TLF-0649, TLF-0650, TLF-0654, and TLF-0657 which still contain a positive bias for total activity. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be investigated in the future. It is also recommended that the total activity results for all samples be qualified as estimated (J).**

G01070041-01A			TLF-0487					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.60E-01	-8.00E-02	1.80E-01	**0.58**	**1400**	U
Ra-226	1.49E+00	3.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	2.10E-01												
Th-230	1.06E+00	2.30E-01					J							
Th-232	6.40E-01	1.60E-01												
U-234	1.17E+00	3.30E-01												
U-235	1.20E-01	9.50E-02						0.00E+00	4.00E-01	1.00E-01	4.40E-01	**0.17**	**200**	U
U-238	9.30E-01	2.90E-01												
Total U Alpha	**2.22E+00**	**4.49E-01**												
Alpha Sum	**6.12E+00**	**1.92E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E-01	2.90E-01						1.20E+00	1.20E+00	1.20E+00	1.70E+00	**0.00**	**0.00**	
Pa-234m (Assumed from U-238)	9.30E-01	2.90E-01						0.00E+00	1.10E+01	0.00E+00	2.30E+02	**0.00**	**0.00**	UJ
Ac-227														
Ra-228	4.90E-01	4.70E-01	5.50E-01	4.40E-01	**0.09**	**11.5**								
Pa-231	-2.00E-01	2.00E+00	6.00E-01	1.90E+00	**0.29**	**400**	U							
Beta Sum	**2.33E+00**	**6.68E-01**						**1.67E+00**	**1.11E+01**	**1.82E+00**	**2.30E+02**			
Total Activity Sum	**8.45E+00**	**2.04E+00**						**7.79E+00**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.43E+01	5.10E+00					J	**1.50**	**(from gamma)**		**80.1**			
Gross Beta	1.13E+01	3.90E+00					J	**2.27**	**0.82**		**132**			
Total Activity	3.08E+01	6.70E+00					J	**3.19**	**1.76**		**114**			

G01070041-02A			TLF-0651					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.80E-01					U
Ra-226	1.00E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	1.70E-01												
Th-230	1.04E+01	2.00E-01					J							
Th-232	7.30E-01	1.50E-01												
U-234	1.33E+00	3.80E-01												
U-235	7.10E-02	8.00E-02						1.90E-01	4.90E-01					U
U-238	1.28E+00	3.60E-01												
Total U Alpha	**2.68E+00**	**5.30E-01**												
Alpha Sum	**1.56E+01**	**1.93E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.28E+00	3.60E-01						8.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	1.28E+00	3.60E-01						3.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.70E-01	3.90E-01												
Pa-231	-1.00E-01	2.00E+00					U							
Beta Sum	**3.32E+00**	**6.85E-01**						**4.56E+00**	**1.11E+01**					
Total Activity Sum	**1.89E+01**	**2.04E+00**						**2.02E+01**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.34E+01	5.50E+00						**0.38**	**(from gamma)**		**15.2**			
Gross Beta	1.66E+01	4.30E+00					J	**3.05**	**1.01**		**133**			
Total Activity	3.05E+01	8.60E+00					J	**1.31**	**0.73**		**46.9**			

G01070041-03A			TLF-0652					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	2.00E-01					U
Ra-226	2.10E+00	4.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.85E+00	3.10E-01												
Th-230	1.97E+00	3.20E-01					J							
Th-232	1.59E+00	2.70E-01												
U-234	2.32E+00	5.60E-01												
U-235	1.90E-01	1.30E-01						1.30E-01	5.60E-01					U
U-238	2.00E+00	5.00E-01												
Total U Alpha	**4.51E+00**	**7.62E-01**												
Alpha Sum	**1.18E+01**	**2.32E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.00E+00	5.00E-01						2.20E+00	1.10E+00					
Pa-234m (Assumed from U-238)	2.00E+00	5.00E-01						3.00E+00	1.30E+01					U
Ac-227														
Ra-228	1.27E+00	4.70E-01												
Pa-231	-3.00E-01	2.30E+00					U							
Beta Sum	**5.23E+00**	**8.93E-01**						**6.43E+00**	**1.31E+01**					
Total Activity Sum	**1.70E+01**	**2.48E+00**						**1.82E+01**	**1.33E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.74E+01	8.40E+00					J	**1.80**	**(from gamma)**		**79.9**			
Gross Beta	1.85E+01	4.90E+00					J	**2.66**	**0.87**		**112**			
Total Activity	4.60E+01	1.00E+01					J	**2.82**	**1.7**		**92.1**			

G01070041-04A			TLF-0653					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.80E-01	4.50E-01					U
Ra-226	2.01E+01	3.80E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.39E+00	3.90E-01												
Th-230	3.25E+01	4.60E+00					J							
Th-232	2.44E+00	3.90E-01												
U-234	3.79E+01	6.20E+00												
U-235	1.99E+00	4.80E-01						1.75E+00	9.90E-01					
U-238	3.94E+01	6.50E+00					J							
Total U Alpha	**7.93E+01**	**9.00E+00**												
Alpha Sum	**1.39E+02**	**1.11E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.94E+01	6.50E+00						2.45E+01	4.80E+00					J
Pa-234m (Assumed from U-238)	3.94E+01	6.50E+00						1.20E+01	1.70E+01					U
Ac-227														
Ra-228	2.15E+00	6.30E-01												
Pa-231	3.00E+00	2.90E+00												
Beta Sum	**8.13E+01**	**9.22E+00**						**3.90E+01**	**1.77E+01**					
Total Activity Sum	**2.21E+02**	**1.44E+01**						**1.78E+02**	**2.09E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.95E+02	3.40E+01					J	**1.55**	**(from gamma)**		**33.2**			
Gross Beta	8.60E+01	1.90E+01					J	**0.22**	**1.81**		**5.61**			
Total Activity	2.96E+02	4.40E+01					J	**1.63**	**2.41**		**29.1**			

G01070041-05A			TLF-0661					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.70E-01					U
Ra-226	8.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	1.70E-01												
Th-230	1.24E+00	2.10E-01					J							
Th-232	7.80E-01	1.50E-01												
U-234	2.07E+00	5.00E-01												
U-235	1.50E-01	1.00E-01						7.00E-02	3.90E-01					U
U-238	2.41E+00	5.60E-01					J							
Total U Alpha	**4.63E+00**	**7.57E-01**												
Alpha Sum	**8.65E+00**	**1.91E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.41E+00	5.60E-01						2.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	2.41E+00	5.60E-01						0.00E+00	1.70E+01					UJ
Ac-227														
Ra-228	2.70E-01	4.40E-01					U							
Pa-231	3.00E-01	1.90E+00					U							
Beta Sum	**5.13E+00**	**9.34E-01**						**5.06E-01**	**1.70E+01**					
Total Activity Sum	**1.38E+01**	**2.13E+00**						**9.16E+00**	**1.72E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.83E+01	5.90E+00					J	**1.56**	**(from gamma)**		**71.6**			
Gross Beta	1.50E+01	4.20E+00					J	**2.29**	**0.83**		**98**			
Total Activity	3.86E+01	9.20E+00					J	**2.63**	**1.51**		**94.8**			

G01070041-06A			TLF-9716					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.70E-01					U
Ra-226	1.41E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	1.70E-01												
Th-230	1.23E+00	2.20E-01					J							
Th-232	8.70E-01	1.60E-01												
U-234	1.65E+00	4.20E-01												
U-235	1.33E-01	9.80E-02						3.00E-02	4.00E-01					U
U-238	1.83E+00	4.50E-01												
Total U Alpha	**3.61E+00**	**6.23E-01**												
Alpha Sum	**7.55E+00**	**1.96E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.83E+00	4.50E-01						1.30E+00	1.20E+00					
Pa-234m (Assumed from U-238)	1.83E+00	4.50E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.30E-01	3.60E-01												
Pa-231	-5.00E-01	2.00E+00					U							
Beta Sum	**4.33E+00**	**7.70E-01**						**2.97E+00**	**1.11E+01**					
Total Activity Sum	**1.19E+01**	**2.10E+00**						**1.05E+01**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.59E+01	5.60E+00					J	**1.41**	**(from gamma)**		**71.2**			
Gross Beta	1.20E+01	3.60E+00					J	**2.08**	**0.78**		**93.9**			
Total Activity	3.47E+01	6.70E+00					J	**3.25**	**1.85**		**98.0**			

G01070041-07A			TLF-0668					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	3.40E-01					U
Ra-226	4.04E+00	8.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.38E+00	5.50E-01												
Th-230	4.08E+00	6.50E-01					J							
Th-232	3.39E+00	5.50E-01												
U-234	1.19E+01	1.90E+00												
U-235	4.60E-01	1.60E-01						9.60E-01	7.90E-01					
U-238	1.20E+01	1.90E+00												
Total U Alpha	**2.44E+01**	**2.69E+00**												
Alpha Sum	**4.14E+01**	**3.32E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.20E+01	1.90E+00						1.24E+01	3.20E+00					
Pa-234m (Assumed from U-238)	1.20E+01	1.90E+00						1.30E+01	2.10E+01					U
Ac-227														
Ra-228	4.30E+00	1.10E+00												
Pa-231	2.40E+00	1.60E+00												
Beta Sum	**2.86E+01**	**2.91E+00**						**3.00E+01**	**2.13E+01**					
Total Activity Sum	**7.00E+01**	**4.41E+00**						**7.14E+01**	**2.15E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.50E+01	1.20E+01						**1.09**	**(from gamma)**		**28.2**			
Gross Beta	3.08E+01	7.60E+00					J	**0.27**	**0.04**		**7.45**			
Total Activity	9.90E+01	1.60E+01					J	**1.75**	**1.03**		**34.3**			

G01070041-08A			TLF-0677					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.00E-01					U
Ra-226	1.09E+00	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	1.60E-01												
Th-230	9.90E-01	1.80E-01					J							
Th-232	9.00E-01	1.70E-01												
U-234	1.22E+00	2.60E-01												
U-235	5.90E-02	4.50E-02						-1.40E-01	5.60E-01					U
U-238	1.39E+00	2.80E-01												
Total U Alpha	**2.67E+00**	**3.85E-01**												
Alpha Sum	**5.75E+00**	**2.23E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.39E+00	2.80E-01						9.00E-01	1.50E+00					U
Pa-234m (Assumed from U-238)	1.39E+00	2.80E-01						-3.00E+00	1.40E+01					UJ
Ac-227														
Ra-228	6.20E-01	3.90E-01												
Pa-231	-8.00E-01	2.40E+00					U							
Beta Sum	**3.30E+00**	**6.26E-01**						**-1.58E+00**	**1.41E+01**					
Total Activity Sum	**9.05E+00**	**2.32E+00**						**4.17E+00**	**1.43E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	5.60E+00					J	**1.72**	**(from gamma)**		**94.8**			
Gross Beta	2.07E+01	5.10E+00					J	**3.39**	**1.49**		**145**			
Total Activity	3.63E+01	7.20E+00					J	**3.60**	**2.01**		**120**			

G01070041-09A			TLF-0480					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.40E-01	1.50E-01					
Ra-226	1.04E+00	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.10E-01	1.70E-01												
Th-230	8.00E-01	1.90E-01					J							
Th-232	5.50E-01	1.50E-01												
U-234	6.90E-01	2.30E-01												
U-235	1.06E-01	8.30E-02						-1.00E-02	8.00E-01					U
U-238	7.80E-01	2.50E-01												
Total U Alpha	**1.58E+00**	**3.50E-01**												
Alpha Sum	**4.94E+00**	**1.54E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.80E-01	2.50E-01						3.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	7.80E-01	2.50E-01						-2.00E+00	7.40E+01					UJ
Ac-227														
Ra-228	7.90E-01	3.80E-01												
Pa-231	4.00E-01	1.60E+00					U							
Beta Sum	**2.40E+00**	**5.53E-01**						**-8.62E-01**	**7.40E+01**					
Total Activity Sum	**7.33E+00**	**1.64E+00**						**4.07E+00**	**7.40E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.90E+00	4.00E+00						**0.69**	**(from gamma)**		**46.2**			
Gross Beta	1.27E+01	4.00E+00					J	**2.55**	**0.18**		**136**			
Total Activity	2.56E+01	6.00E+00					J	**2.94**	**0.29**		**111**			

G01070041-10A			TLF-0481					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.50E-01	2.20E-01					U
Ra-226	5.80E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	1.40E-01												
Th-230	7.40E-01	1.40E-01					J							
Th-232	5.70E-01	1.20E-01												
U-234	7.20E-01	1.90E-01												
U-235	4.60E-02	4.60E-02						7.00E-02	4.70E-01					U
U-238	4.30E-01	1.40E-01												
Total U Alpha	**1.20E+00**	**2.40E-01**												
Alpha Sum	**4.23E+00**	**1.84E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.30E-01	1.40E-01						5.00E-01	1.40E+00					UJ
Pa-234m (Assumed from U-238)	4.30E-01	1.40E-01						0.00E+00	1.30E+01					UJ
Ac-227														
Ra-228	6.90E-01	4.80E-01												
Pa-231	5.00E-01	2.00E+00					U							
Beta Sum	**1.61E+00**	**5.72E-01**						**1.25E+00**	**1.31E+01**					
Total Activity Sum	**5.84E+00**	**1.93E+00**						**5.48E+00**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.07E+01	4.20E+00					J	**1.41**	**(from gamma)**		**86.7**			
Gross Beta	1.94E+01	4.60E+00					J	**3.84**	**1.31**		**169**			
Total Activity	2.42E+01	5.60E+00					J	**3.10**	**1.30**		**122**			

G01070041-11A			TLF-0647					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.70E-01					U
Ra-226	1.21E+00	3.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	1.70E-01												
Th-230	1.02E+00	1.90E-01					J							
Th-232	7.80E-01	1.50E-01												
U-234	1.21E+00	2.50E-01												
U-235	8.10E-02	5.00E-02						3.20E-01	4.60E-01					U
U-238	1.20E+00	2.50E-01												
Total U Alpha	**2.49E+00**	**3.57E-01**												
Alpha Sum	**5.92E+00**	**2.06E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.20E+00	2.50E-01						0.00E+00	1.20E+00					UJ
Pa-234m (Assumed from U-238)	1.20E+00	2.50E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	5.60E-01	3.50E-01												
Pa-231	-5.00E-01	2.20E+00					U							
Beta Sum	**2.90E+00**	**5.63E-01**						**5.00E-01**	**1.21E+01**					
Total Activity Sum	**8.82E+00**	**2.14E+00**						**6.42E+00**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.34E+01	4.90E+00					J	**1.41**	**(from gamma)**		**77.4**			
Gross Beta	1.38E+01	3.90E+00					J	**2.77**	**1.05**		**131**			
Total Activity	2.80E+01	6.00E+00					J	**3.01**	**1.58**		**104**			

G01070041-12A			TLF-0648					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	2.80E-01					U
Ra-226	2.97E+00	6.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.83E+00	4.60E-01												
Th-230	3.55E+00	5.60E-01					J							
Th-232	2.58E+00	4.20E-01												
U-234	4.08E+00	7.60E-01												
U-235	2.20E-01	1.10E-01						1.50E-01	6.80E-01					U
U-238	4.04E+00	7.60E-01												
Total U Alpha	**8.34E+00**	**1.08E+00**												
Alpha Sum	**1.96E+01**	**3.09E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.04E+00	7.60E-01						4.30E+00	1.90E+00					
Pa-234m (Assumed from U-238)	4.04E+00	7.60E-01						1.00E+00	1.60E+01					U
Ac-227														
Ra-228	2.76E+00	7.50E-01												
Pa-231	-8.00E-01	3.00E+00					U							
Beta Sum	**1.07E+01**	**1.36E+00**						**7.96E+00**	**1.61E+01**					
Total Activity Sum	**3.03E+01**	**3.38E+00**						**2.75E+01**	**1.64E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.98E+01	7.90E+00						**1.21**	**(from gamma)**		**41.5**			
Gross Beta	2.46E+01	6.00E+00					J	**2.25**	**0.97**		**78.4**			
Total Activity	6.20E+01	1.10E+01					J	**2.76**	**1.74**		**68.7**			

G01070041-13A			TLF-9714					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								5.00E-02	1.60E-01					U
Ra-226	9.00E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	1.50E-01												
Th-230	1.05E+00	1.90E-01					J							
Th-232	8.20E-01	1.60E-01												
U-234	1.09E+00	2.70E-01												
U-235	7.90E-02	6.10E-02						3.60E-01	2.60E-01					
U-238	1.16E+00	2.80E-01												
Total U Alpha	**2.33E+00**	**3.94E-01**												
Alpha Sum	**5.71E+00**	**1.89E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.16E+00	2.80E-01						6.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	1.16E+00	2.80E-01						1.40E+00	9.80E+00					U
Ac-227														
Ra-228	4.80E-01	3.10E-01												
Pa-231	-2.00E-01	2.00E+00					U							
Beta Sum	**2.78E+00**	**5.57E-01**						**2.46E+00**	**9.88E+00**					
Total Activity Sum	**8.49E+00**	**1.97E+00**						**8.17E+00**	**1.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.74E+01	5.50E+00					J	**2.01**	**(from gamma)**		**101**			
Gross Beta	1.48E+01	4.10E+00					J	**2.91**	**1.15**		**137**			
Total Activity	2.71E+01	7.90E+00					J	**2.29**	**1.48**		**105**			

G01070041-14A			TLF-9715					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	3.20E-01					U
Ra-226	2.40E+00	5.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.37E+00	3.90E-01												
Th-230	2.15E+00	3.60E-01					J							
Th-232	2.10E+00	3.50E-01												
U-234	3.05E+00	6.10E-01												
U-235	2.40E-01	1.20E-01						2.20E-01	7.40E-01					U
U-238	3.37E+00	6.60E-01												
Total U Alpha	**6.66E+00**	**9.07E-01**												
Alpha Sum	**1.55E+01**	**2.97E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.37E+00	6.60E-01						3.10E+00	1.70E+00					
Pa-234m (Assumed from U-238)	3.37E+00	6.60E-01						0.00E+00	1.60E+01					UJ
Ac-227														
Ra-228	2.52E+00	7.20E-01												
Pa-231	-2.00E-01	3.00E+00					U							
Beta Sum	**9.24E+00**	**1.23E+00**						**5.60E+00**	**1.61E+01**					
Total Activity Sum	**2.47E+01**	**3.21E+00**						**2.11E+01**	**1.64E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.88E+01	7.90E+00					J	**1.58**	**(from gamma)**		**60.0**			
Gross Beta	2.16E+01	5.70E+00					J	**2.12**	**0.94**		**80.2**			
Total Activity	5.14E+01	9.30E+00					J	**2.71**	**1.61**		**70.0**			

G01070041-15A			TLF-0649					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	3.30E-01					U
Ra-226	6.70E+00	1.30E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	1.83E+00	3.10E-01												
Th-230	6.49E+00	9.70E-01					J							
Th-232	1.84E+00	3.10E-01												
U-234	1.23E+01	2.20E+00												
U-235	7.70E-01	2.50E-01						6.20E-01	6.90E-01					
U-238	1.24E+01	2.20E+00												
Total U Alpha	**2.55E+01**	**3.12E+00**												
Alpha Sum	**4.11E+01**	**4.68E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.24E+01	2.20E+00						1.19E+01	3.60E+00					
Pa-234m (Assumed from U-238)	1.24E+01	2.20E+00						8.00E+00	1.80E+01					UJ
Ac-227														
Ra-228	1.65E+00	6.00E-01												
Pa-231	-1.40E+00	3.40E+00					U							
Beta Sum	**2.63E+01**	**3.19E+00**						**2.14E+01**	**1.84E+01**					
Total Activity Sum	**6.74E+01**	**5.67E+00**						**6.25E+01**	**1.90E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+01	1.40E+01					J	**1.42**	**(from gamma)**		**40.6**			
Gross Beta	3.50E+01	8.20E+00					J	**0.99**	**0.68**		**28.5**			
Total Activity	1.12E+02	1.70E+01					J	**2.49**	**1.95**		**49.8**			

G01070041-16A			TLF-0650					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.10E-01	3.30E-01					U
Ra-226	5.80E+00	1.20E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	3.17E+00	5.20E-01												
Th-230	4.36E+00	6.90E-01					J							
Th-232	2.83E+00	4.70E-01												
U-234	7.50E+00	1.30E+00												
U-235	2.70E-01	1.30E-01						4.50E-01	7.80E-01					U
U-238	8.60E+00	1.50E+00												
Total U Alpha	**1.64E+01**	**1.99E+00**												
Alpha Sum	**3.19E+01**	**3.90E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.60E+00	1.50E+00						8.70E+00	2.80E+00					
Pa-234m (Assumed from U-238)	8.60E+00	1.50E+00						9.00E+00	1.40E+01					U
Ac-227														
Ra-228	2.85E+00	7.30E-01												
Pa-231	-7.00E-01	3.30E+00					U							
Beta Sum	**2.00E+01**	**2.28E+00**						**2.05E+01**	**1.43E+01**					
Total Activity Sum	**5.19E+01**	**4.51E+00**						**5.24E+01**	**1.48E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.80E+01	1.30E+01					J	**1.92**	**(from gamma)**		**58.1**			
Gross Beta	2.78E+01	7.30E+00					J	**1.02**	**0.46**		**32.8**			
Total Activity	9.70E+01	1.60E+01					J	**2.71**	**2.05**		**60.6**			

G01070041-17A			TLF-0654					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.60E-01					U
Ra-226	4.90E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.60E-01												
Th-230	9.40E-01	1.70E-01					J							
Th-232	7.90E-01	1.50E-01												
U-234	1.15E+00	2.80E-01												
U-235	7.00E-02	5.90E-02						1.10E-01	4.20E-01					U
U-238	1.10E+00	2.80E-01					J							
Total U Alpha	**2.32E+00**	**4.00E-01**												
Alpha Sum	**5.25E+00**	**1.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.10E+00	2.80E-01						1.60E-01	1.50E-01					J
Pa-234m (Assumed from U-238)	1.10E+00	2.80E-01						1.00E+00	2.30E+01					U
Ac-227														
Ra-228	5.10E-01	4.90E-01												
Pa-231	-2.00E-01	1.90E+00					U							
Beta Sum	**2.69E+00**	**6.70E-01**						**1.65E+00**	**2.30E+01**					
Total Activity Sum	**7.94E+00**	**1.91E+00**						**6.90E+00**	**2.31E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.68E+01	5.50E+00					J	**2.00**	**(from gamma)**		**105**			
Gross Beta	1.16E+01	3.60E+00					J	**2.43**	**0.43**		**125**			
Total Activity	2.76E+01	5.70E+00					J	**3.27**	**0.87**		**111**			

G01070041-18A			TLF-0655					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	2.50E-01					U
Ra-226	1.99E+00	4.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.69E+00	3.20E-01												
Th-230	1.82E+00	3.40E-01					J							
Th-232	1.49E+00	2.80E-01												
U-234	6.80E+00	1.20E+00												
U-235	3.80E-01	1.50E-01						-1.00E-02	5.40E-01					U
U-238	7.20E+00	1.30E+00												
Total U Alpha	**1.44E+01**	**1.78E+00**												
Alpha Sum	**2.08E+01**	**2.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E+00	1.30E+00						4.60E+00	1.40E+00					
Pa-234m (Assumed from U-238)	7.20E+00	1.30E+00						9.00E+00	1.00E+01					
Ac-227														
Ra-228	1.53E+00	5.50E-01												
Pa-231	-6.00E-01	2.50E+00					U							
Beta Sum	**1.59E+01**	**1.94E+00**						**1.51E+01**	**1.01E+01**					
Total Activity Sum	**3.67E+01**	**3.53E+00**						**3.59E+01**	**1.05E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.19E+01	8.90E+00						**1.18**	**(from gamma)**		**42.0**			
Gross Beta	1.96E+01	5.00E+00					J	**0.70**	**0.40**		**21.1**			
Total Activity	5.39E+01	9.40E+00					J	**1.71**	**1.28**		**38.0**			

G01070041-19A			TLF-0656					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	3.30E-01					U
Ra-226	3.01E+00	6.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.88E+00	4.80E-01												
Th-230	2.91E+00	4.80E-01					J							
Th-232	2.64E+00	4.40E-01												
U-234	9.80E+00	1.70E+00												
U-235	5.10E-01	1.90E-01						3.80E-01	7.20E-01					U
U-238	9.20E+00	1.60E+00												
Total U Alpha	**1.95E+01**	**2.34E+00**												
Alpha Sum	**3.01E+01**	**4.00E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.20E+00	1.60E+00						9.30E+00	2.80E+00					
Pa-234m (Assumed from U-238)	9.20E+00	1.60E+00						-1.00E+00	4.70E+01					UJ
Ac-227														
Ra-228	2.76E+00	7.70E-01												
Pa-231	-9.00E-01	3.40E+00					U							
Beta Sum	**2.11E+01**	**2.42E+00**						**1.10E+01**	**4.71E+01**					
Total Activity Sum	**5.12E+01**	**4.67E+00**						**4.11E+01**	**4.73E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+01	1.10E+01					J	**1.53**	**(from gamma)**		**45.7**			
Gross Beta	3.35E+01	7.50E+00					J	**1.58**	**0.47**		**45.6**			
Total Activity	7.90E+01	1.30E+01					J	**2.01**	**0.77**		**42.7**			

G01070041-20A			TLF-0657					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	3.10E-01					U
Ra-226	3.31E+00	7.40E-01	2.67E+00	6.20E-01	**0.66**	**21.4**								
Np-237														
Pu-238														
Pu-239														
Th-228	2.82E+00	4.70E-01	3.27E+00	5.80E-01	**0.60**	**14.8**								
Th-230	2.75E+00	4.50E-01	4.31E+00	7.30E-01	**1.82**	**44.2**	J							
Th-232	2.72E+00	4.50E-01	3.01E+00	5.40E-01	**0.41**	**10.1**								
U-234	5.50E+00	1.00E+00	7.20E+00	1.30E+00	**1.04**	**26.8**								
U-235	2.40E-01	1.20E-01	4.70E-01	1.70E-01	**1.11**	**64.8**		2.70E-01	7.00E-01					U
U-238	5.70E+00	1.10E+00	6.70E+00	1.20E+00	**0.61**	**16.1**								
Total U Alpha	**1.14E+01**	**1.49E+00**	**1.44E+01**	**1.78E+00**										
Alpha Sum	**2.18E+01**	**3.57E+00**	**2.76E+01**	**2.17E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.70E+00	1.10E+00	6.70E+00	1.20E+00	**0.61**	**16.1**		7.00E+00	2.00E+00					
Pa-234m (Assumed from U-238)	5.70E+00	1.10E+00	6.70E+00	1.20E+00	**0.61**	**16.1**		1.00E+00	1.50E+01					U
Ac-227														
Ra-228	2.82E+00	7.70E-01												
Pa-231	-1.40E+00	3.40E+00					U							
Beta Sum	**1.41E+01**	**1.78E+00**	**1.34E+01**	**1.70E+00**				**1.07E+01**	**1.52E+01**					
Total Activity Sum	**3.58E+01**	**3.99E+00**	**4.10E+01**	**2.75E+00**				**3.24E+01**	**1.56E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+01	1.00E+01	5.60E+01	1.20E+01	**0.90**	**28.6**	J	**1.90**	**(from gamma)**		**63.4**			
Gross Beta	2.51E+01	6.30E+00	2.45E+01	6.90E+00	**0.06**	**2.42**	J	**1.69**	**0.88**		**56.4**			
Total Activity	7.60E+01	1.30E+01	7.90E+01	1.30E+01	**0.16**	**3.87**	J	**2.95**	**2.15**		**71.8**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070042

This sample delivery group (SDG) contained twenty (20) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0602	G01070042-01A
TLF-0603	G01070042-02A
TLF-0526	G01070042-03A
TLF-0527	G01070042-04A
TLF-0644	G01070042-05A
TLF-0645	G01070042-06A
TLF-0646	G01070042-07A
TLF-0619	G01070042-08A
TLF-0620	G01070042-09A
TLF-0474	G01070042-10A
TLF-0475	G01070042-11A
TLF-9609	G01070042-12A
TLF-0582	G01070042-13A
TLF-0583	G01070042-14A
TLF-0640	G01070042-15A
TLF-9712	G01070042-16A
TLF-0641	G01070042-17A
TLF-9713	G01070042-18A
TLF-0642	G01070042-19A
TLF-0643	G01070042-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. All sample results for ^{228}Ra were greater than 5 greater than the rinsate blank results. **However, samples TLF-0526, TLF-0474, TLF-0475, and TLF-9609 for ^{234}Th, and TLF-0602, TLF-0526, TLF-0527, TLF-0644, TLF-0620, TLF-0474 (laboratory duplicate), TLF-0475, TLF-0583, TLF-0640, and TLF-9712 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified but not reported in all of the samples above the required DL (1.65*TPU). The activity range for ^{40}K was 3.60 " 1.68 pCi/g to 15.4 " 3.62 pCi/g, which are normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0602, TLF-0644, TLF-0619, TLF-9609, TLF-0582, TLF-0583, TLF-0640, TLF-9712, and TLF-0641 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.163 " 0.135 pCi/g to 0.340 " 0.141 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{230}Th and ^{234}U analyses. All samples with ^{230}Th and ^{234}U results less than 5 times the blank should be qualified as estimated (J). All of the results for ^{230}Th and ^{234}U were greater than 5 times the method blank. Therefore, no qualification of the ^{230}Th and ^{234}U results is necessary.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 41.01% for all samples for the Th and U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0527, TLF-0646, TLF-0619, TLF-0474, TLF-0475, TLF-0582, TLF-0643, and TLF-0643 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.80 " 0.19 to 6.49 " 0.97 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0527, TLF-0646, TLF-0619, TLF-0474, TLF-0475, TLF-0582, TLF-0643, and TLF-0643 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 70.9%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross beta analysis. There was indication of blank contamination in the gross alpha analysis. Therefore, all samples with results less than 5 times the gross alpha blank should be qualified as estimated (J). **Therefore, the gross alpha analysis for samples TLF-0602, TLF-0526, TLF-0644, TLF-0619, TLF-0474, TLF-0475, TLF-9609, TLF-0583, and TLF-9712 should be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

A matrix spike was not analyzed for the gross alpha/beta analyses. The statement of work required that a matrix spike be analyzed for analyses that did not have sample-specific chemical recovery mechanisms. This indicates that the laboratory may not have met the DQOs for these samples. However, since the gross alpha/beta analyses are just estimates, no qualification is recommended.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since the gross alpha/beta analyses are just estimates, no additional qualification is necessary.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra results for samples TLF-0640 and TLF-0642 do not agree with the ^{232}Th results. The laboratory duplicates for each analysis are in agreement with one another. For sample TLF-0640 the ^{228}Th and ^{232}Th activities are in equilibrium. Since the ^{228}Ra results are two times greater than either the $^{228/232}$Th results, it appears that there may be a heterogeneity issue. **Therefore, it is recommended that the ^{228}Ra and $^{228/232}$Th results for samples TLF-0640 and TLF-0642 be qualified as estimated (J).**

<u>^{231}Pa Gamma to ^{235}U Alpha:</u>

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF0452, TLF0424, TLF0426 and TLF9438. These differences are most likely due to sample heterogeneity. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

<u>Alpha/Beta Sums to Gross Alpha/Beta Analysis:</u>

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0603 (2.22), TLF-0526 (1.43), TLF-0527 (2.28), TLF-0644 (1.73), TLF-0619 (1.64), TLF-0620 (2.40), TLF-0474 (1.89), TLF-0475 (1.34), TLF-9609 (1.87), TLF-0582 (2.30), TLF-0583 (1.63), TLF-0640 (1.80), TLF-9712 (1.54), TLF-0641 (1.79), TLF-9713 (1.73), and TLF-0643 (2.20) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (69.3%, 92.2%, 114%, 83.9%, 80.3%, 67.8%, 116%, 82.9%, 117%, 116%, 101%, 69.9%, 70.2%, 71.7%, 64.9%, and 82.0%, respectively) also exceed acceptable limits. The samples have a gross alpha result greater than the sum of the alphas by a range of an approximate factor of 2 to 3.6. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possibility of missing activity be investigated in the future and the gross alpha results for samples TLF-0603, TLF-0526, TLF-0527, TLF-0644, TLF-0619, TLF-0620, TLF-0474, TLF-0475, TLF-9609, TLF-0582, TLF-0583, TLF-0640, TLF-9712, TLF-0641, TLF-9713, and TLF-0643 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0602 (1.71), TLF-0603 (2.14), TLF-0526 (3.54), TLF-0527 (1.93), TLF-0644 (2.28), TLF-0619 (2.89), TLF-0620 (1.76), TLF-0475 (3.96), TLF-9609 (2.59), TLF-0582 (3.19), TLF-0583 (1.97), TLF-0640 (1.99), TLF-9712 (2.53), TLF-0641 (2.57), TLF-9713 (2.36), and TLF-0643 (1.43) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence

level. The RPDs (53.0%, 68.6%, 164%, 106%, 103%, 110%, 55.7%, 92.2%, 171%, 152%, 134%, 120%, 75.2%, 104%, 97.0%, 81.0%, and 58.4% respectfully) also exceed acceptable limits. The samples have a gross beta result greater than the sum of the betas by an approximate factor of 1.7 to 10. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs most likely would be within limits. **It is recommended that the laboratory report all gamma results above the DL. Since the gross beta results have been qualified for other reasons, no further qualification is necessary.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for samples TLF-0603 (2.86), TLF-0526 (3.65), TLF-0527 (2.48), TLF-0644 (2.92), TLF-0619 (2.80), TLF-0620 (3.09), TLF-0474 (2.53), TLF-0475 (3.37), TLF-9609 (3.20), TLF-0582 (3.35), TLF-0583 (1.97), TLF-0640 (1.85), TLF-9712 (2.37), TLF-0641 (2.46), TLF-9713 (2.70), TLF-0643 (3.41), and TLF-0642 (1.56) were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs (69.1%, 136%, 82.3%, 88.6%, 84.3%, 68.9%, 105%, 125%, 125%, 108%, 93.8%, 47.7%, 68.6%, 73.7%, 61.6%, and 86.7%) for these samples also exceed acceptable limits. However, the RPD (29.9%) for sample TLF-0642 was within acceptable limits and therefore, no qualification is necessary. The samples have a total activity result greater than the total activity sum by an approximate factor of 2 to 5.2. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0 had been reported from the gamma, the DERs and RPDs would be within limits for samples TLF-0619, TLF-0583, TLF-9712, and TLF-0643. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity results for samples TLF-0603, TLF-0526, TLF-0527, TLF-0644, TLF-0619, TLF-0620, TLF-0474, TLF-0475, TLF-9609, TLF-0582, TLF-0583, TLF-0640, TLF-9712, TLF-0641, TLF-9713, and TLF-0643 be qualified as estimated (J).**

G01070042-01A			TLF-0602					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	2.40E-01					U
Ra-226	1.12E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.80E-01	2.20E-01												
Th-230	9.00E-01	2.20E-01												
Th-232	7.40E-01	1.90E-01												
U-234	5.06E+00	9.10E-01												
U-235	3.00E-01	1.20E-01						1.00E-01	5.30E-01					U
U-238	5.80E+00	1.00E+00												
Total U Alpha	**1.12E+01**	**1.36E+00**												
Alpha Sum	**1.47E+01**	**2.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.80E+00	1.00E+00						4.00E+00	1.80E+00					
Pa-234m (Assumed from U-238)	5.80E+00	1.00E+00						0.00E+00	5.40E+02					UJ
Ac-227														
Ra-228	8.40E-01	5.60E-01												
Pa-231	-1.00E-01	2.30E+00					U							
Beta Sum	**1.24E+01**	**1.55E+00**						**4.83E+00**	**5.40E+02**					
Total Activity Sum	**2.71E+01**	**2.96E+00**						**1.95E+01**	**5.40E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.96E+01	7.40E+00					J	**0.63**	**(from gamma)**		**28.5**			
Gross Beta	2.14E+01	5.00E+00					J	**1.71**	**0.03**		**53.0**			
Total Activity	2.94E+01	6.30E+00						**0.32**	**0.02**		**8.00**			

G01070042-02A			TLF-0603					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	3.20E-01					U
Ra-226	4.45E+00	9.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.47E+00	5.80E-01												
Th-230	3.35E+00	5.60E-01												
Th-232	3.12E+00	5.30E-01												
U-234	7.70E+00	1.30E+00												
U-235	4.30E-01	1.60E-01						6.00E-01	7.20E-01					
U-238	7.20E+00	1.30E+00												
Total U Alpha	**1.53E+01**	**1.85E+00**												
Alpha Sum	**3.01E+01**	**3.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E+00	1.30E+00						6.40E+00	2.30E+00					
Pa-234m (Assumed from U-238)	7.20E+00	1.30E+00						7.00E+00	1.40E+01					U
Ac-227														
Ra-228	2.68E+00	7.50E-01												
Pa-231	4.00E-01	2.70E+00					U							
Beta Sum	**1.71E+01**	**2.01E+00**						**1.61E+01**	**1.42E+01**					
Total Activity Sum	**4.72E+01**	**3.89E+00**						**4.62E+01**	**1.46E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+01	1.40E+01					J	**2.22**	**(from gamma)**		**69.3**			
Gross Beta	3.50E+01	8.10E+00					J	**2.14**	**1.15**		**68.6**			
Total Activity	9.70E+01	1.70E+01					J	**2.86**	**2.27**		**69.1**			

G01070042-03A			TLF-0526					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.40E-01					U
Ra-226	8.00E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	2.10E-01												
Th-230	6.80E-01	2.00E-01												
Th-232	6.80E-01	2.00E-01												
U-234	5.60E-01	1.80E-01												
U-235	3.00E-02	3.90E-02					U	2.40E-01	3.50E-01					U
U-238	7.50E-01	2.10E-01												
Total U Alpha	**1.34E+00**	**2.79E-01**												
Alpha Sum	**3.95E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.10E-01						1.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	7.50E-01	2.10E-01						-1.00E+00	4.10E+01					UJ
Ac-227														
Ra-228	5.20E-01	3.60E-01												
Pa-231	-3.00E-01	1.80E+00					U							
Beta Sum	**1.98E+00**	**5.14E-01**						**-4.16E-01**	**4.10E+01**					
Total Activity Sum	**5.93E+00**	**1.78E+00**						**3.53E+00**	**4.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.07E+01	4.40E+00					J	**1.43**	**(from gamma)**		**92.2**			
Gross Beta	1.98E+01	5.00E+00					J	**3.54**	**0.49**		**164**			
Total Activity	3.09E+01	6.60E+00					J	**3.65**	**0.66**		**136**			

G01070042-04A			TLF-0527					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.50E-01					U
Ra-226	9.70E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.05E+00	2.20E-01												
Th-230	1.01E+00	2.10E-01					J							
Th-232	9.60E-01	2.00E-01												
U-234	1.36E+00	3.50E-01												
U-235	1.15E-01	8.40E-02						-8.00E-02	4.60E-01					U
U-238	1.24E+00	3.20E-01												
Total U Alpha	**2.72E+00**	**4.82E-01**												
Alpha Sum	**6.89E+00**	**1.67E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.24E+00	3.20E-01						9.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	1.24E+00	3.20E-01						0.00E+00	9.30E+00					UJ
Ac-227														
Ra-228	8.70E-01	3.90E-01												
Pa-231	2.00E-01	1.70E+00					U							
Beta Sum	**3.37E+00**	**6.31E-01**						**1.79E+00**	**9.39E+00**					
Total Activity Sum	**1.03E+01**	**1.79E+00**						**8.68E+00**	**9.53E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.51E+01	7.80E+00					J	**2.28**	**(from gamma)**		**114**			
Gross Beta	1.10E+01	3.90E+00					J	**1.93**	**0.91**		**106**			
Total Activity	2.46E+01	5.50E+00					J	**2.48**	**1.45**		**82.3**			

G01070042-05A			TLF-0644					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.90E-01					U
Ra-226	1.41E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	2.40E-01												
Th-230	1.29E+00	2.60E-01												
Th-232	1.09E+00	2.30E-01												
U-234	1.98E+00	4.40E-01												
U-235	2.30E-01	1.10E-01						1.70E-01	4.90E-01					U
U-238	1.92E+00	4.30E-01												
Total U Alpha	**4.13E+00**	**6.25E-01**												
Alpha Sum	**8.59E+00**	**1.91E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.92E+00	4.30E-01						2.20E+00	1.40E+00					
Pa-234m (Assumed from U-238)	1.92E+00	4.30E-01						-1.00E+00	3.00E+01					UJ
Ac-227														
Ra-228	1.02E+00	4.50E-01												
Pa-231	-5.00E-01	1.90E+00					U							
Beta Sum	**4.80E+00**	**7.90E-01**						**2.16E+00**	**3.00E+01**					
Total Activity Sum	**1.34E+01**	**2.06E+00**						**1.08E+01**	**3.01E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.10E+01	6.90E+00					J	**1.73**	**(from gamma)**		**83.9**			
Gross Beta	1.50E+01	4.40E+00					J	**2.28**	**0.42**		**103**			
Total Activity	3.47E+01	7.00E+00					J	**2.92**	**0.78**		**88.6**			

G01070042-06A			TLF-0645					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.60E-01	4.40E-01					U
Ra-226	3.68E+00	7.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.40E+00	4.50E-01												
Th-230	2.85E+00	5.20E-01												
Th-232	2.44E+00	4.60E-01												
U-234	3.64E+01	6.00E+00												
U-235	1.52E+00	4.00E-01						1.55E+00	8.30E-01					
U-238	3.49E+01	5.80E+00												
Total U Alpha	**7.28E+01**	**8.35E+00**												
Alpha Sum	**8.30E+01**	**8.91E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.49E+01	5.80E+00						2.64E+01	4.90E+00					
Pa-234m (Assumed from U-238)	3.49E+01	5.80E+00						4.50E+01	2.00E+01					
Ac-227														
Ra-228	2.06E+00	6.90E-01												
Pa-231	-1.30E+00	3.20E+00					U							
Beta Sum	**7.17E+01**	**8.24E+00**						**7.33E+01**	**2.06E+01**					
Total Activity Sum	**1.55E+02**	**1.21E+01**						**1.56E+02**	**2.25E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.03E+02	2.10E+01						**0.88**	**(from gamma)**		**21.5**			
Gross Beta	6.60E+01	1.40E+01					J	**0.35**	**0.29**		**8.28**			
Total Activity	1.74E+02	2.60E+01						**0.67**	**0.51**		**11.7**			

G01070042-07A			TLF-0646					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.90E-01					U
Ra-226	2.60E+00	6.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.64E+00	3.20E-01												
Th-230	3.52E+00	5.90E-01					J							
Th-232	1.65E+00	3.20E-01												
U-234	3.18E+01	5.30E+00												
U-235	1.92E+00	4.60E-01						7.70E-01	7.20E-01					
U-238	3.24E+01	5.40E+00												
Total U Alpha	**6.61E+01**	**7.58E+00**												
Alpha Sum	**7.54E+01**	**7.94E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.24E+01	5.40E+00						2.03E+01	4.90E+00					
Pa-234m (Assumed from U-238)	3.24E+01	5.40E+00						3.00E+01	1.70E+01					
Ac-227														
Ra-228	1.45E+00	4.90E-01												
Pa-231	-2.00E-01	2.40E+00					U							
Beta Sum	**6.62E+01**	**7.66E+00**						**5.17E+01**	**1.77E+01**					
Total Activity Sum	**1.42E+02**	**1.10E+01**						**1.27E+02**	**1.94E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.70E+01	2.00E+01						**1.01**	**(from gamma)**		**25.1**			
Gross Beta	5.60E+01	1.20E+01					J	**0.72**	**0.20**		**16.7**			
Total Activity	1.60E+02	2.40E+01						**0.70**	**1.07**		**12.2**			

G01070042-08A			TLF-0619					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.00E-01					U
Ra-226	1.01E+00	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.10E-01												
Th-230	1.06E+00	2.30E-01					J							
Th-232	8.30E-01	2.00E-01												
U-234	2.38E+00	5.00E-01												
U-235	1.05E-01	7.70E-02						8.00E-02	4.50E-01					U
U-238	2.55E+00	5.30E-01												
Total U Alpha	**5.04E+00**	**7.33E-01**												
Alpha Sum	**8.63E+00**	**2.25E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.55E+00	5.30E-01						1.30E+00	1.40E+00					
Pa-234m (Assumed from U-238)	2.55E+00	5.30E-01						3.00E+00	1.10E+01					U
Ac-227														
Ra-228	8.70E-01	3.60E-01												
Pa-231	-2.00E-01	2.30E+00					U							
Beta Sum	**5.95E+00**	**8.76E-01**						**5.15E+00**	**1.11E+01**					
Total Activity Sum	**1.46E+01**	**2.41E+00**						**1.38E+01**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.02E+01	6.70E+00					J	**1.64**	**(from gamma)**		**80.3**			
Gross Beta	2.06E+01	5.00E+00					J	**2.89**	**1.27**		**110**			
Total Activity	3.58E+01	7.20E+00					J	**2.80**	**1.64**		**84.3**			

G01070042-09A			TLF-0620					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.50E-01	3.40E-01					U
Ra-226	3.91E+00	8.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.97E+00	6.90E-01												
Th-230	6.30E+00	1.00E+00												
Th-232	4.01E+00	6.90E-01												
U-234	1.03E+01	1.80E+00												
U-235	4.20E-01	1.80E-01						6.10E-01	8.10E-01					U
U-238	9.70E+00	1.70E+00												
Total U Alpha	**2.04E+01**	**2.48E+00**												
Alpha Sum	**4.05E+01**	**3.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.70E+00	1.70E+00						1.33E+01	4.00E+00					
Pa-234m (Assumed from U-238)	9.70E+00	1.70E+00						0.00E+00	1.80E+01					UJ
Ac-227														
Ra-228	2.76E+00	8.10E-01												
Pa-231	2.10E+00	1.50E+00												
Beta Sum	**2.24E+01**	**2.54E+00**						**1.63E+01**	**1.85E+01**					
Total Activity Sum	**6.29E+01**	**4.13E+00**						**5.68E+01**	**1.87E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.20E+01	1.70E+01					J	**2.40**	**(from gamma)**		**67.8**			
Gross Beta	3.97E+01	9.50E+00					J	**1.76**	**1.13**		**55.7**			
Total Activity	1.29E+02	2.10E+01					J	**3.09**	**2.56**		**68.9**			

G01070042-10A			TLF-0474					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.60E-01	1.50E-01	2.20E-01	1.50E-01	**0.19**	**16.7**	
Ra-226	9.30E-01	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	2.00E-01												
Th-230	7.90E-01	2.20E-01					J							
Th-232	6.30E-01	1.80E-01												
U-234	8.60E-01	2.30E-01												
U-235	9.60E-02	7.00E-02						2.50E-01	3.40E-01	0.00E+00	3.50E-01	**0.51**	**200**	U
U-238	8.00E-01	2.20E-01												
Total U Alpha	**1.76E+00**	**3.26E-01**												
Alpha Sum	**4.71E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.20E-01						0.00E+00	2.00E+01	-3.00E-01	1.80E+00	**0.01**	**200**	UJ
Pa-234m (Assumed from U-238)	8.00E-01	2.20E-01						3.00E+00	7.70E+00	0.00E+00	3.00E+02	**0.01**	**200**	U
Ac-227														
Ra-228	2.20E-01	3.10E-01	3.30E-01	2.80E-01	**0.26**	**40.0**	U							
Pa-231	-1.00E-01	1.60E+00	0.00E+00	1.60E+00	**0.04**	**-200**	U							
Beta Sum	**1.81E+00**	**4.79E-01**						**3.21E+00**	**2.14E+01**	**3.00E-02**	**3.00E+02**			
Total Activity Sum	**6.51E+00**	**1.62E+00**						**7.91E+00**	**2.15E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.77E+01	6.70E+00					J	**1.89**	**(from gamma)**		**116**			
Gross Beta	4.90E+00	3.30E+00					J	**0.93**	**0.08**		**92.2**			
Total Activity	2.10E+01	5.50E+00					J	**2.53**	**0.59**		**105**			

G01070042-11A			TLF-0475					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.60E-01					U
Ra-226	1.17E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.01E+00	2.70E-01												
Th-230	8.20E-01	2.30E-01					J							
Th-232	6.40E-01	1.90E-01												
U-234	7.30E-01	2.10E-01												
U-235	1.90E-02	3.30E-02					U	4.00E-02	3.70E-01					U
U-238	6.70E-01	2.00E-01												
Total U Alpha	**1.42E+00**	**2.92E-01**												
Alpha Sum	**5.06E+00**	**1.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.70E-01	2.00E-01						-2.00E-01	1.80E+00					UJ
Pa-234m (Assumed from U-238)	6.70E-01	2.00E-01						-4.00E+00	4.40E+01					UJ
Ac-227														
Ra-228	4.70E-01	3.40E-01												
Pa-231	0.00E+00	1.60E+00					U							
Beta Sum	**1.81E+00**	**4.82E-01**						**-3.73E+00**	**4.40E+01**					
Total Activity Sum	**6.87E+00**	**1.64E+00**						**1.33E+00**	**4.41E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.22E+01	5.10E+00					J	**1.34**	**(from gamma)**		**82.8**			
Gross Beta	2.33E+01	5.40E+00					J	**3.96**	**0.61**		**171**			
Total Activity	2.98E+01	6.60E+00					J	**3.37**	**0.64**		**125**			

G01070042-12A			TLF-9609					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.50E-01					U
Ra-226	8.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.90E-01	1.60E-01												
Th-230	6.70E-01	1.50E-01												
Th-232	6.50E-01	1.50E-01												
U-234	6.70E-01	1.90E-01												
U-235	9.10E-02	6.50E-02						7.00E-02	4.10E-01					U
U-238	5.90E-01	1.80E-01												
Total U Alpha	**1.35E+00**	**2.70E-01**												
Alpha Sum	**4.19E+00**	**1.77E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.90E-01	1.80E-01						0.00E+00	1.10E+00					UJ
Pa-234m (Assumed from U-238)	5.90E-01	1.80E-01						1.00E+00	1.00E+01					U
Ac-227														
Ra-228	3.40E-01	4.30E-01					U							
Pa-231	0.00E+00	1.90E+00					U							
Beta Sum	**1.52E+00**	**5.49E-01**						**1.34E+00**	**1.01E+01**					
Total Activity Sum	**5.71E+00**	**1.85E+00**						**5.53E+00**	**1.02E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.59E+01	6.00E+00					J	**1.87**	**(from gamma)**		**117**			
Gross Beta	1.12E+01	3.70E+00					J	**2.59**	**0.92**		**152**			
Total Activity	2.46E+01	5.60E+00					J	**3.20**	**1.64**		**125**			

G01070042-13A			TLF-0582					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.70E-01					U
Ra-226	1.04E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.90E-01	1.90E-01												
Th-230	1.06E+00	2.20E-01					J							
Th-232	7.30E-01	1.60E-01												
U-234	1.32E+00	3.30E-01												
U-235	7.20E-02	6.90E-02						6.00E-02	4.10E-01					U
U-238	1.57E+00	3.70E-01												
Total U Alpha	**2.96E+00**	**5.01E-01**												
Alpha Sum	**6.23E+00**	**2.01E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.57E+00	3.70E-01						4.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	1.57E+00	3.70E-01						1.00E+00	1.30E+01					U
Ac-227														
Ra-228	8.60E-01	5.30E-01												
Pa-231	-5.00E-01	2.10E+00					U							
Beta Sum	**3.94E+00**	**7.86E-01**						**2.20E+00**	**1.31E+01**					
Total Activity Sum	**1.02E+01**	**2.16E+00**						**8.43E+00**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.34E+01	7.20E+00					J	**2.30**	**(from gamma)**		**116**			
Gross Beta	2.01E+01	5.00E+00					J	**3.19**	**1.28**		**134**			
Total Activity	3.41E+01	6.80E+00					J	**3.35**	**1.73**		**108**			

G01070042-14A			TLF-0583					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.40E-01					U
Ra-226	9.90E-01	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.20E-01												
Th-230	5.90E-01	1.70E-01												
Th-232	8.00E-01	2.00E-01												
U-234	1.37E+00	3.30E-01												
U-235	1.17E-01	7.90E-02						-6.00E-02	3.90E-01					U
U-238	9.80E-01	2.60E-01												
Total U Alpha	**2.47E+00**	**4.27E-01**												
Alpha Sum	**5.27E+00**	**1.74E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.80E-01	2.60E-01						7.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	9.80E-01	2.60E-01						-3.00E-01	9.70E+00					UJ
Ac-227														
Ra-228	6.40E-01	3.30E-01												
Pa-231	-5.00E-01	1.80E+00					U							
Beta Sum	**2.54E+00**	**5.39E-01**						**9.80E-01**	**9.77E+00**					
Total Activity Sum	**7.81E+00**	**1.83E+00**						**6.25E+00**	**9.92E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.61E+01	6.40E+00					J	**1.63**	**(from gamma)**		**101**			
Gross Beta	1.01E+01	3.80E+00					J	**1.97**	**0.87**		**120**			
Total Activity	2.16E+01	5.50E+00					J	**2.38**	**1.35**		**93.8**			

G01070042-15A			TLF-0640					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.50E-01					U
Ra-226	1.39E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.26E+00	2.70E-01					J							
Th-230	1.60E+00	3.20E-01												
Th-232	1.17E+00	2.50E-01					J							
U-234	3.90E+00	7.40E-01												
U-235	1.59E-01	9.40E-02						8.00E-02	4.30E-01					U
U-238	3.41E+00	6.60E-01												
Total U Alpha	**7.47E+00**	**9.96E-01**												
Alpha Sum	**1.28E+01**	**2.15E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.41E+00	6.60E-01						3.60E+00	1.40E+00					
Pa-234m (Assumed from U-238)	3.41E+00	6.60E-01						-3.00E+00	7.50E+01					UJ
Ac-227														
Ra-228	4.90E-01	3.20E-01					J							
Pa-231	-1.00E-01	2.00E+00					U							
Beta Sum	**7.30E+00**	**1.02E+00**						**1.08E+00**	**7.50E+01**					
Total Activity Sum	**2.01E+01**	**2.38E+00**						**1.39E+01**	**7.50E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.65E+01	7.30E+00					J	**1.80**	**(from gamma)**		**69.7**			
Gross Beta	1.61E+01	4.30E+00					J	**1.99**	**0.20**		**75.2**			
Total Activity	3.27E+01	6.40E+00					J	**1.85**	**0.25**		**47.7**			

G01070042-16A			TLF-9712					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	2.00E-01					U
Ra-226	1.60E+00	4.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.25E+00	2.80E-01												
Th-230	1.90E+00	3.80E-01												
Th-232	1.20E+00	2.60E-01												
U-234	2.03E+00	4.30E-01												
U-235	9.50E-02	6.90E-02						2.00E-01	4.80E-01					U
U-238	2.04E+00	4.30E-01												
Total U Alpha	**4.17E+00**	**6.12E-01**												
Alpha Sum	**1.05E+01**	**2.18E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.04E+00	4.30E-01						1.80E+00	1.00E+00					
Pa-234m (Assumed from U-238)	2.04E+00	4.30E-01						0.00E+00	1.20E+01					UJ
Ac-227														
Ra-228	8.50E-01	4.00E-01												
Pa-231	4.00E-01	2.20E+00					U							
Beta Sum	**4.98E+00**	**7.74E-01**						**2.70E+00**	**1.21E+01**					
Total Activity Sum	**1.55E+01**	**2.31E+00**						**1.32E+01**	**1.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.18E+01	7.00E+00					J	**1.54**	**(from gamma)**		**70.2**			
Gross Beta	1.58E+01	4.20E+00					J	**2.53**	**1.03**		**104**			
Total Activity	3.16E+01	6.40E+00					J	**2.37**	**1.33**		**68.6**			

G01070042-17A			TLF-0641					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	2.40E-01					U
Ra-226	2.16E+00	5.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.33E+00	4.30E-01												
Th-230	2.46E+00	4.50E-01												
Th-232	2.35E+00	4.30E-01												
U-234	3.33E+00	6.60E-01												
U-235	2.70E-01	1.30E-01						1.70E-01	6.40E-01					U
U-238	3.19E+00	6.40E-01												
Total U Alpha	**6.79E+00**	**9.28E-01**												
Alpha Sum	**1.58E+01**	**2.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.19E+00	6.40E-01						4.10E+00	1.30E+00					
Pa-234m (Assumed from U-238)	3.19E+00	6.40E-01						2.00E+00	1.50E+01					U
Ac-227														
Ra-228	1.84E+00	6.00E-01												
Pa-231	-3.00E-01	2.70E+00					U							
Beta Sum	**8.18E+00**	**1.13E+00**						**7.90E+00**	**1.51E+01**					
Total Activity Sum	**2.40E+01**	**2.98E+00**						**2.37E+01**	**1.53E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.35E+01	9.50E+00					J	**1.79**	**(from gamma)**		**71.7**			
Gross Beta	2.36E+01	5.90E+00					J	**2.57**	**0.97**		**97.0**			
Total Activity	5.20E+01	1.10E+01					J	**2.46**	**1.50**		**73.7**			

G01070042-18A			TLF-9713					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	2.60E-01					U
Ra-226	3.50E+00	7.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.51E+00	4.70E-01												
Th-230	2.81E+00	5.10E-01												
Th-232	2.27E+00	4.30E-01												
U-234	4.17E+00	8.00E-01												
U-235	3.30E-01	1.40E-01						4.00E-01	6.30E-01					U
U-238	4.71E+00	8.90E-01												
Total U Alpha	**9.21E+00**	**1.20E+00**												
Alpha Sum	**2.04E+01**	**2.71E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.71E+00	8.90E-01						5.20E+00	1.60E+00					
Pa-234m (Assumed from U-238)	4.71E+00	8.90E-01						8.00E+00	1.20E+01					U
Ac-227														
Ra-228	1.92E+00	6.20E-01												
Pa-231	1.00E-01	2.40E+00					U							
Beta Sum	**1.14E+01**	**1.43E+00**						**1.51E+01**	**1.21E+01**					
Total Activity Sum	**3.17E+01**	**3.07E+00**						**3.55E+01**	**1.24E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.00E+01	1.10E+01					J	**1.73**	**(from gamma)**		**64.9**			
Gross Beta	2.68E+01	6.40E+00					J	**2.36**	**0.85**		**81.0**			
Total Activity	6.00E+01	1.00E+01					J	**2.70**	**1.53**		**61.6**			

G01070042-19A			TLF-0642					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.70E-01					U
Ra-226	2.45E+00	5.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.72E+00	3.40E-01					J							
Th-230	2.79E+00	5.00E-01												
Th-232	1.68E+00	3.30E-01					J							
U-234	1.52E+01	2.50E+00												
U-235	5.60E-01	1.90E-01						7.10E-01	5.70E-01					
U-238	1.55E+01	2.50E+00												
Total U Alpha	**3.13E+01**	**3.54E+00**												
Alpha Sum	**3.93E+01**	**4.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.55E+01	2.50E+00						1.43E+01	3.40E+00					
Pa-234m (Assumed from U-238)	1.55E+01	2.50E+00						7.00E+00	1.40E+01					U
Ac-227														
Ra-228	8.40E-01	4.30E-01					J							
Pa-231	-7.00E-01	2.60E+00					U							
Beta Sum	**3.18E+01**	**3.58E+00**						**2.21E+01**	**1.44E+01**					
Total Activity Sum	**7.10E+01**	**5.62E+00**						**6.13E+01**	**1.51E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+01	1.30E+01						**1.07**	**(from gamma)**		**31.6**			
Gross Beta	3.65E+01	8.10E+00					J	**0.54**	**0.87**		**13.9**			
Total Activity	9.60E+01	1.50E+01						**1.56**	**1.63**		**29.9**			

G01070042-20A			TLF-0643					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.10E-01	2.50E-01					U
Ra-226	3.06E+00	6.50E-01	2.43E+00	5.30E-01	**0.75**	**23.0**								
Np-237														
Pu-238														
Pu-239														
Th-228	2.96E+00	5.50E-01	3.04E+00	5.70E-01	**0.10**	**2.67**								
Th-230	2.84E+00	5.20E-01	2.65E+00	5.00E-01	**0.26**	**6.92**	J							
Th-232	2.59E+00	4.90E-01	2.80E+00	5.30E-01	**0.29**	**7.79**								
U-234	3.61E+00	7.00E-01	3.66E+00	6.60E-01	**0.05**	**1.38**								
U-235	1.56E-01	9.40E-02	2.20E-01	1.00E-01	**0.47**	**34.0**		2.80E-01	6.20E-01					U
U-238	3.01E+00	6.10E-01	3.69E+00	6.60E-01	**0.76**	**20.3**								
Total U Alpha	**6.78E+00**	**9.33E-01**	**7.57E+00**	**9.39E-01**										
Alpha Sum	**1.79E+01**	**2.83E+00**	**1.85E+01**	**1.42E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.01E+00	6.10E-01	3.69E+00	6.60E-01	**0.76**	**20.3**		2.40E+00	1.30E+00					
Pa-234m (Assumed from U-238)	3.01E+00	6.10E-01	3.69E+00	6.60E-01	**0.76**	**20.3**		5.00E+00	1.40E+01					U
Ac-227														
Ra-228	3.84E+00	8.80E-01												
Pa-231	-4.00E-01	2.70E+00					U							
Beta Sum	**9.81E+00**	**1.27E+00**	**7.38E+00**	**9.33E-01**				**1.12E+01**	**1.41E+01**					
Total Activity Sum	**2.77E+01**	**3.10E+00**	**2.59E+01**	**1.70E+00**				**2.91E+01**	**1.44E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.30E+01	1.10E+01	4.50E+01	1.10E+01	**0.13**	**4.55**	J	**2.21**	**(from gamma)**		**82.6**			
Gross Beta	1.79E+01	5.50E+00	2.66E+01	6.80E+00	**0.99**	**39.1**	J	**1.43**	**0.44**		**58.4**			
Total Activity	7.00E+01	1.20E+01	6.10E+01	1.10E+01	**0.55**	**13.7**	J	**3.41**	**2.19**		**86.7**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070043

This sample delivery group (SDG) contained twenty (20) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0584	G01070043-01A
TLF-0585	G01070043-02A
TLF-0510	G01070043-03A
TLF-0511	G01070043-04A
TLF-0512	G01070043-05A
TLF-0513	G01070043-06A
TLF-0586	G01070043-07A
TLF-0587	G01070043-08A
TLF-0514	G01070043-09A
TLF-0515	G01070043-10A
TLF-0588	G01070043-11A
TLF-0575	G01070043-12A
TLF-0576	G01070043-13A
TLF-0577	G01070043-14A
TLF-0578	G01070043-15A
TLF-0579	G01070043-16A
TLF-0594	G01070043-17A
TLF-0595	G01070043-18A
TLF-0573	G01070043-19A
TLF-0574	G01070043-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa. All samples with results less than 5 times the rinsate blank for ^{228}Ra, ^{234}Th, and ^{234m}Pa should be qualified as estimated. All sample results for ^{228}Ra analyses are greater than 5 times the rinsate blank. **However, samples TLF-0510, TLF-0512, TLF-0514, and TLF-0594 (laboratory duplicate) for ^{234}Th, and TLF-0585, TLF-0512, TLF-0586, TLF-0514, TLF-0576, TLF-0577, TLF-0579, TLF-0594, and TLF-0595 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ra, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in all of the samples above the required DL (1.65*TPU). The activity range for ^{40}K was 5.46 " 1.88 pCi/g to 20.9 " 4.88 pCi/g, which are normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0511, TLF-0587, TLF-0514, TLF-0588, TLF-0576, TLF-0578, and TLF-0594 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.116 " 0.104 pCi/g to 0.937 " 0.226 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was indication of blank contamination for the ^{230}Th analyses. All samples with ^{230}Th results less than 5 times the blank should be qualified as estimated (J). **Therefore, it is recommended that the ^{230}Th results for samples TLF-0585, TLF-0511, TLF-0514, and TLF-0575 be qualified as estimated (J).**

Equipment Rinsate Blanks:

There was indication of contamination in the rinsate blank for ^{234}U. All samples with results less than 5 times the rinsate blank for ^{234}U should be qualified as estimated. All of the results for ^{234}U were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 50.29% for all samples for the Th alpha spectrometry analyses. Excluding samples TLF-0585, TLF-0510, and TLF0511 (0.05%, 9.44%, and –0.03%), the tracer recoveries were greater than 61.55% for the remaining samples for the U alpha spectrometry analyses. The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th alpha spectrometry analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the U alpha spectrometry analyses in samples TLF-0585, TLF-0510, and TLF-0511. There is between –56.6% and 28.2% uncertainty in the sample specific percent recovery results for samples TLF-0585, TLF-0510, and TLF-0511 for U alpha analyses. **Therefore it is recommended that the $^{234/235/238}$U results for samples TLF-0585, TLF-0510, and TLF-0511 be rejected (R).**

Due to analytical difficulties experienced by the laboratory in processing samples TLF-0585, TLF-0510, and TLF-0511, an investigation was initiated to recover the apparent loss of uranium. This report is being issued before the completion of the investigation. Using ^{234}Th and ^{235}U gamma spectrometry results from these samples, calculations[1] were performed to calculate estimates of the ^{234}U concentrations (0.452 pCi/g, 27.0 pCi/g, and 18.9 pCi/g, respectively) for each sample. Revised uranium results may be available at a future date for the samples in question.

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0584, TLF-0510, TLF-0512, TLF-0513, TLF-0587, TLF-0514, TLF-0588, TLF-0575, TLF-0577, TLF-0595, TLF-0574 and TLF-0574 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.49 " 0.14 to 3.08 " 0.57 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0584, TLF-0510, TLF-0512, TLF-0513, TLF-0587, TLF-0514, TLF-0588, TLF-0575, TLF-0577, TLF-0595, TLF-0574 and TLF-0574 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

---

[1] *"Relationship between isotopic uranium activities and total uranium at various uranium enrichments,"* T. L. Rucker and C. M. Johnson, Jr., Journal of Radioanalytical and Nuclear Chemistry, Vol. 235, Nos 1-2 (1998) pp. 47-52.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{226}Ra results is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analysis were all above 21.06%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha and beta analyses.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha LCS (137%) was outside acceptable limits**. Therefore, it is recommended that the gross alpha results for all samples be qualified as estimated (J).**

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The matrix spike sample (MSS) recovery for the gross alpha/beta analyses were within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since gross alpha/beta analyses are just estimates, no additional qualification is necessary.

5.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the method blank for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The ^{228}Ra results for sample TLF-0573 did not agree with the ^{232}Th results. For sample TLF-0573 the ^{228}Th and ^{232}Th activities are in equilibrium. Since the ^{228}Ra result is about 3 times greater than either the $^{228/232}$Th results, it appears that there may be a heterogeneity issue. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0511. These differences are most likely due to very low chemical recovery, thereby resulting in a very low counting rate. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0584 (1.82), TLF-0510 (1.30), TLF-0586 (1.46), TLF-0587 (1.46), TLF-0514 (1.52), TLF-0515 (2.15), TLF-0588 (1.95), TLF-0577 (1.78), TLF-0594 (1.91), TLF-0595 (1.90), and TLF-0573 (2.12) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (114%, 84.9%, 93.7%, 99.3%, 97.5%, 83.4%, 109%, 110%, 117%, 103%, and 114%, respectfully) also exceed acceptable limits. The samples have a gross alpha result greater than the sum of the alphas by factors ranging from 2.4 to 5.6. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-0584, TLF-0510, TLF-0586, TLF-0587, TLF-0514, TLF-0515, TLF-0588, TLF-0577, TLF-0594, TLF-0595, and TLF-0573 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0584 (2.42), TLF-0510 (2.72), TLF-0512 (4.27), TLF-0513

(3.84), TLF-0586 (3.97), TLF-0587 (3.68), TLF-0514 (2.62), TLF-0515 (2.03), TLF-0588 (3.09), TLF-0575 (3.03), TLF-0576 (3.46), TLF-0577 (2.95), TLF-0578 (2.36), TLF-0579 (3.73), TLF-0594 (3.03), TLF-0595 (2.68), TLF-0573 (4.18), and TLF-0574 (2.14) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (137%, 134%, 177%, 163%, 162%, 159%, 149%, 79.4%, 145%, 160%, 163%, 154%, 99.1%, 172%, 153%, 127%, 175%, and 162% respectfully) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 2.3 to 16.5. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for samples TLF-0584, TLF-0513, TLF-0586, TLF-0587, TLF-0514, TLF-0515, TLF-0588, TLF-0575, TLF-0575, TLF-0578, TLF-0579, TLF-0594, TLF-0573, and TLF-0574. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for samples TLF-0584, TLF-0510, TLF-0512, TLF-0513, TLF-0586, TLF-0587, TLF-0514, TLF-0515, TLF-0588, TLF-0575, TLF-0576, TLF-0577, TLF-0578, TLF-0579, TLF-0594, TLF-0595, TLF-0573, and TLF-0574 be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for samples TLF-0584 (3.70), TLF-0510 (2.78), TLF-0512 (4.01), TLF-0513 (3.36), TLF-0586 (3.78), TLF-0587 (3.21), TLF-0514 (3.03), TLF-0515 (3.37), TLF-0588 (1.58), TLF-0575 (2.85), TLF-0576 (3.59), TLF-0577 (3.97), TLF-0578 (3.06), TLF-0579 (3.20), TLF-0594 (3.98), TLF-0595 (2.41), and TLF-0573 (3.66) were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. The RPDs (130%, 100%, 147%, 126%, 127%, 120%, 119%, 86.5%, 65.6%, 130%, 135%, 142%, 92.9%, 132%, 139%, 91.4%, and 128%) for these samples also exceed acceptable limits. The samples have a total activity result greater than the total activity sum by factors ranging from 2.0 to 6.6. Also, if the ^{40}K and ^{137}Cs results, as discussed in Section 1.0 had been reported from the gamma, the DERs and RPDs for total activity results would be within limits for all samples except TLF-0584, TLF-0510, TLF-0512, TLF-0514, TLF-0515, TLF-0576, TLF-0577, TLF-0578, TLF-0594, and TLF-0595 which still contain a positive bias for total activity. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be investigated in the future. Finally, it is recommended that the total activity results for samples TLF-0584, TLF-0510, TLF-0512, TLF-0513, TLF-0586, TLF-0587, TLF-0514, TLF-0515, TLF-0588, TLF-0575, TLF-0576, TLF-0577, TLF-0578, TLF-0579, TLF-0594, TLF-0595, and TLF-0573 be qualified as estimated (J).**

Calculation of Isotopic Uranium for Comparision to Gamma Spectrometry Results for Case G01070043

Analyses	TLF-0585 Result (pCi/g)	TLF-0585 Uncertainty (pCi/g)	TLF-0510 Result (pCi/g)	TLF-0510 Uncertainty (pCi/g)	TLF-0511 Result (pCi/g)	TLF-0511 Uncertainty (pCi/g)
Total U by TIMS						
U-235 wt%						
Calculated Isotopic Uranium						
U-234 Calculated						
U-235 Calculated						
U-238 Calculated						
Total U Alpha (Calc)						
Alpha Spectrometry Results						
U-234						
U-235						
U-238						
Total U Alpha Sum	**0.00E+00**		**0.00E+00**		**0.00E+00**	
Calculated Results from Gamma						
U-234	**4.52E-01**		**2.70E+01**		**1.89E+01**	
U-235 wt%	**5.72E-01**		**1.99E+01**		**1.50E+01**	
Gamma Spectrometry Results						
Th-234	4.40E-01	3.00E-01	5.80E-01	3.50E-01	5.40E-01	3.80E-01
U-235	2.10E-02	6.50E-02	1.00E+00	2.00E+00	7.00E-01	1.70E+00

G01070043-01A			TLF-0584					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.70E-01					U
Ra-226	7.40E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	1.80E-01												
Th-230	7.50E-01	1.80E-01					J							
Th-232	6.80E-01	1.70E-01												
U-234	7.90E-01	2.60E-01												
U-235	4.80E-02	5.50E-02						-1.00E-01	2.90E+00					U
U-238	9.00E-01	2.80E-01												
Total U Alpha	**1.74E+00**	**3.86E-01**												
Alpha Sum	**4.48E+00**	**1.97E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.80E-01						2.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	9.00E-01	2.80E-01						0.00E+00	1.50E+01					U
Ac-227														
Ra-228	3.60E-01	5.00E-01					U							
Pa-231	-2.00E-01	2.10E+00					U							
Beta Sum	**2.14E+00**	**6.86E-01**						**5.36E-01**	**1.51E+01**					
Total Activity Sum	**6.61E+00**	**2.08E+00**						**5.01E+00**	**1.52E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.66E+01	6.30E+00					J	**1.84**	**(from gamma)**		**115**			
Gross Beta	1.15E+01	3.80E+00					J	**2.43**	**0.71**		**137**			
Total Activity	3.16E+01	6.40E+00					J	**3.71**	**1.61**		**131**			

G01070043-02A			TLF-0585					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-02	2.30E-02					U
Ra-226	2.60E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.70E-01	1.20E-01												
Th-230	4.90E-01	1.40E-01					J							
Th-232	4.40E-01	1.30E-01												
U-234	-2.00E+01	1.70E+02					R							
U-235	2.00E+01	2.40E+02					R	2.10E-02	6.50E-02					U
U-238	0.00E+00	6.50E+01					R							
Total U Alpha	**0.00E+00**	**3.01E+02**												
Alpha Sum	**1.46E+00**	**3.01E+02**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	0.00E+00	6.50E+01						4.40E-01	3.00E-01					
Pa-234m (Assumed from U-238)	0.00E+00	6.50E+01						1.60E+00	1.90E+00					J
Ac-227														
Ra-228	6.10E-01	1.40E-01												
Pa-231	-1.10E-01	3.30E-01					U							
Beta Sum	**5.97E-01**	**9.19E+01**						**2.64E+00**	**1.93E+00**					
Total Activity Sum	**2.06E+00**	**3.15E+02**						**4.10E+00**	**3.01E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	4.20E+00						**0.02**	**(from gamma)**		**141**			
Gross Beta	6.70E+00	3.50E+00					J	**0.07**	**1.02**		**167**			
Total Activity	8.60E+00	3.60E+00					J	**0.02**	**0.01**		**123**			

G01070043-03A			TLF-0510					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-02	2.70E-02					U
Ra-226	7.00E-01	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.10E-01	1.20E-01												
Th-230	6.90E-01	1.60E-01					J							
Th-232	4.60E-01	1.30E-01												
U-234	7.30E-01	6.40E-01					R							
U-235	1.50E-01	3.40E-01					R	-4.00E-03	7.70E-02					U
U-238	1.10E+00	7.90E-01					R							
Total U Alpha	**1.98E+00**	**1.07E+00**												
Alpha Sum	**4.20E+00**	**1.18E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.10E+00	7.90E-01						5.80E-01	3.50E-01					J
Pa-234m (Assumed from U-238)	1.10E+00	7.90E-01						1.00E+00	2.00E+00					U
Ac-227														
Ra-228	6.10E-01	1.20E-01												
Pa-231	-4.00E-02	3.60E-01					U							
Beta Sum	**2.81E+00**	**1.12E+00**						**2.19E+00**	**2.03E+00**					
Total Activity Sum	**7.01E+00**	**1.63E+00**						**6.39E+00**	**2.35E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.04E+01	4.60E+00					J	**1.30**	**(from gamma)**		**84.9**			
Gross Beta	1.41E+01	4.00E+00					J	**2.72**	**2.66**		**134**			
Total Activity	2.11E+01	4.80E+00					J	**2.78**	**2.75**		**100**			

G01070043-04A			TLF-0511					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.40E-02	2.60E-02					U
Ra-226	6.30E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.40E-01	1.50E-01												
Th-230	5.30E-01	1.50E-01					J							
Th-232	4.50E-01	1.30E-01												
U-234	-2.00E+02	2.00E+03					R							
U-235	0.00E+00	0.00E+00					R	3.90E-02	7.10E-02					U
U-238	-7.00E+01	7.40E+02					R							
Total U Alpha	**-2.70E+02**	**2.13E+03**												
Alpha Sum	**-2.68E+02**	**2.13E+03**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	-7.00E+01	7.40E+02					U	5.40E-01	3.80E-01					
Pa-234m (Assumed from U-238)	-7.00E+01	7.40E+02					U	7.00E-01	1.70E+00					U
Ac-227														
Ra-228	5.60E-01	1.30E-01												
Pa-231	-1.60E-01	3.50E-01					U							
Beta Sum	**-1.39E+02**	**1.05E+03**						**1.78E+00**	**1.75E+00**					
Total Activity Sum	**-4.07E+02**	**2.38E+03**						**-2.66E+02**	**2.13E+03**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.20E+00	4.10E+00					J	**0.13**	**(from gamma)**		**-211**			
Gross Beta	8.30E+00	3.50E+00					J	**0.14**	**1.67**		**-225**			
Total Activity	1.28E+01	4.00E+00						**0.18**	**0.13**		**213**			

G01070043-05A			TLF-0512					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.60E-01					U
Ra-226	6.90E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.50E-01	1.90E-01												
Th-230	7.70E-01	2.10E-01					J							
Th-232	6.20E-01	1.80E-01												
U-234	7.20E-01	2.40E-01												
U-235	2.90E-02	4.60E-02					U	-1.70E-01	7.60E-01					U
U-238	5.50E-01	2.10E-01												
Total U Alpha	**1.30E+00**	**3.22E-01**												
Alpha Sum	**3.67E+00**	**1.70E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.50E-01	2.10E-01						-2.00E-01	1.60E+00					UJ
Pa-234m (Assumed from U-238)	5.50E-01	2.10E-01						0.00E+00	3.20E+02					UJ
Ac-227														
Ra-228	4.70E-01	4.20E-01												
Pa-231	-4.00E-01	1.80E+00					U							
Beta Sum	**1.52E+00**	**5.58E-01**						**2.22E-01**	**3.20E+02**					
Total Activity Sum	**5.19E+00**	**1.79E+00**						**3.89E+00**	**3.20E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.50E+00	4.70E+00					J	**0.77**	**(from gamma)**		**68.6**			
Gross Beta	2.51E+01	5.50E+00					J	**4.27**	**0.08**		**177**			
Total Activity	3.42E+01	7.00E+00					J	**4.01**	**0.09**		**147**			

G01070043-06A			TLF-0513					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.70E-01					U
Ra-226	8.80E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.50E-01												
Th-230	7.60E-01	2.10E-01					J							
Th-232	7.50E-01	2.10E-01												
U-234	9.00E-01	2.90E-01												
U-235	4.90E-02	6.10E-02					U	-4.00E-02	9.60E-01					U
U-238	7.10E-01	2.50E-01												
Total U Alpha	**1.66E+00**	**3.88E-01**												
Alpha Sum	**4.81E+00**	**3.03E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.10E-01	2.50E-01						6.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	7.10E-01	2.50E-01						2.00E+00	9.40E+00					U
Ac-227														
Ra-228	9.00E-01	3.70E-01												
Pa-231	-2.00E-01	3.30E+00					U							
Beta Sum	**2.30E+00**	**6.47E-01**						**3.48E+00**	**9.50E+00**					
Total Activity Sum	**7.11E+00**	**3.10E+00**						**8.29E+00**	**9.98E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.34E+01	6.30E+00					J	**1.23**	**(from gamma)**		**94.4**			
Gross Beta	2.24E+01	5.20E+00					J	**3.84**	**1.75**		**163**			
Total Activity	3.13E+01	6.50E+00					J	**3.36**	**1.93**		**126**			

G01070043-07A			TLF-0586					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	1.70E-01					U
Ra-226	8.40E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.40E-01	2.20E-01												
Th-230	8.10E-01	2.10E-01												
Th-232	8.70E-01	2.20E-01												
U-234	6.70E-01	2.50E-01												
U-235	5.60E-02	6.50E-02						1.90E-01	3.50E-01					U
U-238	6.90E-01	2.50E-01												
Total U Alpha	**1.42E+00**	**3.59E-01**												
Alpha Sum	**4.78E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	2.50E-01						3.00E-01	1.10E+00					U
Pa-234m (Assumed from U-238)	6.90E-01	2.50E-01						0.00E+00	1.80E+01					UJ
Ac-227														
Ra-228	8.00E-01	4.50E-01												
Pa-231	0.00E+00	1.80E+00					U							
Beta Sum	**2.18E+00**	**6.12E-01**						**1.10E+00**	**1.80E+01**					
Total Activity Sum	**6.96E+00**	**1.83E+00**						**5.88E+00**	**1.81E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.32E+01	5.50E+00					J	**1.46**	**(from gamma)**		**93.7**			
Gross Beta	2.10E+01	4.70E+00					J	**3.97**	**1.07**		**162**			
Total Activity	3.14E+01	6.20E+00					J	**3.78**	**1.33**		**127**			

G01070043-08A			TLF-0587					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.70E-01					U
Ra-226	1.10E+00	4.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.40E-01	2.20E-01												
Th-230	7.60E-01	2.10E-01					J							
Th-232	9.10E-01	2.40E-01												
U-234	6.50E-01	2.30E-01												
U-235	6.50E-02	6.50E-02						1.00E-01	4.70E-01					U
U-238	9.10E-01	2.80E-01												
Total U Alpha	**1.63E+00**	**3.68E-01**												
Alpha Sum	**4.78E+00**	**2.79E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.10E-01	2.80E-01						7.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	9.10E-01	2.80E-01						7.00E-01	9.60E+00					U
Ac-227														
Ra-228	5.30E-01	3.50E-01												
Pa-231	-4.00E-01	3.00E+00					U							
Beta Sum	**2.30E+00**	**6.39E-01**						**1.88E+00**	**9.70E+00**					
Total Activity Sum	**7.08E+00**	**2.86E+00**						**6.66E+00**	**1.01E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.42E+01	5.80E+00					J	**1.46**	**(from gamma)**		**99.3**			
Gross Beta	2.01E+01	4.80E+00					J	**3.68**	**1.68**		**159**			
Total Activity	2.81E+01	5.90E+00					J	**3.21**	**1.83**		**120**			

G01070043-09A			TLF-0514					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.50E-01					U
Ra-226	7.40E-01	5.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.10E-01	2.20E-01												
Th-230	5.70E-01	2.00E-01					J							
Th-232	7.10E-01	2.10E-01												
U-234	6.10E-01	2.20E-01												
U-235	4.80E-02	5.50E-02						-1.00E-01	3.40E+00					U
U-238	6.00E-01	2.20E-01												
Total U Alpha	**1.26E+00**	**3.16E-01**												
Alpha Sum	**4.17E+00**	**1.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.00E-01	2.20E-01						-1.00E+00	6.50E+00					UJ
Pa-234m (Assumed from U-238)	6.00E-01	2.20E-01						-4.00E+00	2.60E+01					UJ
Ac-227														
Ra-228	4.90E-01	4.50E-01												
Pa-231	2.00E-01	1.80E+00					U							
Beta Sum	**1.71E+00**	**5.88E-01**						**-4.49E+00**	**2.68E+01**					
Total Activity Sum	**5.88E+00**	**1.88E+00**						**-3.18E-01**	**2.69E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.21E+01	4.90E+00					J	**1.52**	**(from gamma)**		**97.5**			
Gross Beta	1.18E+01	3.80E+00					J	**2.62**	**0.60**		**149**			
Total Activity	2.32E+01	5.40E+00					J	**3.03**	**0.86**		**119**			

G01070043-10A			TLF-0515					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	2.60E-01					U
Ra-226	2.73E+00	5.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.97E+00	5.60E-01												
Th-230	3.08E+00	5.70E-01												
Th-232	2.68E+00	5.10E-01												
U-234	3.59E+00	7.30E-01												
U-235	1.60E-01	1.10E-01						3.10E-01	6.80E-01					U
U-238	3.13E+00	6.60E-01												
Total U Alpha	**6.88E+00**	**9.90E-01**												
Alpha Sum	**1.85E+01**	**2.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.13E+00	6.60E-01						3.70E+00	1.70E+00					
Pa-234m (Assumed from U-238)	3.13E+00	6.60E-01						4.00E+00	1.40E+01					U
Ac-227														
Ra-228	2.52E+00	6.40E-01												
Pa-231	2.00E-01	2.60E+00					U							
Beta Sum	**8.80E+00**	**1.17E+00**						**1.02E+01**	**1.41E+01**					
Total Activity Sum	**2.73E+01**	**3.01E+00**						**2.88E+01**	**1.44E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+01	1.20E+01					J	**2.15**	**(from gamma)**		**83.4**			
Gross Beta	2.04E+01	5.60E+00					J	**2.03**	**0.67**		**79.4**			
Total Activity	6.90E+01	1.20E+01					J	**3.37**	**2.15**		**86.5**			

G01070043-11A			TLF-0588					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.60E-01					U
Ra-226	8.10E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.10E-01												
Th-230	1.00E+00	2.50E-01					J							
Th-232	8.50E-01	2.20E-01												
U-234	1.12E+00	3.10E-01												
U-235	8.50E-02	7.60E-02						2.30E-01	4.00E-01					U
U-238	8.10E-01	2.50E-01												
Total U Alpha	**2.02E+00**	**4.05E-01**												
Alpha Sum	**5.34E+00**	**1.74E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E-01	2.50E-01						9.80E-01	8.20E-01					
Pa-234m (Assumed from U-238)	8.10E-01	2.50E-01						2.00E+00	1.30E+01					U
Ac-227														
Ra-228	8.00E-01	4.50E-01												
Pa-231	-1.00E-01	1.80E+00					U							
Beta Sum	**2.41E+00**	**6.12E-01**						**3.77E+00**	**1.30E+01**					
Total Activity Sum	**7.74E+00**	**1.84E+00**						**9.10E+00**	**1.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.81E+01	6.30E+00					J	**1.95**	**(from gamma)**		**109**			
Gross Beta	1.52E+01	4.10E+00					J	**3.09**	**0.84**		**145**			
Total Activity	1.53E+01	4.40E+00					J	**1.58**	**0.45**		**65.6**			

G01070043-12A			TLF-0575					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.40E-01	1.50E-01					
Ra-226	8.90E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.30E-01												
Th-230	5.60E-01	2.00E-01					J							
Th-232	8.60E-01	2.30E-01												
U-234	5.70E-01	2.10E-01												
U-235	2.80E-02	4.50E-02					U	-9.00E-02	6.00E-01					U
U-238	5.00E-01	2.00E-01												
Total U Alpha	**1.10E+00**	**2.93E-01**												
Alpha Sum	**4.11E+00**	**4.26E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.00E-01	2.00E-01						6.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	5.00E-01	2.00E-01						5.00E+00	1.20E+01					U
Ac-227														
Ra-228	7.10E-01	4.00E-01												
Pa-231	-1.00E-01	4.70E+00					U							
Beta Sum	**1.70E+00**	**7.47E-01**						**6.30E+00**	**1.21E+01**					
Total Activity Sum	**5.81E+00**	**4.33E+00**						**1.04E+01**	**1.28E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.12E+01	5.60E+00					J	**1.01**	**(from gamma)**		**92.7**			
Gross Beta	1.52E+01	4.40E+00					J	**3.03**	**0.69**		**160**			
Total Activity	2.76E+01	6.30E+00					J	**2.85**	**1.20**		**130**			

G01070043-13A			TLF-0576					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.00E-02	1.50E-01					U
Ra-226	5.30E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	2.00E-01												
Th-230	7.90E-01	2.00E-01												
Th-232	5.70E-01	1.60E-01												
U-234	6.70E-01	2.50E-01												
U-235	2.70E-02	5.00E-02					U	4.00E-02	3.60E-01					U
U-238	6.90E-01	2.50E-01												
Total U Alpha	**1.39E+00**	**3.57E-01**												
Alpha Sum	**3.91E+00**	**1.62E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	2.50E-01						4.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	6.90E-01	2.50E-01						-4.00E+00	2.90E+01					UJ
Ac-227														
Ra-228	4.90E-01	3.30E-01												
Pa-231	-2.00E-01	1.70E+00					U							
Beta Sum	**1.85E+00**	**5.25E-01**						**-3.13E+00**	**2.90E+01**					
Total Activity Sum	**5.75E+00**	**1.71E+00**						**7.73E-01**	**2.91E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.80E+00	4.30E+00					J	**0.85**	**(from gamma)**		**66.5**			
Gross Beta	1.78E+01	4.60E+00					J	**3.45**	**0.71**		**162**			
Total Activity	2.91E+01	6.30E+00					J	**3.58**	**0.95**		**134**			

G01070043-14A			TLF-0577					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.70E-01					U
Ra-226	1.24E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.04E+00	2.40E-01												
Th-230	7.70E-01	1.90E-01					J							
Th-232	8.70E-01	2.10E-01												
U-234	6.10E-01	2.40E-01												
U-235	8.40E-02	8.40E-02						-1.40E-01	6.40E-01					U
U-238	5.60E-01	2.20E-01												
Total U Alpha	**1.25E+00**	**3.36E-01**												
Alpha Sum	**4.54E+00**	**2.50E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.60E-01	2.20E-01						7.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	5.60E-01	2.20E-01						-1.00E+00	3.70E+01					UJ
Ac-227														
Ra-228	8.50E-01	4.00E-01												
Pa-231	-7.00E-01	2.70E+00					U							
Beta Sum	**1.89E+00**	**6.01E-01**						**4.66E-01**	**3.70E+01**					
Total Activity Sum	**6.43E+00**	**2.58E+00**						**5.01E+00**	**3.71E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.56E+01	5.70E+00					J	**1.78**	**(from gamma)**		**110**			
Gross Beta	1.44E+01	4.20E+00					J	**2.95**	**0.37**		**154**			
Total Activity	3.79E+01	7.50E+00					J	**3.97**	**0.87**		**142**			

G01070043-15A			TLF-0578					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.60E-01					U
Ra-226	9.60E-01	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.05E+00	2.50E-01												
Th-230	9.00E-01	2.20E-01												
Th-232	8.40E-01	2.00E-01												
U-234	1.75E+00	4.50E-01												
U-235	6.30E-02	7.10E-02						-1.00E-01	1.50E+00					U
U-238	1.93E+00	4.80E-01												
Total U Alpha	**3.74E+00**	**6.62E-01**												
Alpha Sum	**7.49E+00**	**2.15E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.93E+00	4.80E-01						1.40E+00	1.40E+00					
Pa-234m (Assumed from U-238)	1.93E+00	4.80E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	8.30E-01	4.50E-01												
Pa-231	0.00E+00	2.20E+00					U							
Beta Sum	**4.69E+00**	**8.56E-01**						**3.23E+00**	**1.11E+01**					
Total Activity Sum	**1.22E+01**	**2.31E+00**						**1.07E+01**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.11E+01	4.60E+00					J	**0.71**	**(from gamma)**		**38.8**			
Gross Beta	1.39E+01	3.80E+00					J	**2.36**	**0.91**		**99.1**			
Total Activity	3.33E+01	6.50E+00					J	**3.06**	**1.73**		**92.9**			

G01070043-16A			TLF-0579					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.80E-01					U
Ra-226	1.07E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	2.70E-01												
Th-230	7.10E-01	2.10E-01												
Th-232	7.20E-01	2.10E-01												
U-234	5.50E-01	2.30E-01												
U-235	1.10E-02	5.80E-02					U	0.00E+00	4.80E-01					U
U-238	4.70E-01	2.10E-01												
Total U Alpha	**1.03E+00**	**3.17E-01**												
Alpha Sum	**4.07E+00**	**2.25E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.70E-01	2.10E-01						4.00E-01	1.30E+00					U
Pa-234m (Assumed from U-238)	4.70E-01	2.10E-01						0.00E+00	1.10E+01					UJ
Ac-227														
Ra-228	6.30E-01	4.20E-01												
Pa-231	-5.00E-01	2.40E+00					U							
Beta Sum	**1.51E+00**	**5.90E-01**						**9.70E-01**	**1.11E+01**					
Total Activity Sum	**5.58E+00**	**2.32E+00**						**5.04E+00**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.70E+00	4.50E+00					J	**0.72**	**(from gamma)**		**61.7**			
Gross Beta	1.99E+01	4.90E+00					J	**3.73**	**1.56**		**172**			
Total Activity	2.74E+01	6.40E+00					J	**3.20**	**1.72**		**132**			

G01070043-17A			TLF-0594					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.30E-01	6.00E-02	1.40E-01	**0.16**	**66.7**	U
Ra-226	8.80E-01	2.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	1.80E-01												
Th-230	6.40E-01	1.80E-01												
Th-232	7.70E-01	2.00E-01												
U-234	7.80E-01	2.60E-01												
U-235	1.05E-01	9.00E-02						-1.50E-01	9.40E-01	7.00E-02	3.60E-01	**0.22**	**550**	U
U-238	7.50E-01	2.50E-01												
Total U Alpha	**1.64E+00**	**3.72E-01**												
Alpha Sum	**4.41E+00**	**1.71E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E-01	2.50E-01						8.20E-01	6.80E-01	1.00E-01	1.20E+00	**0.52**	**157**	
Pa-234m (Assumed from U-238)	7.50E-01	2.50E-01						-2.00E+00	6.10E+01	3.30E+00	9.40E+00	**0.09**	**815**	UJ
Ac-227														
Ra-228	5.80E-01	3.60E-01	3.60E-01	3.60E-01	**0.43**	**46.8**								
Pa-231	-2.00E-01	1.80E+00	3.00E-01	1.70E+00	**0.20**	**1000**	U							
Beta Sum	**2.06E+00**	**5.49E-01**						**-6.24E-01**	**6.10E+01**	**3.80E+00**	**9.49E+00**			
Total Activity Sum	**6.46E+00**	**1.80E+00**						**3.78E+00**	**6.10E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.67E+01	6.20E+00					J	**1.91**	**(from gamma)**		**117**			
Gross Beta	1.55E+01	4.40E+00					J	**3.03**	**0.26**		**153**			
Total Activity	3.56E+01	7.10E+00					J	**3.98**	**0.52**		**139**			

G01070043-18A			TLF-0595					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.60E-01					U
Ra-226	9.60E-01	3.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	2.20E-01												
Th-230	9.20E-01	2.10E-01					J							
Th-232	8.70E-01	2.00E-01												
U-234	1.27E+00	3.60E-01												
U-235	9.30E-02	8.70E-02						-1.30E-01	5.70E-01					U
U-238	1.24E+00	3.50E-01												
Total U Alpha	**2.60E+00**	**5.10E-01**												
Alpha Sum	**6.17E+00**	**3.49E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.24E+00	3.50E-01						3.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	1.24E+00	3.50E-01						-3.00E+00	2.50E+01					UJ
Ac-227														
Ra-228	6.50E-01	3.30E-01												
Pa-231	-2.00E-01	3.80E+00					U							
Beta Sum	**3.11E+00**	**7.50E-01**						**-2.07E+00**	**2.50E+01**					
Total Activity Sum	**9.28E+00**	**3.57E+00**						**4.10E+00**	**2.53E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.94E+01	6.00E+00					J	**1.90**	**(from gamma)**		**103**			
Gross Beta	1.40E+01	4.00E+00					J	**2.68**	**0.63**		**127**			
Total Activity	2.49E+01	5.40E+00					J	**2.41**	**0.80**		**91.4**			

G01070043-19A			TLF-0573					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	2.00E-01					U
Ra-226	9.80E-01	2.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.10E+00	2.80E-01												
Th-230	1.02E+00	2.60E-01												
Th-232	1.02E+00	2.60E-01												
U-234	1.34E+00	4.00E-01												
U-235	3.10E-02	5.90E-02					U	4.00E-02	4.90E-01					U
U-238	9.00E-01	3.00E-01												
Total U Alpha	**2.27E+00**	**5.03E-01**												
Alpha Sum	**6.12E+00**	**2.03E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	3.00E-01						6.00E-01	1.50E+00					U
Pa-234m (Assumed from U-238)	9.00E-01	3.00E-01						1.00E+00	1.70E+01					U
Ac-227														
Ra-228	2.30E-01	5.20E-01					U							
Pa-231	-3.00E-01	2.10E+00					U							
Beta Sum	**1.99E+00**	**7.17E-01**						**1.79E+00**	**1.71E+01**					
Total Activity Sum	**8.12E+00**	**2.15E+00**						**7.92E+00**	**1.72E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.24E+01	7.40E+00					J	**2.12**	**(from gamma)**		**114**			
Gross Beta	2.93E+01	6.50E+00					J	**4.18**	**1.51**		**175**			
Total Activity	3.66E+01	7.50E+00					J	**3.65**	**1.53**		**127**			

G01070043-20A			TLF-0574					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.60E-01					U
Ra-226	8.30E-01	2.50E-01	1.02E+00	2.90E-01	**0.50**	**20.5**								
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	1.90E-01	7.30E-01	1.80E-01	**0.08**	**2.70**								
Th-230	8.30E-01	2.00E-01	7.60E-01	1.80E-01	**0.26**	**8.81**	J							
Th-232	5.90E-01	1.60E-01	7.70E-01	1.80E-01	**0.75**	**26.5**								
U-234	6.00E-01	2.30E-01	7.90E-01	2.60E-01	**0.55**	**27.3**								
U-235	8.10E-02	8.00E-02	8.60E-02	7.90E-02	**0.04**	**5.99**		1.40E-01	3.80E-01					U
U-238	6.30E-01	2.30E-01	6.10E-01	2.20E-01	**0.06**	**3.23**								
Total U Alpha	**1.31E+00**	**3.35E-01**	**1.49E+00**	**3.50E-01**										
Alpha Sum	**4.31E+00**	**4.14E+01**	**4.77E+00**	**5.51E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.30E-01	2.30E-01	6.10E-01	2.20E-01	**0.06**	**3.23**		6.00E-01	1.20E+00					U
Pa-234m (Assumed from U-238)	6.30E-01	2.30E-01	6.10E-01	2.20E-01	**0.06**	**3.23**		2.00E+00	1.10E+01					U
Ac-227														
Ra-228	6.30E-01	3.90E-01												
Pa-231	0.00E+00	4.60E+01					U							
Beta Sum	**1.89E+00**	**5.54E+00**	**1.22E+00**	**3.11E-01**				**3.23E+00**	**1.24E+01**					
Total Activity Sum	**6.20E+00**	**4.18E+01**	**5.99E+00**	**6.33E-01**				**7.54E+00**	**4.32E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.76E+01	5.30E+00	1.15E+01	4.30E+00	**0.89**	**41.9**	J	**0.32**	**(from gamma)**		**121**			
Gross Beta	1.74E+01	4.70E+00	1.56E+01	4.30E+00	**0.28**	**10.9**	J	**2.13**	**1.07**		**161**			
Total Activity	3.38E+01	7.00E+00	3.09E+01	6.50E+00	**0.30**	**8.96**		**0.65**	**0.60**		**138**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070043 – Addendum

This addendum to the original report for this sample delivery group (SDG) includes three (3) individual soil samples for reanalysis from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. Sample reanalysis was necessary due to rejected results. The requested re-analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ by alpha spectrometry. All analyses were originally requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

This report addendum contains only information that changed from the original report.

Client Identification	Laboratory Identification
TLF-0585	G01070043-02A
TLF-0510	G01070043-03A
TLF-0511	G01070043-04A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{238}U. All associated sample results less than 5 times the method blank values for ^{238}U should be qualified as estimated (J). **Therefore, it is recommended that the ^{238}U results for samples TLF-0510 and TLF-0511 be qualified as estimated (J).**

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the ^{234}U results were greater than 5 times the rinsate blank; therefore, no additional qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Sample-Specific Chemical Recovery:

The sample tracer recovery for sample TLF-0510 was 54.88% for the uranium alpha spectrometry analyses. However samples TLF-0587 (0.09%) and TLF-0511 (0.01%) had tracer recoveries outside acceptable limits. **Therefore, it is recommended that the $^{234/235/238}U$ results for samples TLF-0585 and TLF-0511 be rejected (R).**

There is greater than 10% uncertainty in the sample-specific percent recovery results for the U alpha spectrometry analyses. Uncertainties exceeded acceptable limits and ranged from 14.7% for sample TLF-0510 to 400% and 447% for the U analyses in samples TLF-0585 and TLF-0511. **Therefore, it is recommended that the $^{234/235/238}U$ results for samples TLF-0510 be qualified as estimated (J). In addition, it is recommended that the $^{234/235/238}U$ results for samples TLF-0585 and TLF-0511 be rejected (R).**

Spectral Analysis:

No spectral interferences were observed in the isotopic uranium analyses for any of the samples.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0510 (1.30) was greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPD (84.9%) also exceed acceptable limits. The sample has a gross alpha result greater than the sum of the alphas by a factor of 3.2. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future for the gross alpha results in samples TLF-0510.**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DER for sample TLF-0510 (3.08) was greater than 1.29 indicating that the gross beta analysis was not in agreement with the sum of the beta emitters within a 99% confidence level. The RPD (156%) also exceed acceptable limits. This sample has a gross beta result greater than the sum of the betas by a factor of 8.1. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. If the ^{40}K and ^{137}Cs results as discussed in Section 1.0 of the original report, had been reported from the gamma, the DER would have still been outside of acceptable limits for sample TLF-0510. **It is recommended that the possible missing activity be investigated in the future and the gross beta results for samples TLF-0510 be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity sums for ten of the twenty samples agree with the total activity results. The DER for sample TLF-0510 (3.32) was greater than 1.29 indicating that the total activity analysis was not in agreement with the total activity sum for this sample. The RPD (123%) for this sample also exceed acceptable limits. The sample has a total activity result greater than the total activity sum by an approximate factor of 4.2. This may be an indication of other activity in the

sample that was not specifically analyzed for. If the ^{40}K and ^{137}Cs results as discussed in Section 1.0 of the original report, had been reported from the gamma analyses, the DER would not have been within limits for this sample. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for sample TLF-0510 be qualified as estimated (J).**

Summary:

Concerning the usability of data, it is recommend the gamma spectrometry results for ^{235}U and ^{238}U (from ^{234}Th gamma, assuming radioactive equilibrium), plus the calculated ^{234}U results from the original report be used for samples TLF-0585 and TLF-0511.

G01070043-02A			TLF-0585 - Reanalysis					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-02	2.30E-02					U
Ra-226	2.60E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.70E-01	1.20E-01												
Th-230	4.90E-01	1.40E-01					J							
Th-232	4.40E-01	1.30E-01												
U-234	2.00E+01	1.70E+02					R							
U-235	2.00E+01	2.40E+02					R	2.10E-02	6.50E-02					U
U-238	0.00E+00	6.50E+01					R							
Total U Alpha	**4.00E+01**	**3.01E+02**												
Alpha Sum	**4.15E+01**	**3.01E+02**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	0.00E+00	6.50E+01						4.40E-01	3.00E-01					
Pa-234m (Assumed from U-238)	0.00E+00	6.50E+01						1.60E+00	1.90E+00					J
Ac-227														
Ra-228	6.10E-01	1.40E-01												
Pa-231	-1.10E-01	3.30E-01					U							
Beta Sum	**5.97E-01**	**9.19E+01**						**2.64E+00**	**1.93E+00**					
Total Activity Sum	**4.21E+01**	**3.15E+02**						**4.41E+01**	**3.01E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	4.20E+00						**0.11**	**(from gamma)**		**132**			
Gross Beta	6.70E+00	3.50E+00					J	**0.07**	**1.02**		**167**			
Total Activity	8.60E+00	3.60E+00					J	**0.11**	**0.12**		**132**			

G01070043-03A			TLF-0510 - Reanalysis					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.30E-02	2.70E-02					U
Ra-226	7.00E-01	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.10E-01	1.20E-01												
Th-230	6.90E-01	1.60E-01					J							
Th-232	4.60E-01	1.30E-01												
U-234	4.80E-01	1.70E-01					J							
U-235	2.00E-02	3.50E-02					UJ	-4.00E-03	7.70E-02					U
U-238	5.70E-01	1.90E-01					J							
Total U Alpha	**1.07E+00**	**2.57E-01**												
Alpha Sum	**3.29E+00**	**5.64E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.70E-01	1.90E-01						5.80E-01	3.50E-01					J
Pa-234m (Assumed from U-238)	5.70E-01	1.90E-01						1.00E+00	2.00E+00					U
Ac-227														
Ra-228	6.10E-01	1.20E-01												
Pa-231	-4.00E-02	3.60E-01					U							
Beta Sum	**1.75E+00**	**2.97E-01**						**2.19E+00**	**2.03E+00**					
Total Activity Sum	**5.04E+00**	**6.38E-01**						**5.48E+00**	**2.11E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.04E+01	4.60E+00					J	**1.53**	**(from gamma)**		**103.8**			
Gross Beta	1.41E+01	4.00E+00					J	**3.08**	**2.66**		**156**			
Total Activity	2.11E+01	4.80E+00					J	**3.32**	**2.98**		**123**			

G01070043-04A			TLF-0511 - Reanalysis					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.40E-02	2.60E-02					U
Ra-226	6.30E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.40E-01	1.50E-01												
Th-230	5.30E-01	1.50E-01					J							
Th-232	4.50E-01	1.30E-01												
U-234	2.00E+02	2.00E+03					R							
U-235	0.00E+00	0.00E+00					R	3.90E-02	7.10E-02					U
U-238	7.00E+01	7.40E+02					R							
Total U Alpha	**2.70E+02**	**2.13E+03**												
Alpha Sum	**2.72E+02**	**2.13E+03**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.00E+01	7.40E+02					U	5.40E-01	3.80E-01					
Pa-234m (Assumed from U-238)	7.00E+01	7.40E+02					U	7.00E-01	1.70E+00					U
Ac-227														
Ra-228	5.60E-01	1.30E-01												
Pa-231	-1.60E-01	3.50E-01					U							
Beta Sum	**1.41E+02**	**1.05E+03**						**1.78E+00**	**1.75E+00**					
Total Activity Sum	**4.13E+02**	**2.38E+03**						**2.74E+02**	**2.13E+03**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.20E+00	4.10E+00					J	**0.12**	**(from gamma)**		**190**			
Gross Beta	8.30E+00	3.50E+00					J	**0.13**	**1.67**		**178**			
Total Activity	1.28E+01	4.00E+00						**0.17**	**0.12**		**188**			

Radiological Analytical Data Verification
Comments on Data for SDG G01070044

This sample delivery group (SDG) contained sixteen (16) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting of all samples. All analyses requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0743	G01070044-01A
TLF-0744	G01070044-02A
TLF-0589	G01070044-03A
TLF-0590	G01070044-04A
TLF-0591	G01070044-05A
TLF-0592	G01070044-06A
TLF-0593	G01070044-07A
TLF-9606	G01070044-08A
TLF-9607	G01070044-09A
TLF-0741	G01070044-10A
TLF-0742	G01070044-11A
TLF-0516	G01070044-12A
TLF-0517	G01070044-13A
TLF-9489	G01070044-14A
TLF-0476	G01070044-15A
TLF-0477	G01070044-16A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry analysis.

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{226}Ra results greater than 5 times the rinsate blank**. However, samples TLF-0590, TLF-0592, TLF-9606, TLF-0741, TLF-0742, TLF-0516, TLF-0517, TLF-9489, and TLF-0477 for ^{234}Th and samples TLF-0744, TLF-0589, TLF-0591, TLF-0593, TLF-9606, TLF-9607, TLF-0741, TLF-0742, TLF-0517, TLF-9489, TLF-0476, and TLF-0477 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control samples (LCS) were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for all gamma spectrometry duplicate analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am) were reported for all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in all samples and was above the required DL (1.65*TPU). The activity range for ^{40}K was approximately 4.40 " 2.17 to 18.91 " 4.22 pCi/g, which is within normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0591, TLF-0593, and TLF-9607 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.17 " 0.14 pCi/g to 0.28 " 0.15 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{228}Th and ^{230}Th. All associated sample results less than 5 times the method blank values for ^{228}Th and ^{230}Th should be qualified as estimated. All of the ^{228}Th and ^{230}Th sample results were greater than 5 times the method blank values. Therefore, no qualification was necessary.

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{234}U results greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results was necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The sample tracer recoveries were greater than 34% for all alpha spectrometry analyses.

The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th and U alpha spectrometry analyses

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0744, TLF-0589, TLF-0590, TLF-9606, TLF-0516, TLF-0517, TLF-9489 and TLF-0477 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.56 " 0.18 to 3.28 " 0.69 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0744, TLF-0589, TLF-0590, TLF-9606, TLF-0516, TLF-0517, TLF-9489 and TLF-0477 (laboratory duplicate) be qualified as estimated (J).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

The rinsate blank indicated contamination for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. Based on assumed sample and rinsate sizes, all sample results were greater than 5 times the rinsate blank result; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DERs for ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for ^{226}Ra were within acceptable limits.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated in the gross alpha method blank. However, contamination was indicated for the gross beta method blank. Samples with results less than 5 times the gross beta method blank should be qualified as estimated. **Therefore, it is recommended that the gross beta results for samples TLF-0743, TLF-0591, TLF-0593, TLF-9606, TLF-0516, TLF-0517, TLF-9489, TLF-0477 and TLF-0477 (laboratory duplicate) be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The gross alpha and gross beta LCS values were within acceptable limits.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.

Matrix Spike Sample:

The MSS percent recoveries for gross alpha and gross beta matrix spike sample were within acceptable limits

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because gross beta analyses were performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since gross alpha/beta analyses are just estimates, no additional qualification is necessary.

5.0 TOTAL ACTIVITY:

Method Blank:

There was an indication of method blank contamination for total activity analysis. Associated sample results less than 5 times the total activity method blank should be qualified as estimated (J). **Therefore, it is recommended that the total activity results for sample TLF-0477 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was within acceptable limits.

Duplicate Analysis:

The DERs for total activity duplicate analysis was within acceptable limits.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The U alpha data and U gamma data were in agreement within the uncertainties. No further qualification of the results is necessary.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The results for all samples agree within the uncertainties. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another. No qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0589 (2.30), TLF-0590 (1.94), TLF-0592 (1.96), TLF-0593 (1.46), TLF-9606 (1.61), TLF-9607 (1.56), TLF-0516 (1.86), and TLF-0476 (2.04) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (77.1%, 105%, 120%, 92.4%, 90.3%, 92.1%, 116%, and 125%, respectfully) also exceed acceptable limits. The samples have gross alpha results greater than the sum of the alphas by factors ranging from 2.3 to 4.3. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-0589, TLF-0590, TLF-0592, TLF-0593, TLF-9606, TLF-9607, TLF-0516, and TLF-0476 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs (1.85 to 3.89) for all samples were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (60.8%, to 171%) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 1.9 to 13.0. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for all samples. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for all samples be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (2.62 to 3.91) for all samples were greater than 1.29 indicating that the total activity analyses were not in agreement with the total activity sums for those samples. The RPDs (74.7% to 144%) for these samples also exceed acceptable limits. The samples have a total activity result greater than the total activity sum by an approximate factor ranging from 2.2 to 6.1. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for samples TLF-0743, TLF-0590, TLF-0742, TLF-0517, TLF-

9489, TLF-0476, and TLF-0477. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for all samples be qualified as estimated (J).**

G01070044-01A			TLF-0743					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	1.70E-01					U
Ra-226	8.10E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.60E-01	2.20E-01												
Th-230	7.70E-01	2.20E-01												
Th-232	7.90E-01	2.20E-01												
U-234	6.70E-01	2.30E-01												
U-235	8.90E-02	7.30E-02						-1.00E-01	1.50E+00					U
U-238	4.20E-01	1.70E-01												
Total U Alpha	**1.18E+00**	**2.95E-01**												
Alpha Sum	**4.49E+00**	**1.88E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.34E+01	3.56E+00												
Th-234 (Assumed from U-238)	4.20E-01	1.70E-01						3.70E+00	2.40E+00					
Pa-234m (Assumed from U-238)	4.20E-01	1.70E-01						-1.00E+01	1.70E+02					U
Ac-227														
Ra-228	7.30E-01	5.80E-01												
Pa-231	2.00E-01	2.00E+00					U							
Beta Sum	**1.50E+01**	**3.62E+00**						**7.86E+00**	**1.70E+02**					
Total Activity Sum	**1.95E+01**	**4.08E+00**						**1.24E+01**	**1.70E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.00E+00	4.10E+00						**1.00**	**(from gamma)**		**66.9**			
Gross Beta	1.57E+01	4.20E+00					J	**0.13**	**0.05**		**5**			
Total Activity	2.91E+01	6.50E+00					J	**1.25**	**0.10**		**40**			

G01070044-02A			TLF-0744					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.20E-01	2.10E-01					U
Ra-226	8.90E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.80E-01	2.80E-01												
Th-230	7.50E-01	2.30E-01					J							
Th-232	8.70E-01	2.50E-01												
U-234	7.40E-01	2.50E-01												
U-235	7.30E-02	7.70E-02						-9.00E-02	4.80E-01					U
U-238	5.90E-01	2.20E-01												
Total U Alpha	**1.40E+00**	**3.42E-01**												
Alpha Sum	**4.53E+00**	**2.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.43E+01	3.63E+00												
Th-234 (Assumed from U-238)	5.90E-01	2.20E-01						2.90E+00	2.70E+00					
Pa-234m (Assumed from U-238)	5.90E-01	2.20E-01						-2.00E+00	8.10E+01					UJ
Ac-227														
Ra-228	4.30E-01	5.10E-01												
Pa-231	-4.00E-01	2.50E+00					U							
Beta Sum	**1.59E+01**	**3.69E+00**						**1.56E+01**	**8.11E+01**					
Total Activity Sum	**2.04E+01**	**4.36E+00**						**2.01E+01**	**8.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.20E+00	3.90E+00						**0.81**	**(from gamma)**		**57.6**			
Gross Beta	1.98E+01	4.70E+00					J	**0.66**	**0.05**		**22**			
Total Activity	3.58E+01	7.20E+00					J	**1.83**	**0.19**		**55**			

G01070044-03A			TLF-0589					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.80E-01	2.20E-01					U
Ra-226	3.70E+00	7.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.95E+00	6.50E-01												
Th-230	3.28E+00	6.90E-01					J							
Th-232	3.34E+00	7.00E-01												
U-234	4.43E+00	9.00E-01												
U-235	3.30E-01	1.60E-01						1.90E-01	5.50E-01					U
U-238	4.41E+00	9.00E-01												
Total U Alpha	**9.17E+00**	**1.28E+00**												
Alpha Sum	**2.26E+01**	**2.94E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.07E+01	3.20E+00												
Th-234 (Assumed from U-238)	4.41E+00	9.00E-01						2.90E+00	1.70E+00					
Pa-234m (Assumed from U-238)	4.41E+00	9.00E-01						-9.00E+00	8.60E+01					UJ
Ac-227														
Ra-228	4.12E+00	9.50E-01												
Pa-231	2.00E-01	2.50E+00					U							
Beta Sum	**2.37E+01**	**3.59E+00**						**8.74E+00**	**8.61E+01**					
Total Activity Sum	**4.63E+01**	**4.64E+00**						**3.14E+01**	**8.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.10E+01	1.20E+01					J	**2.30**	**(from gamma)**		**77.1**			
Gross Beta	2.43E+01	5.90E+00					J	**0.09**	**0.18**		**2.7**			
Total Activity	7.80E+01	1.30E+01					J	**2.30**	**0.54**		**51.0**			

G01070044-04A			TLF-0590					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.70E-01					U
Ra-226	9.00E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.01E+00	2.50E-01												
Th-230	7.50E-01	2.00E-01					J							
Th-232	9.60E-01	2.40E-01												
U-234	7.70E-01	2.30E-01												
U-235	3.60E-02	4.50E-02					U	3.20E-01	4.90E-01					U
U-238	9.40E-01	2.60E-01												
Total U Alpha	**1.75E+00**	**3.50E-01**												
Alpha Sum	**5.46E+00**	**1.98E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.89E+01	4.20E+00												
Th-234 (Assumed from U-238)	9.40E-01	2.60E-01						5.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	9.40E-01	2.60E-01						4.00E+00	1.00E+01					U
Ac-227														
Ra-228	6.00E-01	5.00E-01												
Pa-231	1.00E-01	2.10E+00					U							
Beta Sum	**2.14E+01**	**4.25E+00**						**2.40E+01**	**1.09E+01**					
Total Activity Sum	**2.68E+01**	**4.69E+00**						**2.95E+01**	**1.11E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.75E+01	5.90E+00					J	**1.94**	**(from gamma)**		**105**			
Gross Beta	1.62E+01	4.40E+00					J	**0.85**	**0.66**		**28**			
Total Activity	3.27E+01	6.90E+00					J	**0.70**	**0.25**		**20**			

G01070044-05A			TLF-0591					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.80E-01					U
Ra-226	6.40E-01	1.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.00E-01	2.50E-01												
Th-230	6.50E-01	2.40E-01												
Th-232	6.90E-01	2.30E-01												
U-234	9.90E-01	2.80E-01												
U-235	1.23E-01	8.50E-02						0.00E+00	1.30E+00					U
U-238	9.20E-01	2.70E-01												
Total U Alpha	**2.03E+00**	**3.98E-01**												
Alpha Sum	**4.35E+00**	**2.24E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr	1.76E-01	1.23E-01												
Tc-99	7.80E+00	2.50E+00												
Th-234 (Assumed from U-238)	9.20E-01	2.70E-01						3.50E+00	1.70E+00					
Pa-234m (Assumed from U-238)	9.20E-01	2.70E-01						-1.00E+01	1.50E+02					UJ
Ac-227														
Ra-228	6.00E-01	3.60E-01												
Pa-231	-4.00E-01	2.40E+00					U							
Beta Sum	**1.04E+01**	**2.57E+00**						**2.03E+00**	**1.50E+02**					
Total Activity Sum	**1.47E+01**	**3.41E+00**						**6.38E+00**	**1.50E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.16E+01	5.50E+00						**1.22**	**(from gamma)**		**90.9**			
Gross Beta	1.21E+01	3.70E+00					J	**0.38**	**0.07**		**15**			
Total Activity	2.47E+01	5.80E+00					J	**1.48**	**0.12**		**51**			

G01070044-06A			TLF-0592					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.60E-01					U
Ra-226	8.50E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.20E-01	2.00E-01												
Th-230	7.30E-01	2.10E-01												
Th-232	5.90E-01	1.80E-01												
U-234	6.10E-01	2.10E-01												
U-235	6.70E-02	6.30E-02						9.00E-02	4.20E-01					U
U-238	5.40E-01	1.90E-01												
Total U Alpha	**1.22E+00**	**2.90E-01**												
Alpha Sum	**3.65E+00**	**1.78E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.24E+01	3.10E+00												
Th-234 (Assumed from U-238)	5.40E-01	1.90E-01						3.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	5.40E-01	1.90E-01						3.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.50E-01	3.90E-01												
Pa-231	-4.00E-01	1.90E+00					U							
Beta Sum	**1.42E+01**	**3.14E+00**						**1.64E+01**	**1.15E+01**					
Total Activity Sum	**1.78E+01**	**3.61E+00**						**2.00E+01**	**1.16E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.46E+01	5.30E+00					J	**1.96**	**(from gamma)**		**120**			
Gross Beta	1.89E+01	4.60E+00					J	**0.85**	**0.20**		**29**			
Total Activity	3.31E+01	6.90E+00					J	**1.96**	**0.97**		**60**			

G01070044-07A			TLF-0593					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.90E-01					U
Ra-226	8.50E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	2.80E-01												
Th-230	7.30E-01	2.00E-01												
Th-232	1.02E+00	2.50E-01												
U-234	8.10E-01	2.60E-01												
U-235	5.00E-02	5.70E-02						0.00E+00	4.50E-01					U
U-238	9.50E-01	2.90E-01												
Total U Alpha	**1.81E+00**	**3.94E-01**												
Alpha Sum	**5.08E+00**	**2.33E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr	1.66E-01	1.36E-01												
Tc-99	4.40E+00	2.17E+00												
Th-234 (Assumed from U-238)	9.50E-01	2.90E-01						1.20E+00	7.50E-01					
Pa-234m (Assumed from U-238)	9.50E-01	2.90E-01						-3.00E+00	3.20E+01					UJ
Ac-227														
Ra-228	5.60E-01	3.70E-01												
Pa-231	-5.00E-01	2.50E+00					U							
Beta Sum	**6.97E+00**	**2.26E+00**						**3.27E+00**	**3.21E+01**					
Total Activity Sum	**1.20E+01**	**3.25E+00**						**8.35E+00**	**3.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.38E+01	5.50E+00					J	**1.46**	**(from gamma)**		**92.4**			
Gross Beta	9.40E+00	3.50E+00					J	**0.58**	**0.19**		**30**			
Total Activity	2.37E+01	5.70E+00					J	**1.78**	**0.47**		**65**			

G01070044-08A			TLF-9606					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								3.00E-02	1.80E-01					U
Ra-226	9.50E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.10E-01												
Th-230	8.80E-01	2.20E-01					J							
Th-232	6.20E-01	1.70E-01												
U-234	9.40E-01	2.90E-01												
U-235	6.50E-02	6.50E-02						-5.00E-02	4.50E-01					U
U-238	6.50E-01	2.30E-01												
Total U Alpha	**1.66E+00**	**3.76E-01**												
Alpha Sum	**5.26E+00**	**1.97E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.07E+01	2.90E+00												
Th-234 (Assumed from U-238)	6.50E-01	2.30E-01						-2.00E-01	2.60E+00					UJ
Pa-234m (Assumed from U-238)	6.50E-01	2.30E-01						0.00E+00	2.10E+02					UJ
Ac-227														
Ra-228	5.20E-01	4.60E-01												
Pa-231	4.00E-01	2.10E+00					U							
Beta Sum	**1.26E+01**	**2.96E+00**						**1.11E+01**	**2.10E+02**					
Total Activity Sum	**1.78E+01**	**3.56E+00**						**1.63E+01**	**2.10E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.39E+01	5.00E+00					J	**1.61**	**(from gamma)**		**90.3**			
Gross Beta	1.46E+01	4.10E+00					J	**0.40**	**0.02**		**15**			
Total Activity	3.25E+01	6.80E+00					J	**1.91**	**0.08**		**58**			

G01070044-09A			TLF-9607					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.60E-01					U
Ra-226	7.70E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.60E-01	1.90E-01												
Th-230	8.10E-01	2.60E-01												
Th-232	6.50E-01	2.20E-01												
U-234	7.60E-01	2.40E-01												
U-235	5.80E-02	5.70E-02						0.00E+00	3.90E-01					U
U-238	8.90E-01	2.60E-01												
Total U Alpha	**1.71E+00**	**3.58E-01**												
Alpha Sum	**4.58E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr	2.76E-01	1.46E-01												
Tc-99	1.03E+01	2.88E+00												
Th-234 (Assumed from U-238)	8.90E-01	2.60E-01						9.30E-01	8.30E-01					
Pa-234m (Assumed from U-238)	8.90E-01	2.60E-01						-1.00E+00	1.60E+01					UJ
Ac-227														
Ra-228	5.80E-01	3.50E-01												
Pa-231	2.00E-01	1.80E+00					U							
Beta Sum	**1.30E+01**	**2.94E+00**						**1.11E+01**	**1.63E+01**					
Total Activity Sum	**1.75E+01**	**3.40E+00**						**1.57E+01**	**1.64E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.24E+01	4.70E+00					J	**1.56**	**(from gamma)**		**92.1**			
Gross Beta	1.82E+01	4.50E+00					J	**0.98**	**0.42**		**34**			
Total Activity	2.74E+01	6.20E+00					J	**1.39**	**0.67**		**44**			

G01070044-10A			TLF-0741					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.80E-01					U
Ra-226	8.80E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.20E-01	2.10E-01												
Th-230	6.50E-01	1.60E-01												
Th-232	7.80E-01	1.80E-01												
U-234	7.10E-01	2.20E-01												
U-235	1.19E-01	8.70E-02						1.00E-01	4.40E-01					U
U-238	8.70E-01	2.50E-01												
Total U Alpha	**1.70E+00**	**3.44E-01**												
Alpha Sum	**4.75E+00**	**1.96E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.22E+01	3.20E+00												
Th-234 (Assumed from U-238)	8.70E-01	2.50E-01						1.00E-01	1.30E+00					UJ
Pa-234m (Assumed from U-238)	8.70E-01	2.50E-01						0.00E+00	1.90E+01					UJ
Ac-227														
Ra-228	5.70E-01	3.50E-01												
Pa-231	-2.00E-01	2.10E+00					U							
Beta Sum	**1.45E+01**	**3.25E+00**						**1.28E+01**	**1.93E+01**					
Total Activity Sum	**1.92E+01**	**3.79E+00**						**1.76E+01**	**1.94E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.90E+00	3.90E+00						**0.72**	**(from gamma)**		**49.8**			
Gross Beta	1.75E+01	4.40E+00					J	**0.55**	**0.24**		**19**			
Total Activity	3.38E+01	7.00E+00					J	**1.83**	**0.79**		**55**			

G01070044-11A			TLF-0742					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.00E-02	2.10E-01					U
Ra-226	7.70E-01	2.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.70E-01	2.00E-01												
Th-230	6.50E-01	1.90E-01												
Th-232	6.90E-01	2.00E-01												
U-234	7.70E-01	2.50E-01												
U-235	7.00E-02	6.90E-02						8.00E-02	5.00E-01					U
U-238	5.10E-01	1.90E-01												
Total U Alpha	**1.35E+00**	**3.21E-01**												
Alpha Sum	**3.50E+00**	**2.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr	1.36E+01	3.80E+00												
Tc-99														
Th-234 (Assumed from U-238)	5.10E-01	1.90E-01						3.00E-01	1.50E+00					UJ
Pa-234m (Assumed from U-238)	5.10E-01	1.90E-01						-1.00E+01	2.30E+02					UJ
Ac-227														
Ra-228	5.50E-01	5.40E-01												
Pa-231	-7.00E-01	2.50E+00					U							
Beta Sum	**1.51E+01**	**3.86E+00**						**4.37E+00**	**2.30E+02**					
Total Activity Sum	**1.86E+01**	**4.50E+00**						**7.87E+00**	**2.30E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.20E+00	3.50E+00						**0.17**	**(from gamma)**		**18.2**			
Gross Beta	1.93E+01	4.60E+00					J	**0.70**	**0.06**		**25**			
Total Activity	2.65E+01	6.00E+00					J	**1.06**	**0.08**		**35**			

G01070044-12A			TLF-0516					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.40E-01	-7.00E-02	1.80E-01	**0.31**	**200**	U
Ra-226	4.00E-01	1.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.20E-01	2.00E-01												
Th-230	5.60E-01	1.80E-01					J							
Th-232	6.50E-01	2.00E-01												
U-234	6.30E-01	2.20E-01												
U-235	5.90E-02	6.30E-02						7.00E-02	3.90E-01	1.90E-01	3.70E-01	**0.22**	**92.3**	U
U-238	6.00E-01	2.20E-01												
Total U Alpha	**1.29E+00**	**3.17E-01**												
Alpha Sum	**3.43E+00**	**1.69E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.19E+01	2.85E+00												
Th-234 (Assumed from U-238)	6.00E-01	2.20E-01						0.00E+00	1.10E+00	3.00E-01	1.20E+00	**0.18**	**200**	UJ
Pa-234m (Assumed from U-238)	6.00E-01	2.20E-01						1.00E+00	9.90E+00	-1.00E+01	3.10E+02	**0.04**	**244**	U
Ac-227														
Ra-228	5.70E-01	4.00E-01	2.70E-01	3.60E-01	**0.56**	**71.4**								
Pa-231	-1.00E-01	1.80E+00	-2.00E-01	1.90E+00	**0.04**	**66.7**	U							
Beta Sum	**1.36E+01**	**2.90E+00**						**1.34E+01**	**1.04E+01**	**-9.45E+00**	**3.10E+02**			
Total Activity Sum	**1.71E+01**	**3.36E+00**						**1.69E+01**	**1.05E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.29E+01	4.80E+00					J	**1.86**	**(from gamma)**		**116**			
Gross Beta	1.02E+01	3.50E+00					J	**0.76**	**0.30**		**29**			
Total Activity	2.84E+01	6.30E+00					J	**1.59**	**0.94**		**50**			

G01070044-13A			TLF-0517					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.00E-02	1.70E-01					U
Ra-226	7.60E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	2.80E-01												
Th-230	5.90E-01	2.20E-01					J							
Th-232	7.70E-01	2.50E-01												
U-234	6.60E-01	2.40E-01												
U-235	7.50E-02	7.50E-02						9.00E-02	5.00E-01					U
U-238	5.20E-01	2.00E-01												
Total U Alpha	**1.26E+00**	**3.21E-01**												
Alpha Sum	**3.77E+00**	**2.32E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99	1.75E+01	4.11E+00												
Th-234 (Assumed from U-238)	5.20E-01	2.00E-01						6.00E-01	1.30E+00					UJ
Pa-234m (Assumed from U-238)	5.20E-01	2.00E-01						-1.00E+00	3.80E+01					UJ
Ac-227														
Ra-228	7.00E-01	3.90E-01												
Pa-231	-6.00E-01	2.50E+00					U							
Beta Sum	**1.91E+01**	**4.15E+00**						**1.77E+01**	**3.82E+01**					
Total Activity Sum	**2.29E+01**	**4.76E+00**						**2.15E+01**	**3.83E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.50E+00	4.60E+00						**1.11**	**(from gamma)**		**86.5**			
Gross Beta	1.26E+01	3.80E+00					J	**1.16**	**0.13**		**41**			
Total Activity	3.14E+01	6.70E+00					J	**1.03**	**0.26**		**31**			

G01070044-14A			TLF-9489					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.70E-01					U
Ra-226	6.30E-01	2.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.40E-01	2.70E-01												
Th-230	8.90E-01	2.60E-01					J							
Th-232	5.40E-01	1.80E-01												
U-234	7.60E-01	2.70E-01												
U-235	8.10E-02	8.00E-02						8.00E-02	4.60E-01					U
U-238	7.40E-01	2.60E-01												
Total U Alpha	**1.58E+00**	**3.83E-01**												
Alpha Sum	**4.67E+00**	**1.81E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.40E-01	2.60E-01						1.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	7.40E-01	2.60E-01						-3.00E+00	2.60E+01					UJ
Ac-227														
Ra-228	5.70E-01	3.30E-01												
Pa-231	1.00E-01	1.90E+00					U							
Beta Sum	**2.06E+00**	**5.44E-01**						**-2.32E+00**	**2.60E+01**					
Total Activity Sum	**6.73E+00**	**1.89E+00**						**2.35E+00**	**2.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.30E+00	4.70E+00						**0.92**	**(from gamma)**		**66.3**			
Gross Beta	1.38E+01	4.10E+00					J	**2.84**	**0.61**		**148**			
Total Activity	2.68E+01	6.20E+00					J	**3.10**	**0.91**		**120**			

G01070044-15A			TLF-0476					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								1.72E+00	4.40E-01					
Ra-226	9.90E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.60E-01	2.20E-01												
Th-230	6.30E-01	2.10E-01												
Th-232	6.30E-01	2.10E-01												
U-234	6.80E-01	2.40E-01												
U-235	7.40E-02	7.30E-02						3.30E-01	4.30E-01					U
U-238	7.90E-01	2.60E-01												
Total U Alpha	**1.54E+00**	**3.61E-01**												
Alpha Sum	**3.64E+00**	**2.15E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.90E-01	2.60E-01						1.50E+00	1.10E+00					
Pa-234m (Assumed from U-238)	7.90E-01	2.60E-01						-5.00E+00	6.70E+01					UJ
Ac-227														
Ra-228	3.40E-01	4.50E-01					U							
Pa-231	-9.00E-01	2.30E+00					U							
Beta Sum	**1.81E+00**	**6.43E-01**						**-3.27E+00**	**6.70E+01**					
Total Activity Sum	**5.46E+00**	**2.24E+00**						**3.76E-01**	**6.70E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.59E+01	5.60E+00					J	**2.04**	**(from gamma)**		**125**			
Gross Beta	1.67E+01	4.40E+00					J	**3.35**	**0.30**		**161**			
Total Activity	2.53E+01	6.00E+00					J	**3.10**	**0.37**		**129**			

G01070044-16A			TLF-0477					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.80E-01					U
Ra-226	8.60E-01	2.60E-01	9.60E-01	2.50E-01	**0.28**	**11.0**								
Np-237														
Pu-238														
Pu-239														
Th-228	6.30E-01	2.20E-01	6.30E-01	2.00E-01	**0.00**	**0.00**								
Th-230	6.20E-01	2.20E-01	6.30E-01	2.00E-01	**0.03**	**1.60**								
Th-232	5.60E-01	2.00E-01	6.40E-01	2.00E-01	**0.28**	**13.3**								
U-234	5.80E-01	2.20E-01	7.20E-01	2.40E-01	**0.43**	**21.5**								
U-235	9.00E-03	4.70E-02	6.60E-02	7.00E-02	**0.68**	**152**	U	1.20E-01	4.80E-01					U
U-238	6.30E-01	2.30E-01	3.90E-01	1.70E-01	**0.84**	**47.1**								
Total U Alpha	**1.22E+00**	**3.22E-01**	**1.18E+00**	**3.02E-01**										
Alpha Sum	**3.98E+00**	**1.80E+00**	**4.04E+00**	**5.23E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.30E-01	2.30E-01	3.90E-01	1.70E-01	**0.84**	**47.1**		5.00E-01	1.30E+00					UJ
Pa-234m (Assumed from U-238)	6.30E-01	2.30E-01	3.90E-01	1.70E-01	**0.84**	**47.1**		-3.00E+00	3.40E+01					UJ
Ac-227														
Ra-228	4.70E-01	4.30E-01												
Pa-231	1.00E-01	1.90E+00					U							
Beta Sum	**1.74E+00**	**5.85E-01**	**7.80E-01**	**2.40E-01**				**-2.02E+00**	**3.40E+01**					
Total Activity Sum	**5.72E+00**	**1.89E+00**	**4.82E+00**	**5.76E-01**				**1.96E+00**	**3.41E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.40E+00	4.20E+00	8.80E+00	4.50E+00	**0.23**	**17.3**		**0.75**	**(from gamma)**		**60.1**			
Gross Beta	1.27E+01	3.90E+00	1.25E+01	3.70E+00	**0.04**	**1.59**	J	**2.78**	**0.43**		**152**			
Total Activity	2.13E+01	5.60E+00	2.73E+01	6.20E+00	**0.72**	**24.7**	J	**2.64**	**0.56**		**115**			

Radiological Analytical Data Verification
Comments on Data for SDG G01080001

This sample delivery group (SDG) contained twenty (20) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting of all samples. All analyses requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0686	G01080001-01A
TLF-0687	G01080001-02A
TLF-0688	G01080001-03A
TLF-0689	G01080001-04A
TLF-0694	G01080001-05A
TLF-0695	G01080001-06A
TLF-0696	G01080001-07A
TLF-0697	G01080001-08A
TLF-0664	G01080001-09A
TLF-0665	G01080001-10A
TLF-0666	G01080001-11A
TLF-0673	G01080001-12A
TLF-0674	G01080001-13A
TLF-0675	G01080001-14A
TLF-0676	G01080001-15A
TLF-0680	G01080001-16A
TLF-0681	G01080001-17A
TLF-0682	G01080001-18A
TLF-0683	G01080001-19A
TLF-0684	G01080001-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

The first gamma spectrometry method blank results did not indicate contamination. However, in the second gamma spectrometry method blank, there was indication of contamination for ^{234}Th. Sample results less than 5 times the ^{234}Th method blank value should be qualified as estimated. All ^{234}Th sample results were greater than 5 times the method blank value; therefore, no qualification is required.

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated (J).). Based on assumed sample and rinsate sizes, all of the ^{228}Ra sample results are greater than 5 times the rinsate blank activity. **Therefore, it is recommended that the ^{234m}Pa results for samples TLF-0686, TLF-0674, TLF-0676, TLF-0683, and TLF-0684; and the ^{234}Th results for sample TLF-0676 and TLF-0683 should be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the laboratory control samples (LCS) were within acceptable limits.

Duplicate Analysis:

The DER (1.50) for ^{234}Th results was outside the acceptable limits for the gamma spectrometry analyses. The RPD (171%) was also outside acceptable limits. **Therefore, it is recommended that the ^{234}Th results for all samples should be qualified as estimated (J).**

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported. The laboratory was instructed to report any radioisotopes detected above the DL (1.65*TPU). Based on data review, ^{40}K was identified in all. The activity range for ^{40}K was approximately 5.99 " 1.60 pCi/g to 24.26 " 4.96 pCi/g, which is within normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0686, TLF-0694, and TLF-0664 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.21 " 0.13 pCi/g to 0.25 " 0.13 pCi/g. Since ^{40}K and ^{137}Cs are both beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{230}Th and ^{232}Th. All associated sample results less than 5 times the method blank values for ^{230}Th and ^{232}Th should be qualified as estimated (J). All ^{230}Th and ^{232}Th sample results were greater than 5 times the method blank values; therefore, no qualification of ^{230}Th and ^{232}Th data was necessary.

There were also indications of blank contamination for ^{234}U, ^{235}U, and ^{238}U. All associated sample results less than 5 times the method blank values for ^{234}U, ^{235}U, and ^{238}U should be qualified as estimated (J). **Therefore, it is recommended that the ^{234}U results for samples TLF-0664 and TLF-0680; the ^{235}U results for samples TLF-0694, TLF-0664, TLF-0673, TLF-0674, TLF-0675, TLF-0676, TLF-0682, TLF-0683, and TLF-0684; and the ^{238}U result for sample TLF-0680 be qualified as estimated (J).**

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the ^{234}U results were greater than 5 times the rinsate blank; therefore, no additional qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Duplicate Analysis:

The DER (1.37) for ^{234}U analyses was outside acceptable limits for the alpha spectrometry duplicate analyses. The RPD (177%) is also outside acceptable limits. **Therefore, it is recommended that the ^{235}U results for all samples be qualified as estimated (J).**

Sample-Specific Chemical Recovery:

The sample tracer recoveries were greater than 10.84% for all alpha spectrometry analyses except for U in samples TLF-0687, TLF-0697, and TLF-0680. The uranium recovery yields for samples TLF-0687, TLF-0697, and TLF-0680 were 8.83%, 5.73%, and 0.22%, respectively, and are outside acceptable limits. **Therefore, it is recommended that the $^{234/235/238}U$ results for samples TLF-0687, TLF-0697, and TLF-0680 be rejected (R).**

The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th alpha spectrometry analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the U alpha spectrometry analyses. Uncertainties exceeded acceptable limits and ranged from 25.2% to 224% for the U analyses in samples TLF-0687, TLF-0697, TLF0664, and TLF-0680. **Therefore, it is recommended that the $^{234/235/238}U$ results for samples TLF-0687, TLF-0697, TLF-0664, and TLF-0680 be rejected (R).**

Spectral Analysis:

Spectral interferences were also observed in the isotopic uranium analyses for samples TLF-0689, and TLF-0696. The ^{238}U peak tails into the ^{235}U peak region. The measured ^{235}U blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{235}U ranged from 0.72 " 0.18 to 2.24 " 0.44 pCi/g. It is estimated that the interference in sample TLF-0689 exceeds 60% of the activity in the ^{235}U peak region. **Therefore, it is recommended that the ^{235}U result for sample TLF-0696, be qualified as estimated (J). It is also recommended that the ^{235}U result for sample TLF-0689 be rejected (R).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

The rinsate blank indicated contamination for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the sample results were greater than 5 times the rinsate blank result; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DER for ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for ^{226}Ra analyses were within acceptable limits.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated in the gross alpha or gross beta method blanks.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The gross alpha and gross beta LCS values were within acceptable limits.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.

Matrix Spike Sample:

The MSS recoveries for gross alpha/beta matrix spike samples were within acceptable limits.

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because gross beta analyses were performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

5.0 TOTAL ACTIVITY:

Method Blank:

Blank contamination was indicated for total activity analysis. Samples with results less than 5 times the total activity method blank result should be qualified as estimated. All sample results were greater than 5 times the method blank result, except samples TLF-0675 and TLF-0676**. Therefore, it is recommended that the total activity results for samples TLF-0675 and TLF-0676 should be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was within acceptable limits.

Duplicate Analysis:

The DER for total activity duplicate analysis was within acceptable limits.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The results for all samples agree within the uncertainties.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0689. These differences indicate a disruption of equilibrium due to uranium processing. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0687 (1.83), TLF-0688 (1.91), TLF-0695 (1.63), TLF-0696 (1.98), TLF-0664 (2.53), TLF-0673 (1.68), TLF-0681 (1.52), TLF-0682 (1.39), and TLF-0683 (1.64) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (46.9%, 49.0%, 54.6%, 62.4%, 139%, 98.4%, 74.6%, 107%, and 98.4%) also exceed acceptable limits. The samples have gross alpha results greater than the sum of the alphas by factors ranging from 1.6 to 5.5. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future for the gross alpha results in samples TLF-0687, TLF-0688, TLF-0695, TLF-0696, TLF-0664, TLF-0673, TLF-0681, TLF-0682, and TLF-0683.**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0694 (2.23), TLF-0695 (1.36), TLF-0664 (2.57), TLF-0673 (3.73), TLF-0674 (1.89), TLF-0675 (3.15), TLF-676 (3.35), TLF-0680 (invalid, due to errors), TLF-0681 (2.50), TLF-0682, (2.98), TLF-0683 (3.64), and TLF-0684 (3.29) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (80.5%, 44.0%, 120%, 161%, 96.4%, 148%, 162%, 107%, 172%, 151%, and 158%) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 1.6 to 13.3. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. However, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for samples TLF-0694, TLF-0695, TLF-0664, TLF-0673, TLF-0674, TLF-0675, TLF-0676, TLF-0681, and TLF-0684. **It is recommended that the possible missing activity be investigated in the future and the gross beta results for samples TLF-0694, TLF-0695, TLF-0664, TLF-0673, TLF-0674, TLF-0675,**

TLF-0676, TLF-0680, TLF-0681, TLF-0682, TLF-0683, and TLF-0684 be qualified as estimated (J).

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity sums for ten of the twenty samples agree with the total activity results. The DERs for samples TLF-0686 (1.38), TLF-0687 (2.40), TLF-0688 (1.40), TLF-0694 (2.80), TLF-0695 (2.98), TLF-0696 (2.50), TLF-0664 (3.27), TLF-0665 (1.36), TLF-0673 (4.04), TLF-0674 (2.59), TLF-0675 (2.91), TLF-0676 (3.28), TLF-0681 (2.72), TLF-0682 (3.94), TLF-0683 (3.53), and TLF-0684 (3.38) were greater than 1.29 indicating that the total activity analyses were not in agreement with the total activity sums for those samples. The RPDs (50.3%, 74.0%, 67.6%, 55.8%, 113%, 137%, 93.0%, 112%, 132%, 86.3%, 150%, 122%, and 128%) for these samples also exceed acceptable limits. However, the RPD (33.3%, 25.6%, and 24.8%) for samples TLF-0686, TLF-0688, and TLF-0665 are within acceptable limits and therefore, no qualification is necessary. The other samples have a total activity result greater than the total activity sum by an approximate factor ranging from 1.7 to 6.9. This may be an indication of other activity in the sample that was not specifically analyzed for. However, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma analyses, the DERs would be within limits for samples TLF-0674, TLF-0675, TLF-0676, TLF-0681, TLF-0682, TLF-0683, and TLF-0684. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for samples, TLF-0687, TLF-0694, TLF-0695, TLF-0696, TLF-0664, and TLF-0673, TLF-0674, TLF-0683, and TLF-0684 be qualified as estimated (J).**

G01080001-01A			TLF-0686					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								0.00E+00	1.70E-01					U
Ra-226	1.42E+00	3.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.61E+00	4.10E-01												
Th-230	1.54E+00	3.90E-01												
Th-232	1.26E+00	3.40E-01												
U-234	5.64E+00	8.80E-01												
U-235	4.40E-01	1.20E-01					J	2.00E-02	4.50E-01					U
U-238	5.57E+00	8.60E-01												
Total U Alpha	**1.17E+01**	**1.24E+00**												
Alpha Sum	**1.75E+01**	**2.53E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.57E+00	8.60E-01						3.70E+00	1.30E+00					J
Pa-234m (Assumed from U-238)	5.57E+00	8.60E-01						-1.00E+00	1.50E+01					UJ
Ac-227														
Ra-228	7.50E-01	3.80E-01												
Pa-231	0.00E+00	2.30E+00					U							
Beta Sum	**1.19E+01**	**1.30E+00**						**3.45E+00**	**1.51E+01**					
Total Activity Sum	**2.94E+01**	**2.84E+00**						**2.09E+01**	**1.53E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.01E+01	7.40E+00						**0.34**	**(from gamma)**		**13.9**			
Gross Beta	1.67E+01	4.50E+00					J	**1.03**	**0.84**		**33.6**			
Total Activity	4.11E+01	8.00E+00						**1.38**	**1.17**		**33.3**			

G01080001-02A			TLF-0687					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.19E+00	6.20E-01					U
Ra-226	6.00E+00	1.20E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.24E+00	4.60E-01												
Th-230	1.17E+01	1.90E+00												
Th-232	1.89E+00	4.00E-01												
U-234	7.10E+01	2.10E+01					R							
U-235	5.20E+00	2.20E+00					R	7.20E+00	2.30E+00					
U-238	7.30E+01	2.20E+01					R							
Total U Alpha	**1.49E+02**	**3.05E+01**												
Alpha Sum	**1.71E+02**	**3.08E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.30E+01	2.20E+01						6.40E+01	1.40E+01					J
Pa-234m (Assumed from U-238)	7.30E+01	2.20E+01						8.60E+01	2.60E+01					
Ac-227														
Ra-228	2.13E+00	6.70E-01												
Pa-231	0.00E+00	4.20E+00					U							
Beta Sum	**1.48E+02**	**3.11E+01**						**1.52E+02**	**2.95E+01**					
Total Activity Sum	**3.19E+02**	**4.38E+01**						**3.23E+02**	**4.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.69E+02	4.60E+01						**1.77**	**(from gamma)**		**44.5**			
Gross Beta	1.78E+02	3.40E+01					J	**0.65**	**0.57**		**18.3**			
Total Activity	5.23E+02	7.50E+01					J	**2.35**	**2.32**		**48.4**			

G01080001-03A			TLF-0688					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.10E-01	3.50E-01					U
Ra-226	4.26E+00	8.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.59E+00	7.90E-01												
Th-230	3.53E+00	7.60E-01												
Th-232	3.07E+00	6.80E-01												
U-234	2.21E+01	3.40E+00												
U-235	1.77E+00	3.60E-01					J	2.20E+00	1.30E+00					
U-238	2.33E+01	3.50E+00												
Total U Alpha	**4.72E+01**	**4.89E+00**												
Alpha Sum	**6.13E+01**	**5.76E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.33E+01	3.50E+00						2.09E+01	5.50E+00					J
Pa-234m (Assumed from U-238)	2.33E+01	3.50E+00						2.80E+01	2.00E+01					
Ac-227														
Ra-228	3.48E+00	8.80E-01												
Pa-231	-4.00E-01	2.90E+00					U							
Beta Sum	**5.00E+01**	**5.04E+00**						**5.23E+01**	**2.08E+01**					
Total Activity Sum	**1.11E+02**	**7.65E+00**						**1.14E+02**	**2.15E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.01E+02	2.00E+01						**1.91**	**(from gamma)**		**49.0**			
Gross Beta	5.80E+01	1.30E+01					J	**0.57**	**0.23**		**14.8**			
Total Activity	1.44E+02	2.20E+01						**1.40**	**0.99**		**25.6**			

G01080001-04A			TLF-0689					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.20E-01	4.00E-01					U
Ra-226	4.42E+00	9.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.78E+00	7.60E-01												
Th-230	3.51E+00	7.20E-01												
Th-232	3.58E+00	7.20E-01												
U-234	2.72E+01	4.10E+00												
U-235	1.86E+00	3.80E-01					R	1.13E+00	8.00E-01					
U-238	2.88E+01	4.40E+00												
Total U Alpha	**5.79E+01**	**6.03E+00**												
Alpha Sum	**7.21E+01**	**6.75E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.88E+01	4.40E+00						2.26E+01	8.00E+00					J
Pa-234m (Assumed from U-238)	2.88E+01	4.40E+00						2.40E+01	1.70E+01					
Ac-227														
Ra-228	4.27E+00	9.70E-01												
Pa-231	-1.20E+00	2.90E+00					U							
Beta Sum	**6.17E+01**	**6.31E+00**						**5.07E+01**	**1.88E+01**					
Total Activity Sum	**1.34E+02**	**9.24E+00**						**1.23E+02**	**2.00E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.40E+01	1.90E+01						**1.09**	**(from gamma)**		**26.4**			
Gross Beta	5.70E+01	1.20E+01					J	**0.35**	**0.28**		**7.96**			
Total Activity	1.62E+02	2.40E+01						**1.10**	**1.26**		**19.1**			

G01080001-05A			TLF-0694					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								2.00E-02	1.90E-01					U
Ra-226	2.81E+00	5.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.41E+00	3.80E-01												
Th-230	1.44E+00	3.80E-01												
Th-232	8.20E-01	2.60E-01												
U-234	3.48E+00	5.60E-01												
U-235	2.88E-01	8.80E-02					J	-1.00E-01	5.80E+00					U
U-238	3.61E+00	5.80E-01												
Total U Alpha	**7.38E+00**	**8.11E-01**												
Alpha Sum	**1.34E+01**	**2.38E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.61E+00	5.80E-01						2.30E+00	1.10E+00					J
Pa-234m (Assumed from U-238)	3.61E+00	5.80E-01						2.00E+00	1.30E+01					U
Ac-227														
Ra-228	1.10E+00	4.70E-01												
Pa-231	-5.00E-01	2.30E+00					U							
Beta Sum	**8.26E+00**	**9.85E-01**						**5.34E+00**	**1.31E+01**					
Total Activity Sum	**2.17E+01**	**2.57E+00**						**1.87E+01**	**1.33E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.79E+01	6.30E+00						**0.67**	**(from gamma)**		**28.7**			
Gross Beta	1.94E+01	4.90E+00					J	**2.23**	**1.01**		**80.5**			
Total Activity	4.71E+01	8.70E+00					J	**2.80**	**1.79**		**74.0**			

G01080001-06A			TLF-0695					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	3.20E-01					U
Ra-226	3.73E+00	7.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.34E+00	7.00E-01												
Th-230	3.38E+00	7.00E-01												
Th-232	3.24E+00	6.80E-01												
U-234	5.56E+00	8.40E-01												
U-235	3.71E-01	9.80E-02					J	3.90E-01	8.00E-01					U
U-238	5.51E+00	8.40E-01												
Total U Alpha	**1.14E+01**	**1.19E+00**												
Alpha Sum	**2.51E+01**	**3.50E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.51E+00	8.40E-01						4.40E+00	1.90E+00					J
Pa-234m (Assumed from U-238)	5.51E+00	8.40E-01						2.00E+00	1.50E+01					U
Ac-227														
Ra-228	3.43E+00	8.10E-01												
Pa-231	0.00E+00	3.30E+00					U							
Beta Sum	**1.45E+01**	**1.49E+00**						**9.83E+00**	**1.51E+01**					
Total Activity Sum	**3.96E+01**	**3.81E+00**						**3.50E+01**	**1.55E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.40E+01	1.10E+01						**1.63**	**(from gamma)**		**54.6**			
Gross Beta	2.26E+01	5.80E+00					J	**1.36**	**0.79**		**44.0**			
Total Activity	8.00E+01	1.30E+01					J	**2.98**	**2.22**		**67.6**			

G01080001-07A			TLF-0696					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	2.80E-01					U
Ra-226	3.68E+00	7.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.85E+00	4.00E-01												
Th-230	2.28E+00	4.70E-01												
Th-232	1.88E+00	4.00E-01												
U-234	8.20E+00	1.30E+00												
U-235	7.00E-01	1.70E-01					J	7.10E-01	6.50E-01					
U-238	8.10E+00	1.30E+00												
Total U Alpha	**1.70E+01**	**1.85E+00**												
Alpha Sum	**2.53E+01**	**3.59E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.10E+00	1.30E+00						9.00E+00	2.30E+00					J
Pa-234m (Assumed from U-238)	8.10E+00	1.30E+00						6.00E+00	1.50E+01					U
Ac-227														
Ra-228	3.00E+00	7.80E-01												
Pa-231	-1.50E+00	3.20E+00					U							
Beta Sum	**1.90E+01**	**2.03E+00**						**1.78E+01**	**1.52E+01**					
Total Activity Sum	**4.44E+01**	**4.12E+00**						**4.32E+01**	**1.56E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+01	1.10E+01						**1.96**	**(from gamma)**		**61.8**			
Gross Beta	2.67E+01	6.50E+00					J	**1.13**	**0.54**		**33.6**			
Total Activity	7.80E+01	1.30E+01					J	**2.47**	**1.71**		**55.0**			

G01080001-08A			TLF-0697					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.60E-01	3.20E-01					U
Ra-226	3.64E+00	7.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.40E+00	4.90E-01												
Th-230	5.15E+00	9.10E-01												
Th-232	2.14E+00	4.40E-01												
U-234	2.16E+01	9.10E+00					R							
U-235	3.00E+00	2.00E+00					R	1.01E+00	7.00E-01					
U-238	2.17E+01	9.10E+00					R							
Total U Alpha	**4.63E+01**	**1.30E+01**												
Alpha Sum	**5.84E+01**	**1.34E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.17E+01	9.10E+00						1.30E+01	4.50E+00					J
Pa-234m (Assumed from U-238)	2.17E+01	9.10E+00						1.40E+01	1.30E+01					
Ac-227														
Ra-228	2.00E+00	5.70E-01												
Pa-231	-1.40E+00	3.10E+00					U							
Beta Sum	**4.52E+01**	**1.29E+01**						**2.88E+01**	**1.38E+01**					
Total Activity Sum	**1.04E+02**	**1.86E+01**						**8.72E+01**	**1.92E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+01	1.30E+01						**0.23**	**(from gamma)**		**7.78**			
Gross Beta	3.98E+01	8.10E+00					J	**0.36**	**0.69**		**12.8**			
Total Activity	1.06E+02	1.70E+01						**0.10**	**0.73**		**2.29**			

G01080001-09A			TLF-0664					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.50E-01					U
Ra-226	1.20E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.10E-01												
Th-230	7.40E-01	2.10E-01												
Th-232	6.10E-01	1.80E-01												
U-234	1.00E-01	4.30E-01					R							
U-235	0.00E+00	3.20E-01					R	1.00E-01	4.10E-01					U
U-238	1.48E+00	9.30E-01					R							
Total U Alpha	**1.58E+00**	**1.07E+00**												
Alpha Sum	**4.88E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.48E+00	9.30E-01						1.60E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	1.48E+00	9.30E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.90E-01	4.90E-01												
Pa-231	0.00E+00	1.60E+00					U							
Beta Sum	**3.75E+00**	**1.42E+00**						**3.39E+00**	**1.11E+01**					
Total Activity Sum	**8.63E+00**	**2.33E+00**						**8.27E+00**	**1.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.69E+01	8.50E+00						**2.53**	**(from gamma)**		**139**			
Gross Beta	1.49E+01	4.10E+00					J	**2.57**	**0.97**		**120**			
Total Activity	3.09E+01	6.40E+00					J	**3.27**	**1.75**		**113**			

G01080001-10A			TLF-0665					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.60E-01	4.20E-01					U
Ra-226	3.56E+00	7.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.02E+00	6.60E-01												
Th-230	3.65E+00	7.50E-01												
Th-232	2.36E+00	5.30E-01												
U-234	2.26E+01	3.70E+00												
U-235	1.56E+00	3.80E-01					J	1.30E+00	8.30E-01					
U-238	2.30E+01	3.80E+00												
Total U Alpha	**4.72E+01**	**5.32E+00**												
Alpha Sum	**5.89E+01**	**6.28E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.30E+01	3.80E+00						1.90E+01	5.20E+00					J
Pa-234m (Assumed from U-238)	2.30E+01	3.80E+00						1.50E+01	1.60E+01					
Ac-227														
Ra-228	3.63E+00	9.90E-01												
Pa-231	-1.00E+00	3.40E+00					U							
Beta Sum	**4.95E+01**	**5.48E+00**						**3.75E+01**	**1.69E+01**					
Total Activity Sum	**1.08E+02**	**8.34E+00**						**9.64E+01**	**1.80E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.30E+01	1.60E+01						**0.82**	**(from gamma)**		**21.5**			
Gross Beta	4.58E+01	9.40E+00					J	**0.34**	**0.43**		**7.79**			
Total Activity	1.39E+02	2.10E+01						**1.36**	**1.54**		**24.8**			

G01080001-11A			TLF-0666					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.00E-02	2.40E-01					U
Ra-226	1.89E+00	4.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.33E+00	3.20E-01												
Th-230	5.13E+00	9.20E-01												
Th-232	1.30E+00	3.10E-01												
U-234	1.40E+01	2.40E+00												
U-235	1.07E+00	3.00E-01					J	5.10E-01	5.20E-01					
U-238	1.45E+01	2.50E+00												
Total U Alpha	**2.96E+01**	**3.48E+00**												
Alpha Sum	**3.99E+01**	**4.07E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.45E+01	2.50E+00						1.18E+01	2.90E+00					J
Pa-234m (Assumed from U-238)	1.45E+01	2.50E+00						1.20E+01	1.50E+01					U
Ac-227														
Ra-228	1.19E+00	4.10E-01												
Pa-231	7.00E-01	2.00E+00					U							
Beta Sum	**3.03E+01**	**3.57E+00**						**2.51E+01**	**1.53E+01**					
Total Activity Sum	**7.01E+01**	**5.41E+00**						**6.49E+01**	**1.58E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.70E+01	1.20E+01						**0.56**	**(from gamma)**		**16.5**			
Gross Beta	2.69E+01	6.60E+00					J	**0.45**	**0.11**		**11.8**			
Total Activity	8.40E+01	1.40E+01						**0.92**	**0.90**		**18.0**			

G01080001-12A			TLF-0673					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	2.10E-01					U
Ra-226	6.40E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	2.20E-01												
Th-230	7.40E-01	2.20E-01												
Th-232	8.60E-01	2.40E-01												
U-234	9.00E-01	2.90E-01												
U-235	1.60E-01	1.10E-01					J	1.40E-01	4.60E-01					U
U-238	8.50E-01	2.80E-01												
Total U Alpha	**1.91E+00**	**4.18E-01**												
Alpha Sum	**5.14E+00**	**1.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.50E-01	2.80E-01						2.00E-01	1.50E+00					UJ
Pa-234m (Assumed from U-238)	8.50E-01	2.80E-01						2.00E+00	1.40E+01					U
Ac-227														
Ra-228	4.10E-01	3.60E-01												
Pa-231	3.00E-01	2.10E+00					U							
Beta Sum	**2.15E+00**	**5.92E-01**						**2.65E+00**	**1.41E+01**					
Total Activity Sum	**7.29E+00**	**2.07E+00**						**7.79E+00**	**1.42E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.51E+01	5.60E+00						**1.68**	**(from gamma)**		**98.4**			
Gross Beta	1.98E+01	4.70E+00					J	**3.73**	**1.16**		**161**			
Total Activity	3.87E+01	7.50E+00					J	**4.04**	**1.92**		**137**			

G01080001-13A			TLF-0674					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	2.00E-01					U
Ra-226	9.60E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.60E-01												
Th-230	1.05E+00	2.90E-01												
Th-232	6.60E-01	2.10E-01												
U-234	1.31E+00	3.80E-01												
U-235	1.80E-01	1.20E-01					J	1.80E-01	4.50E-01					U
U-238	1.75E+00	4.60E-01												
Total U Alpha	**3.24E+00**	**6.09E-01**												
Alpha Sum	**6.47E+00**	**2.05E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.75E+00	4.60E-01						2.70E+00	1.30E+00					J
Pa-234m (Assumed from U-238)	1.75E+00	4.60E-01						0.00E+00	1.50E+01					UJ
Ac-227														
Ra-228	5.90E-01	4.40E-01												
Pa-231	-3.00E-01	2.10E+00					U							
Beta Sum	**4.05E+00**	**8.25E-01**						**3.25E+00**	**1.51E+01**					
Total Activity Sum	**1.05E+01**	**2.21E+00**						**9.72E+00**	**1.52E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.10E+00	5.00E+00						**0.49**	**(from gamma)**		**33.8**			
Gross Beta	1.16E+01	3.90E+00					J	**1.89**	**0.54**		**96.4**			
Total Activity	2.88E+01	6.70E+00					J	**2.59**	**1.15**		**93.0**			

G01080001-14A			TLF-0675					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.60E-01					U
Ra-226	9.90E-01	2.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.20E-01	2.90E-01												
Th-230	9.30E-01	3.00E-01												
Th-232	7.80E-01	2.60E-01												
U-234	7.60E-01	2.70E-01												
U-235	6.70E-02	7.60E-02					J	-9.00E-02	4.70E-01					U
U-238	8.00E-01	2.70E-01												
Total U Alpha	**1.63E+00**	**3.89E-01**												
Alpha Sum	**4.79E+00**	**2.10E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.70E-01						8.00E-01	1.30E+00					UJ
Pa-234m (Assumed from U-238)	8.00E-01	2.70E-01						7.00E+00	1.00E+01					U
Ac-227														
Ra-228	7.00E-01	3.50E-01												
Pa-231	-4.00E-01	2.20E+00					U							
Beta Sum	**2.25E+00**	**5.81E-01**						**8.45E+00**	**1.01E+01**					
Total Activity Sum	**7.04E+00**	**2.17E+00**						**1.32E+01**	**1.03E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.09E+01	4.90E+00						**1.15**	**(from gamma)**		**77.9**			
Gross Beta	1.50E+01	4.00E+00					J	**3.15**	**0.60**		**148**			
Total Activity	2.48E+01	5.70E+00						**2.91**	**0.98**		**112**			

G01080001-15A			TLF-0676					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	1.90E-01					U
Ra-226	6.20E-01	2.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.70E-01	2.80E-01												
Th-230	8.80E-01	2.90E-01												
Th-232	6.00E-01	2.20E-01												
U-234	7.30E-01	2.60E-01												
U-235	1.13E-01	9.20E-02					J	1.00E-02	4.10E-01					U
U-238	5.30E-01	2.10E-01												
Total U Alpha	**1.37E+00**	**3.47E-01**												
Alpha Sum	**4.07E+00**	**2.07E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.30E-01	2.10E-01						1.00E-01	1.40E+00					UJ
Pa-234m (Assumed from U-238)	5.30E-01	2.10E-01						-4.00E+00	6.20E+01					UJ
Ac-227														
Ra-228	7.00E-01	5.80E-01												
Pa-231	-3.00E-01	2.20E+00					U							
Beta Sum	**1.72E+00**	**7.03E-01**						**-3.24E+00**	**6.20E+01**					
Total Activity Sum	**5.80E+00**	**2.19E+00**						**8.37E-01**	**6.21E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.20E+00	4.20E+00						**0.67**	**(from gamma)**		**55.5**			
Gross Beta	1.63E+01	4.30E+00					J	**3.35**	**0.31**		**162**			
Total Activity	2.83E+01	6.50E+00						**3.28**	**0.44**		**132**			

G01080001-16A			TLF-0680					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.10E-02	3.60E-02					U
Ra-226	8.70E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	2.70E-01												
Th-230	1.07E+00	2.90E-01												
Th-232	9.50E-01	2.70E-01												
U-234	-6.00E+00	2.30E+01					R							
U-235	3.00E+00	1.90E+01					R	5.00E-02	9.60E-02					U
U-238	-2.00E+00	1.80E+01					R							
Total U Alpha	**-5.00E+00**	**3.48E+01**												
Alpha Sum	**-6.94E-01**	**3.48E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	-2.00E+00	1.80E+01					U	7.90E-01	7.30E-01					J
Pa-234m (Assumed from U-238)	-2.00E+00	1.80E+01					U	1.80E+00	2.40E+00					U
Ac-227														
Ra-228	1.10E+00	2.20E-01												
Pa-231	5.40E-01	3.10E-01												
Beta Sum	**-2.84E+00**	**2.55E+01**						**3.75E+00**	**2.52E+00**					
Total Activity Sum	**-3.53E+00**	**4.32E+01**						**3.06E+00**	**3.49E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.21E+01	5.10E+00						**0.36**	**(from gamma)**		**224**			
Gross Beta	2.12E+01	4.90E+00					J	**0.93**	**3.17**		**262**			
Total Activity	3.47E+01	7.20E+00						**0.87**	**0.89**		**245**			

G01080001-17A			TLF-0681					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.90E-01					U
Ra-226	1.49E+00	3.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.12E+00	2.70E-01												
Th-230	1.16E+00	2.70E-01												
Th-232	1.29E+00	2.90E-01												
U-234	1.76E+00	3.90E-01												
U-235	2.70E-01	1.20E-01					J	2.90E-01	4.60E-01					U
U-238	1.69E+00	3.80E-01												
Total U Alpha	**3.72E+00**	**5.58E-01**												
Alpha Sum	**8.78E+00**	**2.14E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.69E+00	3.80E-01						2.00E-01	1.50E+00					UJ
Pa-234m (Assumed from U-238)	1.69E+00	3.80E-01						2.00E+00	1.20E+01					U
Ac-227														
Ra-228	1.82E+00	5.90E-01												
Pa-231	0.00E+00	2.20E+00					U							
Beta Sum	**5.20E+00**	**8.41E-01**						**4.02E+00**	**1.21E+01**					
Total Activity Sum	**1.40E+01**	**2.30E+00**						**1.28E+01**	**1.23E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.91E+01	6.50E+00						**1.51**	**(from gamma)**		**74.0**			
Gross Beta	1.64E+01	4.50E+00					J	**2.45**	**0.96**		**104**			
Total Activity	3.45E+01	7.30E+00						**2.68**	**1.52**		**84.7**			

G01080001-18A			TLF-0682					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.60E-01					U
Ra-226	6.60E-01	2.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.30E-01	2.40E-01												
Th-230	7.90E-01	2.50E-01												
Th-232	6.60E-01	2.20E-01												
U-234	8.60E-01	2.90E-01												
U-235	1.50E-01	1.10E-01					J	3.00E-02	3.80E-01					U
U-238	3.50E-01	1.80E-01												
Total U Alpha	**1.36E+00**	**3.59E-01**												
Alpha Sum	**3.84E+00**	**1.90E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.50E-01	1.80E-01						9.00E-01	1.10E+00					UJ
Pa-234m (Assumed from U-238)	3.50E-01	1.80E-01						2.00E+00	1.10E+01					U
Ac-227														
Ra-228	2.50E-01	2.40E-01												
Pa-231	-4.00E-01	2.00E+00					U							
Beta Sum	**9.02E-01**	**4.24E-01**						**3.10E+00**	**1.11E+01**					
Total Activity Sum	**4.74E+00**	**1.94E+00**						**6.94E+00**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.26E+01	6.00E+00						**1.39**	**(from gamma)**		**107**			
Gross Beta	1.20E+01	3.70E+00					J	**2.98**	**0.76**		**172**			
Total Activity	3.30E+01	6.90E+00						**3.94**	**1.98**		**150**			

G01080001-19A			TLF-0683					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	1.50E-01					U
Ra-226	8.30E-01	2.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	2.40E-01												
Th-230	9.20E-01	2.60E-01												
Th-232	7.20E-01	2.20E-01												
U-234	8.30E-01	2.80E-01												
U-235	7.00E-02	7.80E-02					J	-2.00E-02	7.40E-01					U
U-238	9.00E-01	2.90E-01												
Total U Alpha	**1.80E+00**	**4.11E-01**												
Alpha Sum	**4.97E+00**	**1.82E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.90E-01						1.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	9.00E-01	2.90E-01						0.00E+00	1.40E+01					UJ
Ac-227														
Ra-228	8.10E-01	4.50E-01												
Pa-231	-1.00E-01	1.90E+00					U							
Beta Sum	**2.60E+00**	**6.50E-01**						**8.98E-01**	**1.41E+01**					
Total Activity Sum	**7.57E+00**	**1.94E+00**						**5.87E+00**	**1.42E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.46E+01	5.60E+00						**1.64**	**(from gamma)**		**98.4**			
Gross Beta	1.88E+01	4.40E+00					J	**3.64**	**1.22**		**151**			
Total Activity	3.12E+01	6.40E+00					J	**3.53**	**1.63**		**122**			

G01080001-20A			TLF-0684					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-4.00E-02	2.00E-01	-1.00E-02	1.70E-01	**0.11**	**120**	U
Ra-226	8.40E-01	2.60E-01	1.03E+00	3.10E-01	**0.47**	**20.3**								
Np-237														
Pu-238														
Pu-239														
Th-228	8.30E-01	2.70E-01	8.10E-01	2.80E-01	**0.05**	**2.44**								
Th-230	7.70E-01	2.70E-01	9.10E-01	2.90E-01	**0.35**	**16.7**								
Th-232	7.20E-01	2.40E-01	6.90E-01	2.50E-01	**0.09**	**4.26**								
U-234	8.90E-01	3.10E-01	8.20E-01	2.80E-01	**0.17**	**8.19**								
U-235	2.30E-01	1.50E-01	1.40E-02	5.00E-02	**1.37**	**177**	J	3.50E-01	4.80E-01	5.00E-02	4.00E-01	**0.48**	**150**	U
U-238	6.60E-01	2.60E-01	9.00E-01	2.90E-01	**0.62**	**30.8**								
Total U Alpha	**1.78E+00**	**4.32E-01**	**1.73E+00**	**4.06E-01**										
Alpha Sum	**5.12E+00**	**2.01E+00**	**5.44E+00**	**1.93E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.60E-01	2.60E-01	9.00E-01	2.90E-01	**0.62**	**30.8**		2.00E-01	1.40E+00	2.59E+00	7.70E-01	**1.50**	**171**	UJ
Pa-234m (Assumed from U-238)	6.60E-01	2.60E-01	9.00E-01	2.90E-01	**0.62**	**30.8**		-2.00E+00	1.50E+01	-5.00E+00	4.40E+01	**0.06**	**85.7**	UJ
Ac-227														
Ra-228	7.50E-01	4.40E-01	4.20E-01	3.50E-01	**0.59**	**56.4**								
Pa-231	2.00E-01	2.10E+00	3.00E-01	2.00E+00	**0.03**	**40.0**	U							
Beta Sum	**2.09E+00**	**6.26E-01**	**2.26E+00**	**5.90E-01**				**-1.03E+00**	**1.51E+01**	**-1.95E+00**	**4.40E+01**			
Total Activity Sum	**7.21E+00**	**2.10E+00**	**7.70E+00**	**2.02E+00**				**4.09E+00**	**1.52E+01**	**3.49E+00**	**4.41E+01**			
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.22E+01	5.30E+00	9.50E+00	4.80E+00	**0.38**	**24.9**		**1.25**	**(from gamma)**		**81.8**			
Gross Beta	1.80E+01	4.80E+00	1.47E+01	4.30E+00	**0.51**	**20.2**	J	**3.29**	**1.20**		**158**			
Total Activity	3.29E+01	7.30E+00	3.20E+01	7.10E+00	**0.09**	**2.77**	J	**3.38**	**1.71**		**128**			

Radiological Analytical Data Verification
Comments on Data for SDG G01080001 – Addendum

This addendum to the original report for this sample delivery group (SDG) includes three (3) individual soil samples for reanalysis from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. Sample reanalysis was necessary due to rejected results. The requested re-analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ by alpha spectrometry. All analyses were originally requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

This report addendum contains only information that changed from the original report.

Client Identification	Laboratory Identification
TLF-0687	G01080001-02A
TLF-0664	G01080001-09A
TLF-0680	G01080001-16A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for ^{238}U. All associated sample results less than 5 times the method blank values for ^{238}U should be qualified as estimated (J). **Therefore, it is recommended that the ^{238}U results for samples TLF-0664 and TLF-0680 be qualified as estimated (J).**

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the ^{234}U results were greater than 5 times the rinsate blank; therefore, no additional qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Sample-Specific Chemical Recovery:

The sample tracer recoveries were greater than 29.60% for the uranium alpha spectrometry analyses.

There is greater than 10% uncertainty in the sample-specific percent recovery results for the U alpha spectrometry analyses. Uncertainties exceeded acceptable limits and ranged from 11.5% to 21.4% for the U analyses in samples TLF-0687, TLF0664, and TLF-0680. **Therefore, it is recommended that the $^{234/235/238}U$ results for samples TLF-0687, TLF-0664, and TLF-0680 be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the isotopic uranium analyses for any of the samples.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for sample TLF-0680. These differences indicate a disruption of equilibrium due to uranium processing. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0687 (1.83) and TLF-0664 (2.51) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (44.2% and 135%) also exceed acceptable limits. The samples have gross alpha results greater than the sum of the alphas by factors ranging from 1.6 to 5.2. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-0687 and TLF-0664 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DER for samples TLF-0664 (2.97) and TLF-0680 (3.82) were greater than 1.29 indicating that the gross beta analysis was not in agreement with the sum of the beta emitters within a 99% confidence level. The RPDs (141% and 159%) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by a factor of 5.6 to 8.7. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. However, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0 of the original report, had been reported from the gamma, the DERs would be within limits for samples TLF-0664 and TLF-0680. **It is recommended that the possible missing activity be investigated in the future and the gross beta results for samples TLF-0664 and TLF-0680 be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity sums for ten of the twenty samples agree with the total activity results. The DERs for samples TLF-0687 (2.37), TLF-0664 (3.49), and TLF-0680 (3.68) were greater than

1.29 indicating that the total activity analyses were not in agreement with the total activity sums for those samples. The RPDs (47.1%, 119%, and 124%) for these samples also exceed acceptable limits. The samples have a total activity result greater than the total activity sum by an approximate factor ranging from 1.6 to 4.2. This may be an indication of other activity in the sample that was not specifically analyzed for. If the ^{40}K and ^{137}Cs results as discussed in Section 1.0 of the original report, had been reported from the gamma analyses, the DERs would not have been within limits for these samples. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for samples, TLF-0687, TLF-0664, and TLF-0680 be qualified as estimated (J).**

G01080001-02A — **TLF-0687 Reanalysis**

Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	FROM GAMMA Result (pCi/g)	FROM GAMMA Uncertainty (pCi/g)	FROM GAMMA Duplicate Result (pCi/g)	FROM GAMMA Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.19E+00	6.20E-01					U
Ra-226	6.00E+00	1.20E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.24E+00	4.60E-01												
Th-230	1.17E+01	1.90E+00												
Th-232	1.89E+00	4.00E-01												
U-234	7.20E+01	1.80E+01					J							
U-235	2.71E+00	8.20E-01					J	7.20E+00	2.30E+00					
U-238	7.50E+01	1.90E+01					J							
Total U Alpha	**1.50E+02**	**2.62E+01**												
Alpha Sum	**1.72E+02**	**2.66E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.50E+01	1.90E+01						6.40E+01	1.40E+01					J
Pa-234m (Assumed from U-238)	7.50E+01	1.90E+01						8.60E+01	2.60E+01					
Ac-227														
Ra-228	2.13E+00	6.70E-01												
Pa-231	0.00E+00	4.20E+00					U							
Beta Sum	**1.52E+02**	**2.69E+01**						**1.52E+02**	**2.95E+01**					
Total Activity Sum	**3.24E+02**	**3.78E+01**						**3.24E+02**	**3.97E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.69E+02	4.60E+01					J	**1.83**	**(from gamma)**		**44.2**			
Gross Beta	1.78E+02	3.40E+01					J	**0.60**	**0.57**		**15.7**			
Total Activity	5.23E+02	7.50E+01					J	**2.37**	**2.35**		**47.1**			

G01080001-09A			TLF-0664 Reanalysis					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	1.50E-01					U
Ra-226	1.20E+00	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.50E-01	2.10E-01												
Th-230	7.40E-01	2.10E-01												
Th-232	6.10E-01	1.80E-01												
U-234	9.70E-01	2.40E-01					J							
U-235	4.60E-02	3.90E-02					J	1.00E-01	4.10E-01					U
U-238	9.00E-01	2.30E-01					J							
Total U Alpha	**1.92E+00**	**3.35E-01**												
Alpha Sum	**5.22E+00**	**1.55E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.00E-01	2.30E-01						1.60E+00	1.40E+00					J
Pa-234m (Assumed from U-238)	9.00E-01	2.30E-01						1.00E+00	1.10E+01					U
Ac-227														
Ra-228	7.90E-01	4.90E-01												
Pa-231	0.00E+00	1.60E+00					U							
Beta Sum	**2.59E+00**	**6.19E-01**						**3.39E+00**	**1.11E+01**					
Total Activity Sum	**7.81E+00**	**1.67E+00**						**8.61E+00**	**1.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.69E+01	8.50E+00					J	**2.51**	**(from gamma)**		**135**			
Gross Beta	1.49E+01	4.10E+00					J	**2.97**	**0.97**		**141**			
Total Activity	3.09E+01	6.40E+00					J	**3.49**	**1.73**		**119**			

G01080001-16A			TLF-0680 Reanalysis					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.10E-02	3.60E-02					U
Ra-226	8.70E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	2.70E-01												
Th-230	1.07E+00	2.90E-01												
Th-232	9.50E-01	2.70E-01												
U-234	6.70E-01	1.80E-01					J							
U-235	3.00E-02	3.10E-02					J	5.00E-02	9.60E-02					U
U-238	6.40E-01	1.70E-01					J							
Total U Alpha	**1.34E+00**	**2.50E-01**												
Alpha Sum	**5.65E+00**	**6.66E-01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.40E-01	1.70E-01						7.90E-01	7.30E-01					J
Pa-234m (Assumed from U-238)	6.40E-01	1.70E-01						1.80E+00	2.40E+00					U
Ac-227														
Ra-228	1.10E+00	2.20E-01												
Pa-231	5.40E-01	3.10E-01												
Beta Sum	**2.44E+00**	**3.28E-01**						**3.75E+00**	**2.52E+00**					
Total Activity Sum	**8.09E+00**	**7.42E-01**						**9.40E+00**	**2.60E+00**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.21E+01	5.10E+00						**1.25**	**(from gamma)**		**72.7**			
Gross Beta	2.12E+01	4.90E+00					J	**3.82**	**3.17**		**159**			
Total Activity	3.47E+01	7.20E+00					J	**3.68**	**3.30**		**124**			

Radiological Analytical Data Verification
Comments on Data for SDG G01080002

This sample delivery group (SDG) contained twenty (20) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses [from the Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All analyses requested in the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0678	G01080002-01A
TLF-0679	G01080002-02A
TLF-0670	G01080002-03A
TLF-0671	G01080002-04A
TLF-0667	G01080002-05A
TLF-0669	G01080002-06A
TLF-0662	G01080002-07A
TLF-0663	G01080002-08A
TLF-0658	G01080002-09A
TLF-0659	G01080002-10A
TLF-0660	G01080002-11A
TLF-0693	G01080002-12A
TLF-0690	G01080002-13A
TLF-0691	G01080002-14A
TLF-9717	G01080002-15A
TLF-0692	G01080002-16A
TLF-0698	G01080002-17A
TLF-0699	G01080002-18A
TLF-0700	G01080002-19A
TLF-0701	G01080002-20A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of contamination for the gamma spectrometry method blank.

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{228}Ra results greater than 5 times the rinsate blank**. However, sample TLF-0679 for ^{234}Th and samples TLF-0679 and TLF-0698 for ^{234m}Pa should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control samples (LCS) were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for gamma spectrometry duplicate analyses.

Data entries of 0.00 " 0.00 pCi/g for gamma spectrometry radionuclides into Form 4 by the laboratory for sample TLF-0701 implies that there were duplicate analyses performed. These entries are erroneous. Duplicate analyses for gamma spectrometry results were performed for sample TLF-0699.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am) were reported for all samples. Since ^{228}Ra decay emits no discernible gamma photons, this activity is calculated from the gamma energies of its immediate daughter ^{228}Ac, assuming secular equilibrium.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

The laboratory was instructed to report any radioisotopes detected above the decision level. Based on the gamma summary of nuclides report, ^{40}K was identified in all samples and was above the required DL (1.65*TPU). The activity range for ^{40}K was approximately 3.5 " 1.79 to 21.5 " 2.81 pCi/g, which is within normal levels for ^{40}K naturally found in soil. The laboratory also indicated that ^{137}Cs peaks were identified in gamma spectrometry report for TLF-0670, TLF-0667, TLF-0658, TLF-0690, and TLF-0691 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). The activity range for ^{137}Cs was 0.24 " 0.13 pCi/g to 0.82 " 0.15 pCi/g. Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U. All associated sample results less than 5 times the method blank values for ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U should be qualified as estimated (J). All samples had ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U results greater than 5 times the rinsate blank. Therefore, no qualification of the ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U results is necessary.

Equipment Rinsate Blanks:

There was an indication of rinsate blank contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{234}U results greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were within acceptable limits.

Duplicate Analysis:

The DERs were within acceptable limits for the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The sample tracer recoveries were greater than 11.42% for all alpha spectrometry analyses except for sample TLF-0692. The uranium recovery yield for sample TLF-0692 was 9.61%, which is outside acceptable limits. **Therefore, it is recommended that the $^{234/235/238}$U results for sample TLF-0692 be qualified as estimated (J).**

The sample-specific percent recovery results for all samples have less than 10% uncertainty for the Th alpha spectrometry analyses. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the U alpha spectrometry analyses. There is 12.6% uncertainty for the U analyses for sample TLF-9717 and 13.7% uncertainty for the U analyses for sample TLF-0692. **Therefore, it is recommended that the $^{234/235/238}$U results for samples TLF-9717 and TLF-0692 be qualified as estimated (J).**

Spectral Analysis:

Spectral interferences were observed in the alpha spectra for samples TLF-0679, TLF-0671, TLF-0669, TLF-0662, TLF-0698, and TLF-0701 (laboratory duplicate) for the isotopic thorium analyses. The spectral interference observed is from the tailing of a higher energy peak into a lower energy peak. In each case and in the matrix blank sample, the isotopic thorium analyses, the tracer peaks for ^{229}Th tails into the ^{230}Th peak region. The measured ^{230}Th blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{230}Th ranged from 0.70 " 0.17 to 13.8 " 2.2 pCi/g. **Therefore, it is recommended that the ^{230}Th results for samples TLF-0679, TLF-0671, TLF-0669, TLF-0662, TLF-0698, and TLF-0701 (laboratory duplicate) be qualified as estimated (J).**

Spectral interferences were also observed in the isotopic uranium analyses for samples TLF-0671, TLF-0693, TLF-0691, TLF-9717, and TLF-0692. The ^{238}U peak tails into the ^{235}U peak region. The measured ^{235}U blank activity is below the MDC (1.0 pCi/g). Sample activities for ^{235}U ranged from 1.64 " 0.36 to 10.4 " 2.3 pCi/g. It is estimated that the interference in sample TLF-9717 exceeds 60% of the activity in the ^{235}U peak region. **Therefore, it is recommended that the ^{235}U results for samples TLF-0671, TLF-0693, TLF-0691, and TLF-0692 be qualified as estimated (J). It is also recommended that the ^{235}U result for sample TLF-9717 be rejected (R).**

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There is an indication of rinsate blank contamination for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the sample results were greater than 5 times the rinsate blank result; therefore, no qualification was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DER for the ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{226}Ra analyses were all above 16.72%.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated in the gross alpha method blank. However, contamination was indicated for the gross beta method blank. Samples with results less than 5 times the gross beta method blank should be qualified as estimated. **Therefore, it is recommended that the gross beta results for samples TLF-0679, TLF-0663, and TLF-0658 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The gross alpha and gross beta LCS values were within acceptable limits.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.
Matrix Spike Sample:

The MSS (66%) recovery for gross alpha matrix spike samples was outside acceptable limits. **Therefore, it is recommended that the gross alpha analyses for all samples be qualified as estimated (J).**

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because gross beta analyses were performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL) for the gross alpha/beta analyses is 1.0 pCi/g. All of the samples' results exceeded the required MDL. The gross alpha and gross beta results for these samples may not have met the project data quality objectives (DQOs). Since gross alpha/beta analyses are just estimates, no additional qualification is necessary.

5.0 TOTAL ACTIVITY:

Method Blank:

No contamination was indicated for the total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was within acceptable limits.

Duplicate Analysis:

The DER for the total activity duplicate analysis was within acceptable limits.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The U alpha data and U gamma data were in agreement within the uncertainties. No further qualification of the results is necessary.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The results for all samples agree within the uncertainties. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another except for samples TLF-9717 and TLF-0692. These differences are most likely due to the uranium concentration process. Since the ^{231}Pa gamma results are for comparison purposes, no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DERs for samples TLF-0678 (1.87), TLF-0670 (1.32), TLF-0671 (1.31), TLF-0663 (1.31), TLF-0658 (2.40), TLF-0659 (1.42), TLF-0680 (2.31), TLF-0690 (1.51), TLF-9717 (1.63), and TLF-0698 (1.37) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPDs (116%, 40.6%, 46.3%, 118%, 45.3%, 66.2%, 61.7%, and 61.9%) also exceed acceptable limits. However, the RPD (29.2% and 32.4%) for samples TLF-0671 and TLF-9717 are within acceptable limits and therefore, no qualification is necessary. The samples have gross alpha results greater than the sum of the alphas by factors ranging from 1.3 to 15.1. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possible missing activity be investigated in the future and the gross alpha results for samples TLF-0678, TLF-0670, TLF-0671, TLF-0663, TLF-0658, TLF-0659, TLF-0680, TLF-0690, TLF-9717, and TLF-0698 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0678 (3.55), TLF-0679 (3.10), TLF-0662 (1.67), TLF-0658 (2.96), TLF-0690 (2.48), TLF-0692, (1.66), and TLF-0698 (3.16) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters

within a 99% confidence level. The RPDs (161%, 153%, 56.9%, 124%, 86.5%, 37.2%, and 118%) also exceed acceptable limits. The samples have gross beta results greater than the sum of the betas by factors ranging from 1.8 to 9.1. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma, the DERs would be within limits for these samples. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for samples TLF-0678, TLF-0679, TLF-0662, TLF-0658, TLF-0690, and TLF-0698 be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The total activity sums for ten of the twenty samples agree with the total activity results. The DERs for samples TLF-0678 (2.98), TLF-0679 (2.42), TLF-0670 (2.08), TLF-0671 (1.94), TLF-0669 (2.14), TLF-0658 (2.16), TLF-0659 (2.37), TLF-0660 (2.18), TLF-0690 (2.83), TLF-9717 (2.43), TLF-0698 (3.20) and TLF-0701 (1.58) were greater than 1.29 indicating that the total activity analyses were not in agreement with the total activity sums for those samples.

The RPDs (127%, 102%, 43.2%, 44.1%, 78.1%, 50.8%, 46.3%, 76.6%, 44.5%, and 94.9%) for these samples also exceed acceptable limits. However, the RPD (29.5% and 29.8%) for samples TLF-0671 and TLF-0701 are within acceptable limits and therefore, no qualification is necessary. The samples have total activity results greater than the total activity sum by an approximate factor ranging from 1.6 to 4.5. This may be an indication of other activity in the sample that was not specifically analyzed for. Also, if the ^{40}K and ^{137}Cs results as discussed in Section 1.0, had been reported from the gamma analyses, the DERs would be within limits for these samples. **Therefore, it is recommended that the possibility of missing activity be subsequently investigated in the future. Finally, it is recommended that the total activity result for samples TLF-0678, TLF-0679, TLF-0670, TLF-0669, TLF-0658, TLF-0659, TLF-0660, TLF-0690, TLF-9717, and TLF-0698 be qualified as estimated (J).**

G01080002-01A			TLF-0678					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-9.00E-02	1.90E-01					U
Ra-226	8.60E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.10E-01	1.90E-01												
Th-230	6.20E-01	1.50E-01												
Th-232	7.60E-01	1.70E-01												
U-234	8.00E-01	2.70E-01												
U-235	2.70E-02	5.00E-02					U	5.00E-02	4.00E-01					U
U-238	8.40E-01	2.70E-01												
Total U Alpha	**1.67E+00**	**3.85E-01**												
Alpha Sum	**4.09E+00**	**2.31E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.40E-01	2.70E-01						1.80E+00	1.60E+00					
Pa-234m (Assumed from U-238)	8.40E-01	2.70E-01						3.00E+00	1.50E+01					U
Ac-227														
Ra-228	6.90E-01	4.10E-01												
Pa-231	-7.00E-01	2.50E+00					U							
Beta Sum	**2.29E+00**	**6.36E-01**						**5.41E+00**	**1.51E+01**					
Total Activity Sum	**6.37E+00**	**2.40E+00**						**9.49E+00**	**1.53E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.54E+01	5.60E+00					J	**1.87**	**(from gamma)**		**116**			
Gross Beta	2.09E+01	5.20E+00					J	**3.55**	**0.97**		**161**			
Total Activity	2.84E+01	7.00E+00					J	**2.98**	**1.13**		**127**			

G01080002-02A			TLF-0679					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-7.00E-02	1.70E-01					U
Ra-226	7.40E-01	2.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.80E-01	1.70E-01												
Th-230	7.00E-01	1.70E-01					J							
Th-232	6.20E-01	1.50E-01												
U-234	1.05E+00	3.50E-01												
U-235	1.60E-02	6.10E-02					U	1.70E-01	4.30E-01					U
U-238	8.00E-01	2.80E-01												
Total U Alpha	**1.87E+00**	**4.52E-01**												
Alpha Sum	**5.06E+00**	**1.72E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.00E-01	2.80E-01						5.00E-01	1.20E+00					UJ
Pa-234m (Assumed from U-238)	8.00E-01	2.80E-01						0.00E+00	1.30E+02					UJ
Ac-227														
Ra-228	2.90E-01	3.90E-01					U							
Pa-231	5.00E-01	1.80E+00					U							
Beta Sum	**1.95E+00**	**5.96E-01**						**8.50E-01**	**1.30E+02**					
Total Activity Sum	**7.01E+00**	**1.82E+00**						**5.91E+00**	**1.30E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.60E+00	4.00E+00					J	**0.81**	**(from gamma)**		**51.9**			
Gross Beta	1.45E+01	4.00E+00					J	**3.10**	**0.10**		**153**			
Total Activity	2.15E+01	5.70E+00					J	**2.42**	**0.12**		**102**			

G01080002-03A			TLF-0670					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.90E-01	2.70E-01					U
Ra-226	2.79E+00	6.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.53E+00	3.10E-01												
Th-230	3.30E+00	5.70E-01												
Th-232	1.22E+00	2.50E-01												
U-234	1.04E+01	1.70E+00												
U-235	4.40E-01	1.40E-01						4.60E-01	6.10E-01					U
U-238	1.04E+01	1.70E+00												
Total U Alpha	**2.12E+01**	**2.41E+00**												
Alpha Sum	**2.98E+01**	**3.48E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.04E+01	1.70E+00						8.80E+00	2.50E+00					
Pa-234m (Assumed from U-238)	1.04E+01	1.70E+00						5.00E+00	1.70E+01					U
Ac-227														
Ra-228	1.00E+00	4.90E-01												
Pa-231	-3.00E-01	2.60E+00					U							
Beta Sum	**2.18E+01**	**2.47E+00**						**1.48E+01**	**1.72E+01**					
Total Activity Sum	**5.16E+01**	**4.27E+00**						**4.46E+01**	**1.75E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.50E+01	1.10E+01					J	**1.32**	**(from gamma)**		**40.6**			
Gross Beta	2.86E+01	6.60E+00					J	**0.97**	**0.75**		**27.1**			
Total Activity	8.00E+01	1.30E+01					J	**2.08**	**1.62**		**43.2**			

G01080002-04A			TLF-0671					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-6.40E-01	4.10E-01					U
Ra-226	1.49E+01	2.80E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.06E+00	4.20E-01												
Th-230	1.38E+01	2.20E+00					J							
Th-232	1.91E+00	3.90E-01												
U-234	4.21E+01	6.50E+00												
U-235	2.11E+00	4.20E-01					J	1.81E+00	9.20E-01					
U-238	4.05E+01	6.20E+00												
Total U Alpha	**8.47E+01**	**8.99E+00**												
Alpha Sum	**1.18E+02**	**1.01E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	4.05E+01	6.20E+00						3.31E+01	7.20E+00					
Pa-234m (Assumed from U-238)	4.05E+01	6.20E+00						4.20E+01	1.90E+01					
Ac-227														
Ra-228	1.99E+00	6.20E-01												
Pa-231	2.00E-01	3.10E+00					U							
Beta Sum	**8.30E+01**	**8.80E+00**						**7.71E+01**	**2.03E+01**					
Total Activity Sum	**2.01E+02**	**1.34E+01**						**1.95E+02**	**2.27E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.58E+02	2.90E+01					J	**1.32**	**(from gamma)**		**29.4**			
Gross Beta	8.20E+01	1.80E+01					J	**0.05**	**0.18**		**1.23**			
Total Activity	1.49E+02	2.30E+01						**1.94**	**1.41**		**29.5**			

G01080002-05A			TLF-0667					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	2.70E-01					U
Ra-226	1.33E+00	4.90E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.20E-01	1.80E-01												
Th-230	5.80E-01	1.50E-01												
Th-232	5.80E-01	1.60E-01												
U-234	1.43E+01	2.10E+00												
U-235	6.20E-01	1.40E-01						7.40E-01	5.40E-01					
U-238	1.42E+01	2.10E+00												
Total U Alpha	**2.91E+01**	**2.97E+00**												
Alpha Sum	**3.28E+01**	**3.57E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.42E+01	2.10E+00						1.08E+01	2.50E+00					
Pa-234m (Assumed from U-238)	1.42E+01	2.10E+00						9.00E+00	1.30E+01					U
Ac-227														
Ra-228	5.50E-01	3.80E-01												
Pa-231	5.00E-01	2.10E+00					U							
Beta Sum	**2.90E+01**	**3.00E+00**						**2.04E+01**	**1.32E+01**					
Total Activity Sum	**6.18E+01**	**4.66E+00**						**5.32E+01**	**1.37E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.68E+01	9.60E+00					J	**0.39**	**(from gamma)**		**11.6**			
Gross Beta	3.06E+01	6.50E+00					J	**0.22**	**0.69**		**5.33**			
Total Activity	6.90E+01	1.10E+01						**0.60**	**0.90**		**11.0**			

G01080002-06A			TLF-0669					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.40E-01	2.70E-01					U
Ra-226	2.59E+00	5.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.00E+00	6.60E-01												
Th-230	4.07E+00	8.30E-01					J							
Th-232	3.15E+00	6.70E-01												
U-234	1.46E+01	2.40E+00												
U-235	6.80E-01	2.00E-01						6.10E-01	6.00E-01					
U-238	1.45E+01	2.30E+00												
Total U Alpha	**2.98E+01**	**3.33E+00**												
Alpha Sum	**4.24E+01**	**4.30E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.45E+01	2.30E+00						1.52E+01	3.30E+00					
Pa-234m (Assumed from U-238)	1.45E+01	2.30E+00						1.50E+01	1.10E+01					
Ac-227														
Ra-228	3.35E+00	7.20E-01												
Pa-231	-2.00E-01	2.60E+00					U							
Beta Sum	**3.23E+01**	**3.35E+00**						**3.35E+01**	**1.15E+01**					
Total Activity Sum	**7.47E+01**	**5.45E+00**						**7.59E+01**	**1.23E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.40E+01	1.20E+01					J	**0.91**	**(from gamma)**		**24.0**			
Gross Beta	4.26E+01	9.20E+00					J	**1.05**	**0.62**		**27.4**			
Total Activity	1.17E+02	1.90E+01					J	**2.14**	**1.81**		**44.1**			

G01080002-07A			TLF-0662					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	2.30E-01					U
Ra-226	1.90E+00	4.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.70E+00	3.40E-01												
Th-230	2.09E+00	3.90E-01					J							
Th-232	1.74E+00	3.40E-01												
U-234	5.70E+00	1.10E+00												
U-235	3.00E-01	1.60E-01						2.00E-01	5.40E-01					U
U-238	5.50E+00	1.10E+00												
Total U Alpha	**1.15E+01**	**1.56E+00**												
Alpha Sum	**1.98E+01**	**2.85E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.50E+00	1.10E+00						3.00E+00	1.30E+00					
Pa-234m (Assumed from U-238)	5.50E+00	1.10E+00						5.00E+00	1.40E+01					U
Ac-227														
Ra-228	1.19E+00	5.40E-01												
Pa-231	1.00E+00	2.50E+00					U							
Beta Sum	**1.23E+01**	**1.67E+00**						**9.31E+00**	**1.41E+01**					
Total Activity Sum	**3.21E+01**	**3.30E+00**						**2.91E+01**	**1.44E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.03E+01	8.20E+00					J	**1.21**	**(from gamma)**		**41.8**			
Gross Beta	2.21E+01	5.60E+00					J	**1.67**	**0.84**		**56.9**			
Total Activity	3.91E+01	8.00E+00						**0.80**	**0.61**		**19.5**			

G01080002-08A			TLF-0663					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.40E-01	2.10E-01					U
Ra-226	1.61E+00	4.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.38E+00	2.90E-01												
Th-230	1.36E+00	2.90E-01												
Th-232	1.24E+00	2.70E-01												
U-234	6.50E+00	1.20E+00												
U-235	1.60E-01	1.10E-01						1.00E-02	4.30E-01					U
U-238	5.90E+00	1.10E+00												
Total U Alpha	**1.26E+01**	**1.63E+00**												
Alpha Sum	**1.78E+01**	**2.51E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.90E+00	1.10E+00						7.20E+00	1.90E+00					
Pa-234m (Assumed from U-238)	5.90E+00	1.10E+00						4.00E+00	1.30E+01					U
Ac-227														
Ra-228	9.60E-01	4.00E-01												
Pa-231	-4.00E-01	2.00E+00					U							
Beta Sum	**1.27E+01**	**1.62E+00**						**1.21E+01**	**1.31E+01**					
Total Activity Sum	**3.05E+01**	**2.99E+00**						**2.99E+01**	**1.34E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.85E+01	7.80E+00					J	**1.31**	**(from gamma)**		**46.3**			
Gross Beta	1.48E+01	4.30E+00					J	**0.45**	**0.19**		**15.2**			
Total Activity	4.03E+01	7.90E+00						**1.16**	**0.67**		**27.7**			

G01080002-09A			TLF-0658					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-02	1.60E-01					U
Ra-226	1.38E+00	4.50E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.00E-01	2.10E-01												
Th-230	1.03E+00	2.30E-01												
Th-232	8.30E-01	1.90E-01												
U-234	1.81E+00	4.40E-01												
U-235	2.70E-02	4.30E-02					U	1.40E-01	4.70E-01					U
U-238	1.78E+00	4.30E-01												
Total U Alpha	**3.62E+00**	**6.17E-01**												
Alpha Sum	**6.68E+00**	**2.40E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.78E+00	4.30E-01						1.10E+00	1.20E+00					
Pa-234m (Assumed from U-238)	1.78E+00	4.30E-01						4.00E+00	1.00E+01					U
Ac-227														
Ra-228	5.60E-01	4.10E-01												
Pa-231	-1.20E+00	2.50E+00					U							
Beta Sum	**3.98E+00**	**7.92E-01**						**5.52E+00**	**1.01E+01**					
Total Activity Sum	**1.07E+01**	**2.53E+00**						**1.22E+01**	**1.04E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.60E+01	7.70E+00					J	**2.40**	**(from gamma)**		**118**			
Gross Beta	1.69E+01	4.30E+00					J	**2.96**	**1.04**		**124**			
Total Activity	2.43E+01	5.80E+00					J	**2.16**	**1.02**		**78.1**			

G01080002-10A			TLF-0659					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.00E-01	2.20E-01					U
Ra-226	2.85E+00	6.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.79E+00	5.30E-01												
Th-230	2.58E+00	4.90E-01												
Th-232	2.66E+00	5.10E-01												
U-234	8.70E+00	1.40E+00												
U-235	3.60E-01	1.30E-01						2.60E-01	5.20E-01					U
U-238	8.70E+00	1.40E+00												
Total U Alpha	**1.78E+01**	**1.98E+00**												
Alpha Sum	**2.96E+01**	**2.42E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	8.70E+00	1.40E+00						9.00E+00	2.00E+00					
Pa-234m (Assumed from U-238)	8.70E+00	1.40E+00						6.00E+00	1.20E+01					U
Ac-227														
Ra-228	2.79E+00	6.80E-01												
Pa-231	1.12E+00	9.50E-01												
Beta Sum	**2.03E+01**	**2.10E+00**						**1.79E+01**	**1.22E+01**					
Total Activity Sum	**5.00E+01**	**3.20E+00**						**4.76E+01**	**1.24E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.70E+01	1.20E+01					J	**1.42**	**(from gamma)**		**45.3**			
Gross Beta	2.80E+01	6.50E+00					J	**1.12**	**0.73**		**31.8**			
Total Activity	8.40E+01	1.40E+01					J	**2.37**	**1.95**		**50.8**			

G01080002-11A			TLF-0660					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.60E-01	2.30E-01					U
Ra-226	3.43E+00	7.30E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.52E+00	6.00E-01												
Th-230	3.13E+00	5.40E-01												
Th-232	3.03E+00	5.20E-01												
U-234	9.00E+00	1.30E+00												
U-235	3.90E-01	1.00E-01						4.10E-01	5.30E-01					U
U-238	9.30E+00	1.40E+00												
Total U Alpha	**1.87E+01**	**1.91E+00**												
Alpha Sum	**3.12E+01**	**3.13E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	9.30E+00	1.40E+00						8.60E+00	1.90E+00					
Pa-234m (Assumed from U-238)	9.30E+00	1.40E+00						1.20E+01	1.00E+01					
Ac-227														
Ra-228	2.73E+00	6.10E-01												
Pa-231	-7.00E-01	2.40E+00					U							
Beta Sum	**2.12E+01**	**2.09E+00**						**2.32E+01**	**1.02E+01**					
Total Activity Sum	**5.24E+01**	**3.76E+00**						**5.44E+01**	**1.07E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.20E+01	1.30E+01					J	**2.31**	**(from gamma)**		**66.2**			
Gross Beta	2.55E+01	6.60E+00					J	**0.61**	**0.19**		**18.2**			
Total Activity	8.40E+01	1.40E+01					J	**2.18**	**1.68**		**46.3**			

G01080002-12A			TLF-0693					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-5.80E-01	5.10E-01					U
Ra-226	7.90E+00	1.60E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	1.99E+00	3.80E-01												
Th-230	1.18E+01	1.80E+00												
Th-232	2.31E+00	4.30E-01												
U-234	7.20E+01	1.20E+01												
U-235	3.25E+00	6.70E-01					J	5.30E+00	1.60E+00					
U-238	7.20E+01	1.20E+01												
Total U Alpha	**1.47E+02**	**1.70E+01**												
Alpha Sum	**1.71E+02**	**1.74E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.20E+01	1.20E+01						5.24E+01	9.80E+00					
Pa-234m (Assumed from U-238)	7.20E+01	1.20E+01						6.70E+01	2.60E+01					
Ac-227														
Ra-228	2.28E+00	7.20E-01												
Pa-231	2.00E-01	3.50E+00					U							
Beta Sum	**1.46E+02**	**1.70E+01**						**1.22E+02**	**2.78E+01**					
Total Activity Sum	**3.18E+02**	**2.44E+01**						**2.93E+02**	**3.28E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.41E+02	2.60E+01					J	**0.97**	**(from gamma)**		**19.5**			
Gross Beta	1.24E+02	2.30E+01					J	**0.78**	**0.06**		**16.5**			
Total Activity	3.49E+02	5.10E+01						**0.55**	**0.92**		**9.4**			

G01080002-13A			TLF-0690					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-02	2.10E-01					U
Ra-226	1.58E+00	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.90E-01	1.90E-01												
Th-230	1.29E+00	2.30E-01												
Th-232	7.90E-01	1.60E-01												
U-234	3.18E+00	6.80E-01												
U-235	9.30E-02	7.90E-02						1.50E-01	5.20E-01					U
U-238	3.66E+00	7.60E-01												
Total U Alpha	**6.93E+00**	**1.02E+00**												
Alpha Sum	**1.13E+01**	**2.29E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.66E+00	7.60E-01						2.30E+00	1.10E+00					
Pa-234m (Assumed from U-238)	3.66E+00	7.60E-01						1.00E+00	1.40E+01					U
Ac-227														
Ra-228	7.60E-01	4.20E-01												
Pa-231	-3.00E-01	2.20E+00					U							
Beta Sum	**8.04E+00**	**1.18E+00**						**4.02E+00**	**1.41E+01**					
Total Activity Sum	**1.94E+01**	**2.57E+00**						**1.53E+01**	**1.42E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.14E+01	6.30E+00					J	**1.51**	**(from gamma)**		**61.7**			
Gross Beta	2.03E+01	4.80E+00					J	**2.48**	**1.10**		**86.5**			
Total Activity	4.34E+01	8.10E+00					J	**2.83**	**1.71**		**76.6**			

G01080002-14A			TLF-0691					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.80E-01	3.70E-01					U
Ra-226	2.06E+00	4.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.23E+00	2.20E-01												
Th-230	1.40E+00	2.40E-01												
Th-232	1.06E+00	1.90E-01												
U-234	3.54E+01	5.50E+00												
U-235	1.64E+00	3.60E-01					J	2.80E+00	1.10E+00					
U-238	3.42E+01	5.30E+00												
Total U Alpha	**7.12E+01**	**7.65E+00**												
Alpha Sum	**7.88E+01**	**7.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	3.42E+01	5.30E+00						2.82E+01	5.40E+00					
Pa-234m (Assumed from U-238)	3.42E+01	5.30E+00						3.40E+01	1.90E+01					
Ac-227														
Ra-228	9.00E-01	4.10E-01												
Pa-231	2.00E+00	2.50E+00					U							
Beta Sum	**6.95E+01**	**7.51E+00**						**6.33E+01**	**1.98E+01**					
Total Activity Sum	**1.48E+02**	**1.10E+01**						**1.42E+02**	**2.13E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.30E+01	1.50E+01					J	**0.34**	**(from gamma)**		**7.63**			
Gross Beta	6.40E+01	1.30E+01					J	**0.37**	**0.03**		**8.30**			
Total Activity	1.54E+02	2.30E+01						**0.22**	**0.38**		**3.75**			

G01080002-15A			TLF-9717					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.43E+00	8.20E-01					U
Ra-226	1.69E+01	3.30E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.63E+00	4.40E-01												
Th-230	7.60E+01	1.10E+01												
Th-232	2.35E+00	4.00E-01												
U-234	2.00E+02	3.70E+01					J							
U-235	9.90E+00	2.10E+00					R	1.78E+01	4.90E+00					
U-238	2.05E+02	3.80E+01					J							
Total U Alpha	**4.15E+02**	**5.31E+01**												
Alpha Sum	**5.15E+02**	**5.44E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.05E+02	3.80E+01						2.05E+02	3.60E+01					
Pa-234m (Assumed from U-238)	2.05E+02	3.80E+01						3.62E+02	7.60E+01					
Ac-227														
Ra-228	3.04E+00	8.50E-01												
Pa-231	2.80E+00	3.60E+00					U							
Beta Sum	**4.13E+02**	**5.37E+01**						**5.70E+02**	**8.41E+01**					
Total Activity Sum	**9.29E+02**	**7.65E+01**						**1.09E+03**	**1.00E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	7.10E+02	1.10E+02					J	**1.59**	**(from gamma)**		**31.8**			
Gross Beta	4.99E+02	9.80E+01					J	**0.77**	**0.55**		**18.8**			
Total Activity	1.42E+03	2.00E+02					J	**2.29**	**1.49**		**41.8**			

G01080002-16A			TLF-0692					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-2.99E+00	8.40E-01					U
Ra-226	1.86E+01	3.60E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	2.66E+00	4.40E-01												
Th-230	7.10E+01	1.00E+01												
Th-232	2.56E+00	4.20E-01												
U-234	2.29E+02	4.30E+01					J							
U-235	1.04E+01	2.30E+00					J	1.73E+01	4.30E+00					
U-238	2.27E+02	4.30E+01					J							
Total U Alpha	**4.66E+02**	**6.09E+01**												
Alpha Sum	**5.63E+02**	**6.19E+01**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.27E+02	4.30E+01						1.88E+02	3.40E+01					
Pa-234m (Assumed from U-238)	2.27E+02	4.30E+01						3.05E+02	6.10E+01					
Ac-227														
Ra-228	2.03E+00	5.40E-01												
Pa-231	1.50E+00	3.30E+00					U							
Beta Sum	**4.56E+02**	**6.08E+01**						**4.95E+02**	**6.98E+01**					
Total Activity Sum	**1.02E+03**	**8.67E+01**						**1.06E+03**	**9.33E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.80E+02	7.80E+01					J	**0.83**	**(from gamma)**		**15.8**			
Gross Beta	3.13E+02	6.10E+01					J	**1.66**	**1.96**		**37.2**			
Total Activity	9.30E+02	1.30E+02						**0.57**	**0.80**		**9.11**			

G01080002-17A			TLF-0698					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.30E-01	2.30E-01					U
Ra-226	1.14E+00	3.40E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.50E-01	1.80E-01												
Th-230	1.18E+00	2.10E-01					J							
Th-232	8.60E-01	1.60E-01												
U-234	2.57E+00	6.00E-01												
U-235	1.20E-01	1.10E-01						2.10E-01	5.00E-01					U
U-238	2.78E+00	6.30E-01												
Total U Alpha	**5.47E+00**	**8.77E-01**												
Alpha Sum	**9.24E+00**	**2.30E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.78E+00	6.30E-01						2.00E+00	1.10E+00					
Pa-234m (Assumed from U-238)	2.78E+00	6.30E-01						0.00E+00	2.20E+01					UJ
Ac-227														
Ra-228	5.50E-01	3.90E-01												
Pa-231	-4.00E-01	2.30E+00					U							
Beta Sum	**6.06E+00**	**1.01E+00**						**2.50E+00**	**2.20E+01**					
Total Activity Sum	**1.53E+01**	**2.51E+00**						**1.17E+01**	**2.22E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.75E+01	5.60E+00					J	**1.36**	**(from gamma)**		**61.8**			
Gross Beta	2.30E+01	5.30E+00					J	**3.14**	**0.90**		**117**			
Total Activity	4.26E+01	8.20E+00					J	**3.18**	**1.31**		**94.3**			

G01080002-18A			TLF-0699					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.70E-01	2.80E-01	-2.60E-01	3.00E-01	**0.22**	**41.9**	U
Ra-226	1.90E+00	4.60E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.72E+00	3.00E-01												
Th-230	1.67E+00	2.90E-01												
Th-232	1.55E+00	2.70E-01												
U-234	1.02E+01	1.60E+00												
U-235	4.50E-01	1.50E-01						5.10E-01	6.00E-01	7.60E-01	5.80E-01	**0.30**	**39.4**	
U-238	1.06E+01	1.70E+00												
Total U Alpha	**2.13E+01**	**2.34E+00**												
Alpha Sum	**2.87E+01**	**3.20E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+01	1.70E+00						1.05E+01	2.80E+00	8.70E+00	2.60E+00	**0.47**	**18.8**	
Pa-234m (Assumed from U-238)	1.06E+01	1.70E+00						8.00E+00	1.60E+01	1.30E+01	1.40E+01	**0.24**	**47.6**	U
Ac-227														
Ra-228	1.46E+00	5.90E-01	1.43E+00	5.00E-01	**0.04**	**2.08**								
Pa-231	7.00E-01	2.30E+00	-1.00E-01	2.40E+00	**0.24**	**267**	U							
Beta Sum	**2.27E+01**	**2.49E+00**						**2.00E+01**	**1.63E+01**	**2.31E+01**	**1.43E+01**			
Total Activity Sum	**5.15E+01**	**4.05E+00**						**4.88E+01**	**1.66E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.07E+01	8.20E+00					J	**0.22**	**(from gamma)**		**6.66**			
Gross Beta	2.61E+01	6.00E+00					J	**0.52**	**0.35**		**13.7**			
Total Activity	6.60E+01	1.10E+01						**1.24**	**0.87**		**24.7**			

G01080002-19A			TLF-0700					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.10E-01	2.90E-01					U
Ra-226	2.77E+00	6.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.55E+00	3.00E-01												
Th-230	3.90E+00	6.40E-01												
Th-232	1.49E+00	2.80E-01												
U-234	2.63E+01	3.90E+00												
U-235	1.27E+00	2.60E-01						2.30E+00	1.00E+00					
U-238	2.53E+01	3.80E+00												
Total U Alpha	**5.29E+01**	**5.45E+00**												
Alpha Sum	**6.38E+01**	**5.63E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	2.53E+01	3.80E+00						2.45E+01	5.70E+00					
Pa-234m (Assumed from U-238)	2.53E+01	3.80E+00						2.30E+01	1.40E+01					
Ac-227														
Ra-228	1.27E+00	4.50E-01												
Pa-231	1.30E+00	1.10E+00												
Beta Sum	**5.20E+01**	**5.39E+00**						**4.89E+01**	**1.51E+01**					
Total Activity Sum	**1.16E+02**	**7.79E+00**						**1.13E+02**	**1.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+01	1.20E+01					J	**0.58**	**(from gamma)**		**12.9**			
Gross Beta	4.89E+01	9.90E+00					J	**0.28**	**0.00**		**6.19**			
Total Activity	1.42E+02	2.20E+01						**1.12**	**1.07**		**20.3**			

G01080002-20A			TLF-0701					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.00E-01	2.70E-01	0.00E+00	0.00E+00	**1.11**	**200**	U
Ra-226	5.80E+00	1.20E+00	6.10E+00	1.20E+00	**0.18**	**5.04**								
Np-237														
Pu-238														
Pu-239														
Th-228	2.80E+00	4.60E-01	3.16E+00	5.20E-01	**0.52**	**12.1**								
Th-230	3.21E+00	5.10E-01	3.65E+00	5.90E-01	**0.56**	**12.8**								
Th-232	2.20E+00	3.70E-01	2.78E+00	4.60E-01	**0.98**	**23.3**								
U-234	1.69E+01	2.80E+00	1.66E+01	2.70E+00	**0.08**	**1.79**								
U-235	9.30E-01	2.70E-01	5.40E-01	1.90E-01	**1.18**	**53.1**		7.80E-01	6.10E-01	0.00E+00	0.00E+00	**1.28**	**200**	
U-238	1.68E+01	2.80E+00	1.75E+01	2.90E+00	**0.17**	**4.08**								
Total U Alpha	**3.46E+01**	**3.97E+00**	**3.46E+01**	**3.97E+00**										
Alpha Sum	**4.87E+01**	**4.78E+00**	**5.03E+01**	**4.24E+00**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.68E+01	2.80E+00	1.75E+01	2.90E+00	**0.17**	**4.08**		1.42E+01	4.00E+00	0.00E+00	0.00E+00	**3.55**	**200**	
Pa-234m (Assumed from U-238)	1.68E+01	2.80E+00	1.75E+01	2.90E+00	**0.17**	**4.08**		1.60E+01	1.20E+01	0.00E+00	0.00E+00	**1.33**	**200**	
Ac-227														
Ra-228	3.54E+00	8.40E-01	0.00E+00	0.00E+00	**4.21**	**200**								
Pa-231	1.00E-01	2.50E+00	0.00E+00	0.00E+00	**0.04**	**200**	U							
Beta Sum	**3.72E+01**	**4.06E+00**	**3.50E+01**	**4.10E+00**				**3.38E+01**	**1.27E+01**	**0.00E+00**	**0.00E+00**			
Total Activity Sum	**8.59E+01**	**6.27E+00**	**8.53E+01**	**5.90E+00**				**8.25E+01**	**1.36E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.30E+01	1.20E+01	3.60E+01	1.00E+01	**1.09**	**38.2**	J	**0.33**	**(from gamma)**		**8.39**			
Gross Beta	3.75E+01	7.70E+00	3.16E+01	6.90E+00	**0.57**	**17.1**	J	**0.04**	**0.25**		**0.93**			
Total Activity	1.16E+02	1.80E+01	1.14E+02	1.80E+01	**0.08**	**1.74**		**1.58**	**1.49**		**29.8**			

Radiological Analytical Data Verification
Comments on Data for SDG G01080003

This sample delivery group (SDG) contained one soil sample from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}U$ and $^{228/230/232}Th$ by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}Pa$, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0672	G01080003-01A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated. The sample results are greater than 5 times the rinsate blank activity for ^{228}Ra, ^{234m}Pa and ^{234}Th; therefore, none of the data should be qualified.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) were within acceptable limits.

Duplicate Analysis:

The batch duplicate for the gamma analysis for this sample was in SDG # G01080004 and was not reported on Form 4, per the SOW in this SDG. Review of the batch duplicate data in SDG # G01080004 the gamma spectrometry results DERs are within acceptable limits for this duplicate. Although the duplicate is in another SDG it is comparable since it is a sample from the same area. No qualification of the gamma spectrometry results is necessary.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported. The laboratory was instructed to report any radioisotopes detected above the DL (1.65*TPU). Based on data review, ^{40}K was identified in the sample. The activity for ^{40}K was 3.17 " 1.98 pCi/g. Since ^{40}K is a beta emitter, **the activity should have been reported in order to account for total beta activity**.

The software utilized by the laboratory calculates the uncertainty as a percentage of the associated result. Therefore, for a negative result, the associated uncertainty is negative. The laboratory reports the absolute value of the associated uncertainty instead of a negative number.

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtraction was indicated for ^{241}Am for sample TLF-0672. **It is recommended that the ^{241}Am result for sample TLF-0672 be qualified as estimated (J).**

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{228}Th, ^{230}Th, and ^{238}U. All associated sample results less than 5 times the method blank values for ^{228}Th, ^{230}Th, and ^{238}U should be qualified as estimated (J). All of the sample results were greater than 5 times the method blank values, therefore no qualification of the data is necessary.

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). All of the sample ^{234}U results were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for the alpha spectrometry LCS values were acceptable.

Duplicate Analysis:

The DERs were acceptable for the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries and their associated uncertainties were acceptable for isotopic Th. The chemical tracer recoveries for U were low, but acceptable, at 21 and 13% for the sample and duplicate analyses, respectively. However, there is greater than 10% uncertainty in the sample-specific percent recovery results for the isotopic uranium analysis for sample TLF-0672 (laboratory duplicate) (11.1%). **Therefore, it is recommended that the $^{234/235/238}$U results for sample TLF-0672 (laboratory duplicate) be qualified as estimated (J).**

Spectral Analysis:

The isotopic thorium alpha spectra indicated two extra peaks. These peaks were in the 5.8 MeV and 6.3 MeV, regions. We assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There was no indication of interference with the isotopic thorium results. No qualification of the isotopic thorium results was required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

Contamination was indicated in the rinsate blank for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. The sample results were greater than 5 times the rinsate blank result. Therefore, no qualification of the ^{226}Ra results was necessary.

Laboratory Control Sample:

The percent recoveries for the ^{226}Ra LCS were within acceptable limits.

Duplicate Analysis:

The DER for the ^{226}Ra duplicate analysis was within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recovery for the ^{226}Ra analyses exceeded 93%. The percent recovery values were within acceptable limits; therefore, no qualification was necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

No contamination was indicated for the gross alpha or gross beta method blank.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recoveries (79% and 75%)for the LCS were outside acceptable limits for the gross alpha/beta analysis. **Therefore, it is recommended that the gross alpha/beta results for samples TLF-0672 and TLF-0672 (laboratory duplicate) be qualified as estimated (J).**

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analyses were within acceptable limits.

Matrix Spike Sample:

The MSS percent recovery values for gross alpha/ beta were acceptable.

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL), stated in the SOW, for the gross alpha/beta analyses was 1.0 pCi/g. None of the gross alpha/beta tests met the required MDL indicating that the laboratory may not have met the project DQO for these samples.

5.0 TOTAL ACTIVITY:

Method Blank:

No blank contamination was indicated for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was acceptable.

Duplicate Analysis:

The DER for the total activity duplicate analysis was acceptable.

Matrix Spike Sample:

The matrix spike percent recovery (52%) was low for the total activity analysis. This may indicate a low bias, evident in the data intercomparison section. **Therefore, the total activity results for samples TLF-0672 and TLF-0672 (laboratory duplicate) should be qualified as estimated (J).**

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. Within errors, the ^{228}Ra results agree with the ^{232}Th results.

^{231}Pa Gamma to ^{235}U Alpha:

Comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that the results agree within the respective uncertainties.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER for sample TLF-0672 was less than 1.29 indicating that the gross alpha analysis was in agreement with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analysis, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DER for sample TLF-0672 was less than 1.29 indicating that the gross beta analysis was in agreement with the sum of the beta emitters within a 99% confidence level.

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER (2.49) for sample TLF-0672 was greater than 1.29 indicating that the total activity analysis are not in agreement with the sum of the alpha and beta emitters within a 99% confidence level. The RPD (38.0%) is also outside acceptable limits. The total activity results

are less than the sum of the alpha and beta emitters by a factor of approximately 1.5. This most likely is due to the negative bias observed in the matrix spike sample for the total activity analysis. Since the total activity analysis results for TLF-0672 and TLF-0672 (laboratory duplicate) are qualified for a negative bias, no further qualification is necessary.

G01080003-01A			TLF-0672					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-1.08E+00	5.80E-01					UJ
Ra-226	6.00E+00	1.20E+00	7.80E+00	1.60E+00	**0.90**	**26.1**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.94E+00	3.30E-01	1.82E+00	3.10E-01	**0.27**	**6.38**								
Th-230	8.70E+00	1.30E+00	9.60E+00	1.40E+00	**0.47**	**9.84**								
Th-232	1.59E+00	2.70E-01	1.62E+00	2.80E-01	**0.08**	**1.87**								
U-234	6.90E+01	1.10E+01	7.80E+01	1.40E+01	**0.51**	**12.2**								
U-235	3.52E+00	7.20E-01	4.00E+00	9.10E-01	**0.41**	**12.8**		4.40E+00	1.50E+00					
U-238	6.90E+01	1.10E+01	7.40E+01	1.30E+01	**0.29**	**6.99**								
Total U Alpha	**1.42E+02**	**1.56E+01**	**1.56E+02**	**1.91E+01**										
Alpha Sum	**1.59E+02**	**1.61E+01**	**1.77E+02**	**1.92E+01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E+01	1.10E+01	7.40E+01	1.30E+01	**0.29**	**6.99**		5.40E+01	1.20E+01					
Pa-234m (Assumed from U-238)	6.90E+01	1.10E+01	7.40E+01	1.30E+01	**0.29**	**6.99**		7.60E+01	2.60E+01					
Ac-227														
Ra-228	1.23E+00	5.70E-01												
Pa-231	-7.00E-01	3.90E+00					U							
Beta Sum	**1.39E+02**	**1.56E+01**	**1.48E+02**	**1.84E+01**				**1.31E+02**	**2.86E+01**					
Total Activity Sum	**2.98E+02**	**2.24E+01**	**3.25E+02**	**2.66E+01**				**2.90E+02**	**3.28E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.47E+02	2.70E+01	1.90E+02	3.40E+01	**0.99**	**25.5**	J	**0.39**	**(from gamma)**		**7.92**			
Gross Beta	1.23E+02	2.30E+01	1.15E+02	2.40E+01	**0.24**	**6.72**	J	**0.58**	**0.22**		**12.3**			
Total Activity	2.03E+02	3.10E+01	2.05E+02	3.10E+01	**0.05**	**0.98**	J	**2.49**	**1.93**		**38.0**			

Radiological Analytical Data Verification
Comments on Data for SDG G01080004

This sample delivery group (SDG) contained six (6) individual soil samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by Acculabs, Inc. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLF-0685	G01080004-01A
TLF-9718	G01080004-02A
TLF-0702	G01080004-03A
TLF-0703	G01080004-04A
TLF-0490	G01080004-05A
TLF-0491	G01080004-06A

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

Contamination was indicated in the rinsate blank for ^{228}Ra, ^{234m}Pa and ^{234}Th. Those samples with results less than 5 times the rinsate blank activities for ^{228}Ra, ^{234m}Pa and ^{234}Th should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the ^{228}Ra sample results are greater than 5 times the rinsate blank activity. **Also, samples TLF-00685, TLF-0490 and TLF-0491 for ^{234m}Pa; and samples TLF-0685, TLF-0703, TLF-0490 and TLF-0491 for ^{234}Th should be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) were within acceptable limits.

Duplicate Analysis:

The DERs were acceptable for all gamma spectrometry duplicate analyses.

Identification and Quantification:

As the attached tables show, all target radionuclides (^{228}Ra, ^{231}Pa, ^{234}Th, ^{234m}Pa, ^{235}U and ^{241}Am.) were reported.

The laboratory was instructed to report any radioisotopes detected above the DL (1.65*TPU). Based on data review, ^{40}K was identified in all samples. The activity range for ^{40}K was approximately 10 – 20 pCi/g, within the normal range of naturally radioactive potassium found in soils. **Since ^{40}K is a beta emitter, the activity should have been reported in order to account for total beta activity.**

2.0 ALPHA SPECTROMETRY

Method Blank:

There were indications of blank contamination for ^{230}Th, ^{234}U, and ^{238}U. All associated sample results less than 5 times the method blank values for ^{230}Th, ^{234}U, and ^{238}U should be qualified as estimated (J). All of the sample results for^{230}Th, ^{234}U, and ^{238}U were greater than 5 times the method blank values, therefore no qualification of the data is necessary.

Equipment Rinsate Blanks:

The rinsate blank indicates contamination for ^{234}U. Samples with results less than 5 times the rinsate blank ^{234}U activity should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all of the sample ^{234}U results were greater than 5 times the rinsate blank. Therefore, no qualification of the ^{234}U results is necessary.

Laboratory Control Sample:

The percent recoveries for all the alpha spectrometry LCSs were acceptable.

Duplicate Analysis:

The DERs were acceptable for all the alpha spectrometry duplicate analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries and their associated uncertainties were acceptable for all samples for isotopic Th and isotopic U.

Spectral Analysis:

Several of the isotopic thorium alpha spectra indicated two extra peaks. These peaks were in the 5.8 MeV and 6.3 MeV, regions. We assumed that the peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There was no indication of interference with the isotopic thorium results. No qualification of the isotopic thorium results was required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was an indication of contamination was indicated in the rinsate blank for ^{226}Ra. Samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. Based on assumed sample and rinsate sizes, all of the sample results were greater than 5 times the rinsate blank result. Therefore, no qualification of the ^{226}Ra results was necessary.

Laboratory Control Sample:

The percent recovery for the ^{226}Ra LCS was within acceptable limits.

Duplicate Analysis:

The DER for the ^{226}Ra duplicate analysis was acceptable.

Chemical Recoveries:

The sample-specific chemical recoveries for all ^{226}Ra analyses exceeded 87%. The range of percent recovery values were within acceptable limits; therefore, no qualification was necessary.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross beta method blank. However, blank contamination was indicated in the gross alpha method blank. Therefore, samples with results less than 5 times the gross alpha method blank activity should be qualified as estimated (J). **Gross alpha results for samples TLF-0685 and TLF-0703 should be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery values for the gross alpha/beta LCS were acceptable.

Duplicate Analysis:

The DERs for the gross alpha/beta duplicate analysis were within acceptable limits.

Matrix Spike Sample:

The MSS percent recovery values for gross alpha/beta were acceptable.

Quantification:

We recommend the gross beta results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting. Sample preparation for this technique is non-quantitative and may not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit

The required method detection limit (MDL), stated in the SOW, for the gross alpha/beta analyses was 1.0 pCi/g. None of the gross alpha/beta tests met the required MDL indicating that the laboratory may not have met the project DQOs for these samples. Since the gross alpha/beta analyses are semi-quantitative, no qualification is recommended.

5.0 TOTAL ACTIVITY:

Method Blank:

No blank contamination was indicated for total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS was acceptable.

Duplicate Analysis:

The DER for the total activity duplicate analysis was acceptable.

Matrix Spike Sample:

The matrix spike percent recovery was within acceptable limits for the total activity analysis.

6.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

All samples are in agreement within the uncertainties. No further qualification of the gamma spectrometry results is required.

^{228}Ra Gamma to ^{232}Th:

When comparing the ^{228}Ra activity to the ^{232}Th activity, it was assumed that the two are in equilibrium. The results for all samples agree within the uncertainties. No qualification is necessary.

^{231}Pa Gamma to ^{235}U Alpha:

Comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the respective uncertainties.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha DER tests for samples TLF-0490 (1.90), TLF-0491 (1.52), and TLF-9718 (1.35) were greater than 1.29 indicating that the gross alpha analyses are not in agreement with the sum of the alpha emitters within a 99% confidence level. The RPD (107, 84.9%, and 36.5%, respectfully) also exceed acceptable limits. The samples have a gross alpha result greater than the sum of the alphas. This may be an indication of other activity in the sample that was not specifically analyzed for or a positive bias on the gross alpha analysis. **It is recommended that the possibility of missing activity be investigated in the future, and the gross alpha results for samples TLF-0490, TLF-0491, and TLF-9718 be qualified as estimated (J).**

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The gross beta DERs for samples TLF-0685 (2.83), TLF-0702 (3.56), TLF-0703 (3.48), TLF-0490 (3.26), and TLF-0491 (3.35) were greater than 1.29 indicating that the gross beta analyses are not in agreement with the sum of the beta emitters within a 99% confidence level. Also, the RPDs (152%, 144%, 137%, 155%, and 148% respectively) were outside acceptable limits. The samples have a gross beta result greater than the sum of the betas by a factors ranging from 5 to 8. This may be an indication of other activity in the samples that was not specifically analyzed for or a positive bias on the gross beta analysis. Also, if the ^{40}K results, as discussed in Section 1.0, had been reported from the gamma, the DER values would be within limits. Due to the weight of the beta emitting radionuclides on the total activity values, inclusion of the ^{40}K data

would be highly valuable in data comparison. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the gross beta results for samples TLF-0685, TLF-0702, TLF-0703, TLF-0490, and TLF-0491 be qualified as estimated (J).**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs (ranging from 1.80 to 3.60) for all samples were greater than 1.29 indicating that the total activity analyses are not in agreement with the total activity sums within a 99% confidence level. Also, the RPDs (ranging from 35.3% to 153%) for all samples were outside acceptable limits. The samples have total activity results greater than the total activity sum. Also, if the ^{40}K results, as discussed in Section 1.0, had been reported from the gamma, the DER values would most likely have been within limits. **It is recommended that the laboratory report all gamma results above the DL. Furthermore, it is recommended that the possibility of missing activity be investigated in the future. Finally, it is recommended that the total activity results for all samples be qualified as estimated (J).**

G01080004-01A			TLF-0685					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-8.00E-02	1.90E-01					U
Ra-226	8.40E-01	3.00E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.90E-01	1.90E-01												
Th-230	7.60E-01	1.80E-01												
Th-232	6.50E-01	1.60E-01												
U-234	7.30E-01	1.50E-01												
U-235	4.60E-02	3.10E-02						-1.00E-01	3.50E+00					U
U-238	6.90E-01	1.40E-01												
Total U Alpha	**1.47E+00**	**2.08E-01**												
Alpha Sum	**4.42E+00**	**1.95E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	6.90E-01	1.40E-01						6.00E-01	1.40E+00					UJ
Pa-234m (Assumed from U-238)	6.90E-01	1.40E-01						0.00E+00	1.50E+01					UJ
Ac-227														
Ra-228	3.30E-01	5.30E-01					U							
Pa-231	-1.00E-01	2.10E+00					U							
Beta Sum	**1.70E+00**	**6.19E-01**						**9.18E-01**	**1.51E+01**					
Total Activity Sum	**6.11E+00**	**2.05E+00**						**5.33E+00**	**1.52E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+00	3.80E+00					J	**0.58**	**(from gamma)**		**43.9**			
Gross Beta	1.26E+01	3.80E+00					J	**2.83**	**0.75**		**152**			
Total Activity	3.03E+01	6.80E+00					J	**3.41**	**1.50**		**133**			

G01080004-02A			TLF-9718					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								-3.70E-01	4.00E-01					U
Ra-226	4.90E+00	1.00E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	3.05E+00	5.10E-01												
Th-230	3.62E+00	5.90E-01												
Th-232	2.98E+00	5.00E-01												
U-234	1.67E+01	2.50E+00												
U-235	6.10E-01	1.50E-01						6.10E-01	8.30E-01					U
U-238	1.69E+01	2.50E+00												
Total U Alpha	**3.42E+01**	**3.54E+00**												
Alpha Sum	**4.77E+01**	**4.99E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.69E+01	2.50E+00						1.52E+01	4.70E+00					
Pa-234m (Assumed from U-238)	1.69E+01	2.50E+00						3.10E+01	2.00E+01					
Ac-227														
Ra-228	2.63E+00	7.70E-01												
Pa-231	-1.20E+00	3.60E+00					U							
Beta Sum	**3.63E+01**	**3.64E+00**						**4.87E+01**	**2.06E+01**					
Total Activity Sum	**8.40E+01**	**6.18E+00**						**9.64E+01**	**2.12E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.90E+01	1.50E+01					J	**1.35**	**(from gamma)**		**36.5**			
Gross Beta	5.00E+01	1.00E+01					J	**1.29**	**0.06**		**31.8**			
Total Activity	1.20E+02	1.90E+01					J	**1.80**	**0.83**		**35.3**			

G01080004-03A			TLF-0702					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.90E-01	-7.00E-02	1.90E-01	**0.41**	**733**	U
Ra-226	1.20E+00	3.20E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	9.30E-01	1.90E-01												
Th-230	1.02E+00	2.00E-01												
Th-232	8.00E-01	1.70E-01												
U-234	1.77E+00	3.00E-01												
U-235	1.15E-01	4.90E-02						1.00E-02	4.20E-01	0.00E+00	4.20E-01	**0.02**	**200**	U
U-238	1.61E+00	2.80E-01												
Total U Alpha	**3.50E+00**	**4.13E-01**												
Alpha Sum	**7.27E+00**	**2.25E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.61E+00	2.80E-01						8.00E-01	1.60E+00	1.27E+00	9.70E-01	**0.25**	**45.4**	U
Pa-234m (Assumed from U-238)	1.61E+00	2.80E-01						3.00E+00	1.20E+01	5.00E+00	1.20E+01	**0.12**	**50.0**	U
Ac-227														
Ra-228	8.00E-01	4.20E-01	4.50E-01	3.20E-01	**0.66**	**56.0**								
Pa-231	-2.00E-01	2.40E+00	2.00E+00	2.10E+00	**0.69**	**244**	U							
Beta Sum	**4.00E+00**	**6.45E-01**						**4.58E+00**	**1.21E+01**	**6.96E+00**	**1.20E+01**			
Total Activity Sum	**1.13E+01**	**2.34E+00**						**1.18E+01**	**1.23E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.33E+01	4.90E+00						**1.12**	**(from gamma)**		**58.7**			
Gross Beta	2.44E+01	5.70E+00					J	**3.56**	**1.48**		**144**			
Total Activity	3.85E+01	7.80E+00					J	**3.35**	**1.83**		**109**			

G01080004-04A			TLF-0703					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								8.00E-02	2.10E-01					U
Ra-226	9.80E-01	3.10E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.15E+00	2.30E-01												
Th-230	1.15E+00	2.30E-01												
Th-232	8.20E-01	1.80E-01												
U-234	1.46E+00	2.60E-01												
U-235	7.10E-02	4.20E-02						-2.00E-01	1.60E+00					U
U-238	1.62E+00	2.80E-01												
Total U Alpha	**3.15E+00**	**3.84E-01**												
Alpha Sum	**6.53E+00**	**2.16E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.62E+00	2.80E-01						7.00E-01	1.50E+00					UJ
Pa-234m (Assumed from U-238)	1.62E+00	2.80E-01						3.00E+00	1.50E+01					U
Ac-227														
Ra-228	8.50E-01	5.00E-01												
Pa-231	-8.00E-01	2.30E+00					U							
Beta Sum	**3.99E+00**	**6.95E-01**						**4.45E+00**	**1.51E+01**					
Total Activity Sum	**1.05E+01**	**2.27E+00**						**1.10E+01**	**1.52E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.50E+00	4.50E+00					J	**0.39**	**(from gamma)**		**26.2**			
Gross Beta	2.12E+01	4.90E+00					J	**3.48**	**1.06**		**137**			
Total Activity	3.98E+01	7.80E+00					J	**3.60**	**1.68**		**116**			

G01080004-05A			TLF-0490					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								4.00E-02	1.70E-01					U
Ra-226	8.70E-01	2.70E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	8.60E-01	1.80E-01												
Th-230	1.07E+00	2.10E-01												
Th-232	7.70E-01	1.70E-01												
U-234	8.50E-01	1.70E-01												
U-235	7.40E-02	3.60E-02						-1.40E-01	5.30E-01					U
U-238	7.70E-01	1.50E-01												
Total U Alpha	**1.69E+00**	**2.30E-01**												
Alpha Sum	**4.90E+00**	**1.86E+00**												
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	7.70E-01	1.50E-01						0.00E+00	1.70E+00					UJ
Pa-234m (Assumed from U-238)	7.70E-01	1.50E-01						-2.00E+00	3.60E+01					UJ
Ac-227														
Ra-228	7.70E-01	4.80E-01												
Pa-231	-4.00E-01	2.00E+00					U							
Beta Sum	**2.26E+00**	**5.77E-01**						**-1.28E+00**	**3.60E+01**					
Total Activity Sum	**7.17E+00**	**1.95E+00**						**3.63E+00**	**3.61E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.63E+01	5.70E+00					J	**1.90**	**(from gamma)**		**107**			
Gross Beta	1.80E+01	4.80E+00					J	**3.26**	**0.53**		**155**			
Total Activity	3.15E+01	7.00E+00					J	**3.35**	**0.76**		**126**			

G01080004-06A			TLF-0491					FROM GAMMA						
Analyses	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q	Result (pCi/g)	Uncertainty (pCi/g)	Duplicate Result (pCi/g)	Duplicate Uncertainty (pCi/g)	DER	RPD	Val Q
Am-241								6.00E-02	1.90E-01					U
Ra-226	1.10E+00	3.30E-01	8.20E-01	2.80E-01	**0.65**	**29.2**								
Np-237														
Pu-238														
Pu-239														
Th-228	1.00E+00	2.10E-01	9.90E-01	2.20E-01	**0.03**	**1.01**								
Th-230	1.04E+00	2.20E-01	9.20E-01	2.10E-01	**0.39**	**12.2**								
Th-232	9.30E-01	2.00E-01	7.60E-01	1.80E-01	**0.63**	**20.1**								
U-234	8.80E-01	1.80E-01	1.01E+00	1.90E-01	**0.50**	**13.8**								
U-235	5.90E-02	3.90E-02	7.40E-02	3.90E-02	**0.27**	**22.6**		-2.00E-02	6.70E-01					U
U-238	1.06E+00	2.00E-01	9.10E-01	1.80E-01	**0.56**	**15.2**								
Total U Alpha	**2.00E+00**	**2.72E-01**	**1.99E+00**	**2.65E-01**										
Alpha Sum	**5.62E+00**	**2.41E+00**	**5.48E+00**	**5.23E-01**										
Total U by KPA														
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.06E+00	2.00E-01	9.10E-01	1.80E-01	**0.56**	**15.2**		4.00E-01	1.50E+00					UJ
Pa-234m (Assumed from U-238)	1.06E+00	2.00E-01	9.10E-01	1.80E-01	**0.56**	**15.2**		-3.00E+00	2.90E+01					UJ
Ac-227														
Ra-228	7.80E-01	5.70E-01												
Pa-231	-5.00E-01	2.60E+00					U							
Beta Sum	**2.84E+00**	**7.09E-01**	**1.82E+00**	**2.55E-01**				**-1.88E+00**	**2.90E+01**					
Total Activity Sum	**8.46E+00**	**2.51E+00**	**7.30E+00**	**5.81E-01**				**3.74E+00**	**2.91E+01**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.39E+01	4.90E+00	1.46E+01	5.30E+00	**0.10**	**4.91**	J	**1.52**	**(from gamma)**		**84.9**			
Gross Beta	1.91E+01	4.80E+00	2.05E+01	5.00E+00	**0.20**	**7.07**	J	**3.35**	**0.71**		**148**			
Total Activity	3.03E+01	6.70E+00	3.73E+01	7.50E+00	**0.70**	**20.7**	J	**3.05**	**0.89**		**113**			

Radiological Analytical Data Verification
Comments on Data for SDG 45784

This sample delivery group (SDG) contained one individual source water sample and two equipment rinsate samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry, any radioisotopes detected above the decision level (DL) by gamma spectrometry, ^{226}Ra by radon emanation, ^{228}Ra and gross alpha/beta by gas proportional counting, total uranium by KPA, and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by General Engineering Laboratories. The equipment rinsate samples are applicable to all Tonawanda site soil samples. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
SW-1	45784002

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the liquid samples.

Equipment Rinsate Sample:

There were no indications of equipment rinsate blank contamination for gamma spectrometry analyses.

Laboratory Control Sample:

The percent recovery (36300%) for the laboratory control sample (LCS) was outside acceptable limits. The radionuclide used for the LCS was ^{241}Am, which is subject to variations in the Compton region of the gamma spectrum. **Therefore, it is recommended that the gamma spectrometry result for sample SW-1 be qualified as estimated (J).**

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all gamma spectrometry analyses.

Matrix Spike Analysis:

The percent recovery (493000 %) for the MS for the gamma spectrometry analysis is outside acceptable limits. The radionuclide used for the MS was ^{241}Am, which is subject to variations in the Compton region of the gamma spectrum. **Therefore, it is recommended that the gamma spectrometry result for sample SW-1 be qualified as estimated (J).**

Identification and Quantification:

All target radionuclides were reported. As the following tables show, ^{228}Ac, ^{241}Am, ^{231}Pa, ^{234m}Pa, ^{234}Th and ^{235}U gamma emitting radionuclides were reported in all samples. There were no incidents of identified radionuclides being excluded from the laboratory reports. No problems were observed for the gamma spectrometry analyses.

The MDA is an estimate of the concentration of the analyte that must be present in order to have assurance that it will be statistically distinguished (with a given confidence) from the background. However, the software-calculated MDA does not reflect the selected instrument peak search sensitivity factor used by the analysis software to determine which peaks are reported as present. When the peak search sensitivity factor is set at a value greater than 2.3, the reported value is not an estimate of the true concentration nor is it an upper limit for the true concentration in the sample. The extent to which the reported value could be lower than the true 95% confident less than value depends on the sample background and the selected sensitivity factor. The laboratory used a peak search sensitivity factor of 3. Therefore, there is a greater

than 5% chance that concentrations greater than the reported less than value may be present in these samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There is an indication of blank contamination in the method blank for ^{230}Th. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). Sample SW-1 has a result that is less than 5 times the blank value for the ^{230}Th analyses. **Therefore, it is recommended that the ^{230}Th results for sample SW-1 be qualified as estimated (J).**

Equipment Rinsate Blank:

There were indications of equipment rinsate blank contamination for ^{230}Th. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). Sample SW-1 has a ^{230}Th activity greater than 5 times the equipment rinsate values. **Therefore, it is recommended that the ^{230}Th result for sample SW-1 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs are within acceptable limits for the duplicate analysis for all alpha spectrometry analyses.

Matrix Spike Sample:

The percent recovery for the MSS for the ^{230}Th alpha spectrometry analysis was within acceptable limits.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 80.52 % for all samples for the alpha thorium and uranium analyses. The sample-specific percent recovery thorium result for sample SW-1 has an uncertainty of 16.00 %. **Therefore, it is recommended that the ^{227}Ac and $^{228/230/232}$Th results for sample SW-1 be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the samples' alpha spectra for isotopic thorium or uranium.

3.0 ^{226}Ra and ^{228}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{228}Ra analysis.

There is an indication of blank contamination in the method blank for ^{226}Ra. All associated sample results less than 5 times the blank value for ^{226}Ra analyses should be qualified as estimated (J). Sample SW-1 has a result that is less than 5 times the blank value for the ^{226}Ra analyses. **Therefore, it is recommended that the ^{226}Ra result for sample SW-1 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs for the $^{226/228}$Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the $^{226/228}$Ra analyses were within acceptable limits.

Matrix Spike Sample:

The percent recoveries for the MSSs for the $^{226/228}$Ra analyses were within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{228}Ra analysis were within acceptable limits.

Method Detection Limit:

The sample met the required method detection limits (MDL) of 1.0 pCi/L for ^{228}Ra and 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Blank:

There were indications of equipment rinsate blank contamination for the gross beta analysis. All associated sample results less than 5 times the blank value for gross beta analyses should be qualified as estimated (J). Sample SW-1 has a gross beta activity greater than 5 times the equipment rinsate values. **Therefore, it is recommended that the gross beta result for sample SW-1 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Quantification:

It is recommended that the gross beta analysis results for sample SW-1 be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/L. All of the samples results met the required MDL.

5.0 TOTAL ACTIVITY ANALYSIS

Method Blank:

No blank contamination was indicated for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analyses is within acceptable limits.

Matrix Spike Analysis:

The MS percent recoveries for the total analyses were within acceptable limits for sample SW-1.

6.0 TOTAL URANIUM BY KPA

Method Blank:

There was an indication of blank contamination for the total uranium analyses. All sample results less than 5 times the blank value for the total uranium analysis should be qualified as estimated (J). Sample SW-1 has total uranium results less than 5 times the blank values. **Therefore, it is recommended that the total uranium result for sample SW-1 be qualified as estimated (J).**

Equipment Rinsate Blank:

There were indications of equipment rinsate blank contamination for the total uranium analysis. All associated sample results less than 5 times the blank value for total uranium analyses should be qualified as estimated (J). Sample SW-1 has a total uranium activity greater than 5 times the equipment rinsate values. **Therefore, it is recommended that the gross beta result for sample SW-1 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total uranium analysis.

Duplicate Analysis:

The total uranium laboratory duplicate DER (2.23) is outside acceptable limits. However, the RPD (14.6 %) is within acceptable limits, therefore, no qualification is required.

Matrix Spike Sample:

The percent recovery for the MSS for the total uranium analysis is within acceptable limits.

7.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For both samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER for sample SW-1 indicates that the gross alpha analysis agrees with the sum of the alpha emitters within a 99% confidence level.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs for sample SW-1 is less than or equal to 1.29 indicating that the gross beta analyses are in agreement with the sum of the beta emitters within a 99% confidence level.

Total Activity to Sum of Alpha and Beta Emitters:

The DER for sample SW-1 indicates that the total activity analysis agrees with the sum of the alpha and beta emitters within a 99% confidence level.

^{228}Ac Gamma to ^{228}Ra Beta and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

^{231}Pa Gamma to ^{235}U Alpha:

The ^{231}Pa and ^{235}U activities are within the measurement uncertainties.

Summary:

Based on the agreements between the gross analyses and the sums of the individual analysis, all activity is accounted for in sample SW-1.

45784002			SW-1					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								2.14E-01	9.82E+00	-2.53E+00	9.88E+00	**0.20**	**237**	UJ
Ra-226	1.96E-01	2.57E-01	6.38E-01	9.00E-01	**0.47**	**106**	UJ							
Np-237														
Pu-238														
Pu-239														
Th-228	3.28E-01	2.59E-01	1.84E-01	1.99E-01	**0.44**	**56.3**	J							
Th-230	-1.33E-02	1.63E-01	7.77E-03	5.22E-02	**0.12**	**762**	UJ							
Th-232	4.37E-02	1.36E-01	7.93E-03	3.52E-02	**0.25**	**139**	UJ							
U-234	-5.14E-02	1.22E-01	1.99E-03	6.80E-02	**0.38**	**216**	U							
U-235	-6.49E-02	6.78E-02	2.53E-02	4.88E-02	**1.08**	**456**	U	0.00E+00	9.49E+00	0.00E+00	1.17E+01	**0.00**	**0.00**	UJ
U-238	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U							
Total U Alpha	**-7.34E-02**	**1.82E-01**	**6.91E-02**	**1.02E-01**										
Alpha Sum	**-4.94E+01**	**5.76E+01**	**-1.52E+01**	**5.64E+01**										
Total U by KPA	0.35 µg/L	0.02 µg/L	0.30 µg/L	0.01 µg/L	**2.23**	**14.6**	J							
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	6.76E+00	8.52E+00	3.55E+00	1.01E+01	**0.24**	**62.3**	UJ							
Th-234 (Assumed from U-238)	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U	5.59E+01	8.21E+01					UJ
Pa-234m (Assumed from U-238)	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U	0.00E+00	1.83E+02					UJ
Ac-227														
Ra-228	4.70E-01	7.28E-01	4.74E-01	7.53E-01	**0.00**	**0.85**	U							
Pa-231	-5.54E+01	6.40E+01	-1.79E+01	6.27E+01	**0.42**	**102**	UJ							
Beta Sum	**6.68E-01**	**1.15E+01**	**1.96E+00**	**1.26E+01**				**5.65E+01**	**2.01E+02**					
Total Activity Sum	**-4.87E+01**	**5.87E+01**	**-1.32E+01**	**5.78E+01**				**7.10E+00**	**2.09E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-1.80E-02	2.93E-01	0.00E+00	2.74E-01	**0.04**	**200**	U	**0.86**	**(from gamma)**		**200**			
Gross Beta	-4.68E-01	7.19E-01	1.28E-01	6.77E-01	**0.60**	**351**	UJ	**0.10**	**0.28**		**1137**			
Total Activity	9.70E+00	4.39E+02	-2.17E+02	4.37E+02	**0.37**	**219**	U	**0.13**	**0.01**		**299**			

45784002			SW-1					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								2.14E-01	9.82E+00	-2.53E+00	9.88E+00	**0.20**	**237**	UJ
Ra-226	1.96E-01	2.57E-01	6.38E-01	9.00E-01	**0.47**	**106**	UJ							
Np-237														
Pu-238														
Pu-239														
Th-228	3.28E-01	2.59E-01	1.84E-01	1.99E-01	**0.44**	**56.3**	J							
Th-230	-1.33E-02	1.63E-01	7.77E-03	5.22E-02	**0.12**	**762**	UJ							
Th-232	4.37E-02	1.36E-01	7.93E-03	3.52E-02	**0.25**	**139**	UJ							
U-234	-5.14E-02	1.22E-01	1.99E-03	6.80E-02	**0.38**	**216**	U							
U-235	-6.49E-02	6.78E-02	2.53E-02	4.88E-02	**1.08**	**456**	U	0.00E+00	9.49E+00	0.00E+00	1.17E+01	**0.00**	**0.00**	UJ
U-238	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U							
Total U Alpha	**-7.34E-02**	**1.82E-01**	**6.91E-02**	**1.02E-01**										
Alpha Sum	**-4.94E+01**	**5.76E+01**	**-1.52E+01**	**5.64E+01**										
Total U by KPA	0.35 µg/L	0.02 µg/L	0.30 µg/L	0.01 µg/L	**2.23**	**14.6**	J							
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	6.76E+00	8.52E+00	3.55E+00	1.01E+01	**0.24**	**62.3**	UJ							
Th-234 (Assumed from U-238)	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U	5.59E+01	8.21E+01					UJ
Pa-234m (Assumed from U-238)	4.29E-02	1.17E-01	4.18E-02	5.87E-02	**0.01**	**2.60**	U	0.00E+00	1.83E+02					UJ
Ac-227														
Ra-228	4.70E-01	7.28E-01	4.74E-01	7.53E-01	**0.00**	**0.85**	U							
Pa-231	-5.54E+01	6.40E+01	-1.79E+01	6.27E+01	**0.42**	**102**	UJ							
Beta Sum	**6.68E-01**	**1.15E+01**	**1.96E+00**	**1.26E+01**				**5.65E+01**	**2.01E+02**					
Total Activity Sum	**-4.87E+01**	**5.87E+01**	**-1.32E+01**	**5.78E+01**				**7.10E+00**	**2.09E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-1.80E-02	2.93E-01	0.00E+00	2.74E-01	**0.04**	**200**	U	**0.86**	**(from gamma)**		**200**			
Gross Beta	-4.68E-01	7.19E-01	1.28E-01	6.77E-01	**0.60**	**351**	UJ	**0.10**	**0.28**		**1137**			
Total Activity	9.70E+00	4.39E+02	-2.17E+02	4.37E+02	**0.37**	**219**	U	**0.13**	**0.01**		**299**			

Radiological Analytical Data Verification
Comments on Data for SDG 46757

This sample delivery group (SDG) contained four (4) individual surface water and lechate samples and two equipment rinsate samples from the Tonawanda Landfill FUSRAP Site for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U, ^{241}Am, and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; ^{228}Ra and gross alpha/beta by gas proportional counting; total uranium by KPA; and total activity by liquid scintillation were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by General Engineering Laboratories. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLW-0100	46757001
TLW-0101	46757002
TLW-9103	46757003
TLW-0102	46757004

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were assumed to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blank for the liquid samples.

Equipment Rinsate Sample:

There was an indication of ^{234}Th contamination of equipment rinsate blank contamination for gamma spectrometry analyses. All associated sample results less than 5 times the blank value for ^{234}Th analyses should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{234}Th results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recovery for the laboratory control sample (LCS) was within acceptable limits.

Duplicate Analysis:

The DERs (1.96 and 4.81) are outside acceptable limits for the duplicate analysis for ^{234}Th, and ^{40}K gamma spectrometry analyses. The respective RPDs (200% and 143%) are also outside acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the gamma spectrometry analyses. No qualification is necessary.

Matrix Spike Analysis:

The percent recovery for the MS for the total gamma spectrometry analysis was within acceptable limits.

Identification and Quantification:

As the following tables show, all target radionuclides (^{228}Ac, ^{241}Am, ^{40}K, ^{231}Pa, ^{234m}Pa, ^{234}Th and ^{235}U) plus ^{40}K were reported for all samples.

The MDA is an estimate of the concentration of the analyte that must be present in order to have assurance that it will be statistically distinguished (with a given confidence) from the background. However, the software-calculated MDA does not reflect the selected instrument peak search sensitivity factor used by the analysis software to determine which peaks are reported as present. When the peak search sensitivity factor is set at a value greater than 2.3, the reported value is not an estimate of the true concentration nor is it an upper limit for the true

concentration in the sample. The extent to which the reported value could be lower than the true 95% confident less than value depends on the sample background and the selected sensitivity factor. The laboratory used a peak search sensitivity factor of 3. Therefore, there is a greater than 5% chance that concentrations greater than the reported less than value may be present in these samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There is an indication of blank contamination in the method blank for ^{235}U. All associated sample results less than 5 times the blank value for ^{230}Th analyses should be qualified as estimated (J). All samples had ^{235}U results greater than 5 times the blank. No qualification is necessary.

Equipment Rinsate Blank:

There were indications of equipment rinsate blank contamination for ^{234}U. All associated sample results less than 5 times the blank value for ^{234}U analyses should be qualified as estimated (J). Based on assumed sample and rinsate sizes, all samples had ^{234}U results greater than 5 times the blank. No qualification is necessary.

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DER (1.59) is outside acceptable limits for the duplicate analysis for the ^{234}U alpha spectrometry analyses. The RPD (153%) is also outside acceptable limits. However, the duplicate analyses for the thorium and uranium samples were analyzed using the EQ-5 equipment rinsate sample. **Therefore, it is recommended that the $^{234/235/238}U$ and $^{228/230/232}Th$ results for all samples be qualified as estimated (J).**

Matrix Spike Sample:

The percent recovery for the MSS for all the alpha spectrometry analyses was within acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the MS gamma spectrometry analyses. Since these are water samples, no qualification of the results is recommended.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 20.52% for all samples for the alpha thorium and uranium analyses. The sample-specific percent recovery uncertainties uranium results for samples TLW-0100, TLW-0101, TLW-9103 ranged from 10.14 to 14.14%. **Therefore, it is recommended that the $^{234/235/238}$U results for samples TLW-0100, TLW-0101, TLW-9103 be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the samples' alpha spectra for isotopic thorium or uranium.

3.0 ^{226}Ra and ^{228}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

There is an indication of blank contamination in the method blanks for ^{228}Ra. All associated sample results less than 5 times the blank value for ^{228}Ra analyses should be qualified as estimated (J). **Therefore, it is recommended that the ^{228}Ra results for samples TLW-0100, TLW-0101, TLW-9103 be qualified as estimated (J).**

Equipment Rinsate Blank:

There were indications of equipment rinsate blank contamination for the $^{226/228}$Ra analyses. All associated sample results less than 5 times the blank value for the $^{226/228}$Ra analyses should be qualified as estimated (J). **Therefore, it is recommended that the ^{226}Ra results for samples TLW-0100 and TLW-0101 and the ^{228}Ra results for samples TLW-0100, TLW-0101, and TLW-9103 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs for the $^{226/228}$Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DERs for the $^{226/228}$Ra analyses were within acceptable limits. For samples TLW-0101 and TLW-0102, the laboratory used water samples from another project for the $^{226/228}$Ra analyses. No qualification of the results is recommended.

Matrix Spike Sample:

The percent recovery for the one of the MSS (23%) for the ^{228}Ra analyses was outside acceptable limits. **Therefore, it is recommended that the ^{228}Ra results for samples TLW-0100 and TLW-9103 be qualified as estimated (J).** The laboratory used water samples from another project for the MS ^{228}Ra analyses for samples TLW-0101 and TLW-0102. No further qualification of these results is recommended.

Chemical Recoveries:

In the ^{226}Ra analysis, the entire sample is de-emanated and no chemical separation takes place. Therefore 100% recovery is assumed for all samples. The MSSs for the ^{226}Ra analysis, which was discussed above, recovered within acceptable limits, indicating the procedure's performance is acceptable.

The sample-specific chemical recoveries for the ^{228}Ra analyses were within acceptable limits.

Method Detection Limit:

The sample met the required method detection limits (MDL) of 1.0 pCi/L for ^{228}Ra and 0.5 pCi/L for ^{226}Ra.

4.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha/beta analyses.

Equipment Rinsate Blank:

There were no indications of equipment rinsate blank contamination for the gross beta analysis.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs (2.01 and 1.99) for the gross alpha/beta analyses are outside acceptable limits. The RPDs (191% and 164%) are also outside acceptable limits. The laboratory used water samples from another project for the gross alpha/beta analyses. No qualification of the results is recommended.

Matrix Spike and Matrix Spike Dupliate Samples:

The MS (65%) and MSD (64%) results for the gross alpha analyses were outside acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the MS gross alpha/bets analyses. Since these are water samples from another project, no qualification of the results is recommended.

Quantification:

It is recommended that the gross beta analysis results for samples TLW-0100, TLW-0101, TLW-9103, and TLW-0102 be qualified as estimated (J) because the gross beta analysis was performed using gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

Method Detection Limit:

The required method detection limit (MDL) for the gross alpha/beta analysis is 1 pCi/L. All of the samples results met the required MDL.

5.0 TOTAL ACTIVITY ANALYSIS

Method Blank:

No blank contamination was indicated for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analyses is within acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the total activity analyses. Since these are water samples, no qualification of the results is recommended.

Matrix Spike Analysis:

The MS percent recoveries for the total analyses were within acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the MS total activity analyses. Since both SDG consist of water samples from another project, no qualification is recommended.

Quantification:

Improper background subtraction is indicated when a negative result is reported with a smaller 2σ uncertainty. This would indicate a negative bias on the analysis data for a particular radionuclide. Improper background subtractions were indicated for the total activity result for

sample TLW-0102. **Therefore, it is recommended that the total activity result for sample TLW-0102 be qualified as estimated (J).**

6.0 TOTAL URANIUM BY KPA

Method Blank:

There were indications of blank contamination for the total uranium analyses. All associated sample results less than 5 times the blank value for total uranium analyses should be qualified as estimated (J). All samples had total uranium results greater than 5 times the blank. No qualification is necessary.

Equipment Rinsate Blank:

There were no indications of equipment rinsate blank contamination for the total uranium analysis.

Laboratory Control Sample:

The percent recoveries for the reported LCSs are within acceptable limits for the total uranium analysis.

Duplicate Analysis:

The total uranium laboratory duplicate DER (14.4) is outside acceptable limits. The RPD (197%) is also outside acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the total uranium analyses. Since these are water samples from another project, no qualification of the results is recommended.

Matrix Spike Sample:

The percent recovery for the MSS for the total uranium analysis is within acceptable limits. The laboratory used samples from a batch of water samples from separate SDG for the MS total uranium analyses. Since both SDG consist of water samples, no qualification is recommended.

7.0 DATA INTERCOMPARISON

U Alpha to U Gamma:

For all samples, the uranium alpha and uranium gamma agree within the uncertainties. No further qualification of the gamma spectrometry results is required since it is for information purposes only.

^{228}Ac Gamma to ^{228}Ra Beta and ^{232}Th:

When comparing the ^{228}Ac activity to ^{228}Ra activity, it was assumed that the actinium and radium are in equilibrium with ^{232}Th. The activities are all within the uncertainties of the measurements for all three radionuclides.

^{231}Pa Gamma to ^{235}U Alpha:

The ^{231}Pa and ^{235}U activities are within the measurement uncertainties.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

For the comparison of gross alpha with the sum of the alpha emitters, the DERs for all samples are within acceptable limits. This is an indication that the gross alpha analysis agrees with the sum of the alpha emitters within a 99% confidence limit. No qualification of the gross alpha analysis is required.

When comparing the sums of the beta emitters to the gross beta analyses, it was assumed that the ^{234}Th and ^{234m}Pa are in equilibrium with ^{238}U, thus having the same activity as the ^{238}U. The DERs (7.59, 3.26, and 4.35) for samples TLW-0100, TLW0101, TLW-9103 indicates that the gross beta analysis does not agree with the sum of the beta emitters within a 99% confidence level. The RPDs (144%, 96.1%, 118.8%) are also outside acceptable limits. In each case, the gross beta activity is smaller than the beta sum activities. This discrepancy is most likely due to the loss of volatile radionuclides and the use of the gas proportional counting method. No further qualification of the gross beta analysis is required.

Total Activity to Sum of Alpha and Beta Emitters:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DER (1.95) for sample TLW-0102 indicates that the total activity analysis does not agree with the sum of the alpha and beta emitters within a 99% confidence level. The RPD (286%) is also out side acceptable limits. The total activity result is much smaller than the sum of the alpha and beta emitters. However, since improper background subtraction was identified for this sample's total activity analysis, no further qualification is necessary.

Summary:

Based on the agreements between the gross analyses and the sums of the individual analysis, all alpha activity is accounted for in all samples. Samples TLW-0100, TLW-0101, and TLW-9103 exhibit a negative bias for gross beta analyses and TLW-0102 exhibits a negative bias for the total activity analysis.

46757001			TLW-0100					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								6.37E+00	5.32E+00	6.73E+00	9.66E+00	**0.03**	**5.50**	
Ra-226	3.06E+00	2.13E+00	1.02E+00	7.99E-01	**0.90**	**100**	J							
Np-237														
Pu-238														
Pu-239														
Th-228	2.61E-01	2.36E-01					J							
Th-230	2.20E-01	1.77E-01					J							
Th-232	1.51E-01	1.33E-01					J							
U-234	2.17E+02	3.56E+01					J							
U-235	2.07E+01	3.92E+00					J	1.60E+01	2.47E+01	7.45E+00	1.66E+01	**0.29**	**73**	U
U-238	2.11E+02	3.46E+01					J							
Total U Alpha	**4.49E+02**	**4.98E+01**												
Alpha Sum	**4.23E+02**	**1.06E+02**												
Total U by KPA	416.0 µg/g	2.87E+01	3.67 µg/L	0.16 µg/L	**14.4**	**197**								
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.97E+01	2.68E+01	1.30E+01	8.25E+00	**0.24**	**41.0**	U							
Th-234 (Assumed from U-238)	2.11E+02	3.46E+01						2.99E+02	1.18E+02	0.00E+00	9.61E+01	**1.96**	**200**	
Pa-234m (Assumed from U-238)	2.11E+02	3.46E+01						4.82E+02	7.15E+02	2.87E+02	2.36E+02	**0.26**	**50.7**	U
K-40	4.77E+02	6.80E+01	7.96E+01	4.68E+01	**4.81**	**143**								
Ra-228	1.89E+00	1.29E+00	1.35E-01	1.23E+00	**0.98**	**173**	J							
Pa-231	-3.28E+01	1.04E+02	-6.08E+00	9.73E+01	**0.19**	**137**	U							
Beta Sum	**9.17E+02**	**8.88E+01**						**1.28E+03**	**7.28E+02**	**3.79E+02**	**2.59E+02**			
Total Activity Sum	**1.34E+03**	**1.38E+02**						**1.70E+03**	**7.36E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.66E+02	1.29E+02	6.06E+00	2.83E+00	**2.01**	**191**		**0.94**	**(from gamma)**		**45.5**			
Gross Beta	1.50E+02	6.79E+01	1.47E+01	3.42E+00	**1.99**	**164**	J	**6.86**	**1.54**		**144**			
Total Activity	-9.17E+02	3.62E+03	2.34E+02	3.59E+03	**0.23**	**337**	U	**0.62**	**0.71**		**1068**			

46757002			TLW-0101					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-5.27E+00	9.46E+00					U
Ra-226	2.00E+00	1.46E+00					J							
Np-237														
Pu-238														
Pu-239														
Th-228	2.16E-01	2.41E-01					J							
Th-230	5.31E-01	3.09E-01					J							
Th-232	7.69E-02	1.49E-01					UJ							
U-234	1.72E+02	3.29E+01					J							
U-235	9.21E+00	2.53E+00					J	2.14E+01	2.32E+01					
U-238	1.70E+02	3.25E+01					J							
Total U Alpha	**3.51E+02**	**4.63E+01**												
Alpha Sum	**3.01E+02**	**8.59E+01**												
Total U by KPA	459.00 µg/L	32.60 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.34E+01	1.24E+01												
Th-234 (Assumed from U-238)	1.70E+02	3.25E+01						2.37E+02	1.39E+02					
Pa-234m (Assumed from U-238)	1.70E+02	3.25E+01						3.16E+02	3.13E+02					
K-40	2.43E+02	5.21E+01												
Ra-228	3.23E+00	2.32E+00	2.20E+00	9.79E-01	**0.41**	**37.9**	J							
Pa-231	-5.86E+01	8.03E+01					U							
Beta Sum	**5.93E+02**	**7.13E+01**						**8.06E+02**	**3.47E+02**					
Total Activity Sum	**8.94E+02**	**1.12E+02**						**1.11E+03**	**3.57E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.18E+02	1.46E+02						**0.10**	**(from gamma)**		**5.40**			
Gross Beta	2.08E+02	9.42E+01					J	**3.26**	**1.66**		**96.1**			
Total Activity	3.46E+03	3.66E+03						**0.70**	**0.64**		**118**			

46757003			TLW-9103					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								3.93E+00	8.20E+00					U
Ra-226	7.20E+00	4.90E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	1.13E-01	2.17E-01					UJ							
Th-230	4.65E-01	3.08E-01					J							
Th-232	8.04E-02	1.13E-01					UJ							
U-234	1.60E+02	3.12E+01					J							
U-235	1.55E+01	3.84E+00					J	1.29E+01	1.97E+01					U
U-238	1.65E+02	3.22E+01					J							
Total U Alpha	**3.41E+02**	**4.50E+01**												
Alpha Sum	**3.10E+02**	**8.32E+01**												
Total U by KPA	294.00 µg/L	20.30 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac228	7.95E+00	1.66E+01					U							
Th-234 (Assumed from U-238)	1.65E+02	3.22E+01						2.30E+02	1.54E+02					
Pa-234m (Assumed from U-238)	1.65E+02	3.22E+01						6.29E+02	4.27E+02					
K-40	2.18E+02	4.99E+01												
Ra-228	2.38E+00	1.36E+00					J							
Pa-231	-4.24E+01	7.75E+01					U							
Beta Sum	**5.53E+02**	**7.02E+01**						**1.08E+03**	**4.57E+02**					
Total Activity Sum	**8.63E+02**	**1.09E+02**						**1.39E+03**	**4.65E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.28E+02	1.05E+02						**0.61**	**(from gamma)**		**30.5**			
Gross Beta	1.41E+02	6.38E+01					J	**4.35**	**2.04**		**118.8**			
Total Activity	-1.63E+03	3.59E+03					U	**0.69**	**0.83**		**651**			

46757004			TLW-0102					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								5.30E+00	1.39E+01					U
Ra-226	5.08E+00	3.47E+00												
Np-237														
Pu-238														
Pu-239														
Th-228	4.28E+00	1.05E+00					J							
Th-230	4.34E+00	1.05E+00					J							
Th-232	2.77E+00	7.42E-01					J							
U-234	3.56E+00	7.56E-01					J							
U-235	3.25E-01	1.80E-01					J	1.39E+01	2.46E+01					U
U-238	3.21E+00	7.01E-01					J							
Total U Alpha	**7.10E+00**	**1.05E+00**												
Alpha Sum	**6.02E+00**	**8.89E+01**												
Total U by KPA	5.16 µg/L	0.26 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	3.35E+01	1.76E+01												
Th-234 (Assumed from U-238)	3.21E+00	7.01E-01						1.55E+02	1.67E+02					
Pa-234m (Assumed from U-238)	3.21E+00	7.01E-01						6.94E+02	4.25E+02					
K-40	1.07E+03	8.58E+01												
Ra-228	3.23E+01	6.29E+00												
Pa-231	-1.95E+01	9.87E+01					U							
Beta Sum	**1.14E+03**	**8.86E+01**						**1.98E+03**	**4.65E+02**					
Total Activity Sum	**1.15E+03**	**1.26E+02**						**1.99E+03**	**4.74E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	3.10E+01	3.09E+01						**0.27**	**(from gamma)**		**135**			
Gross Beta	5.98E+02	5.39E+02					J	**0.99**	**1.94**		**62.4**			
Total Activity	-6.48E+03	3.90E+03					UJ	**1.95**	**2.16**		**286**			

46757005			EQ-5					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.06E+01	9.68E+00					U
Ra-226	4.32E-01	4.02E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.42E-01	1.50E-01	1.02E-01	1.65E-01	**0.18**	**32.8**								
Th-230	1.92E-02	6.33E-02	1.12E-01	1.41E-01	**0.60**	**141**	U							
Th-232	-1.50E-02	2.10E-02	6.60E-03	5.19E-02	**0.39**	**514**	U							
U-234	4.51E-02	7.03E-02	3.36E-01	1.69E-01	**1.59**	**153**	U							
U-235	5.80E-02	8.19E-02	1.25E-01	1.00E-01	**0.52**	**73.2**	U	1.98E+00	1.70E+01					U
U-238	1.27E-02	4.13E-02	3.75E-02	5.23E-02	**0.37**	**98.8**	U							
Total U Alpha	**1.16E-01**	**1.16E-01**	**4.99E-01**	**2.03E-01**										
Alpha Sum	**2.81E+01**	**7.43E+01**	**7.19E-01**	**3.02E-01**										
Total U by KPA	-0.18 µg/L	0.02 µg/L					U							
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.08E+01	1.67E+01					U							
Th-234 (Assumed from U-238)	1.27E-02	4.13E-02	3.75E-02	5.23E-02	**0.37**	**98.8**	U	1.44E+02	8.81E+01					
Pa-234m (Assumed from U-238)	1.27E-02	4.13E-02	3.75E-02	5.23E-02	**0.37**	**98.8**	U	5.11E+01	2.33E+02					U
K-40														
Ra-228	2.80E+00	1.08E+00												
Pa-231	3.04E+01	8.26E+01					U							
Beta Sum	**1.73E+01**	**1.95E+01**	**7.50E-02**	**7.40E-02**				**2.12E+02**	**2.50E+02**					
Total Activity Sum	**4.53E+01**	**7.68E+01**	**7.94E-01**	**3.11E-01**				**2.40E+02**	**2.61E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-1.55E-01	7.20E-01					U	**0.38**	**(from gamma)**		**202**			
Gross Beta	1.56E-01	6.98E-01					U	**0.88**	**0.85**		**196**			
Total Activity	-6.31E+02	8.83E+02					U	**0.76**	**0.95**		**231**			

46757006			EQ-4					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								1.79E+00	1.54E+01					U
Ra-226	7.58E-01	6.12E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.51E-02	1.83E-01					U							
Th-230	1.00E-01	1.64E-01					U							
Th-232	1.62E-02	5.28E-02					U							
U-234	5.19E-01	2.28E-01												
U-235	6.54E-02	9.24E-02					U	9.36E+00	1.62E+01					U
U-238	6.34E-02	1.06E-01					U							
Total U Alpha	**6.48E-01**	**2.68E-01**												
Alpha Sum	**2.93E+00**	**6.79E+01**												
Total U by KPA	-0.15 µg/L	0.02 µg/L					U							
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.89E+00	5.92E+00					U							
Th-234 (Assumed from U-238)	6.34E-02	1.06E-01					U	9.25E+01	1.83E+02					U
Pa-234m (Assumed from U-238)	6.34E-02	1.06E-01					U	1.89E+02	1.83E+02					
K-40														
Ra-228	2.21E+00	1.10E+00												
Pa-231	1.52E+00	7.54E+01					U							
Beta Sum	**4.41E+00**	**1.09E+01**						**2.86E+02**	**2.59E+02**					
Total Activity Sum	**7.33E+00**	**6.87E+01**						**2.89E+02**	**2.68E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-8.23E-02	6.69E-01					U	**0.04**	**(from gamma)**		**212**			
Gross Beta	-1.07E+00	8.37E-01					U	**0.50**	**1.11**		**328**			
Total Activity	-1.41E+03	8.69E+02					U	**1.63**	**1.87**		**202**			

Radiological Analytical Data Verification
Comments on Data for SDG 49323

This sample delivery group (SDG) contained six (6) Individual water samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra by beta counting, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by General Engineering Laboratories. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLW-0150	49323001
TLW-0152	49323002
TLW-0154	49323003
TLW-9178	49323004
TLW-0151	49323005
TLW-9180	49323006

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were declared to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was no indication of blank contamination in the gamma spectrometry equipment rinsate blanks.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ac, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for in all samples.

The laboratory was instructed to report any radioisotopes detected above the DL. Based on the gamma summary of nuclides report, ^{40}K was identified significantly above the level of the blank but not reported in four of the samples above the required DL (Samples TLW-0150, TLW-9178, TLW-0151, TLW-9180. The laboratory data also shows that ^{137}Cs peaks were identified in gamma spectrometry report for TLW-0150 and TLW-0152 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). **Since both of the radioisotopes are also beta emitters, they should have been included in the laboratory's report in order to account for any beta activity present in the samples.** Other peaks detected but not reported were mostly also detected in the blank. There were a few peaks detected that were not included in the blank; however, since there is not detector specific background information, their identification was uncertain and it is not recommended that they be included in the report.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for the ^{230}Th and ^{234}U analyses. All samples with ^{230}Th or ^{234}U results less than 5 times the blank should be qualified as estimated (J).

Therefore, it is recommended that the ^{230}Th results for samples TLW-0152 and TLW-0154 be qualified and estimated (J).

.

Equipment Rinsate Blanks:

There was an indication of contamination in one of the rinsate blanks for ^{230}Th. All samples with results less than 5 times the rinsate blank for ^{230}Th should be qualified as estimated. **Therefore, it is recommended that the ^{230}Th results for samples TLW-0152 and TLW-0154 be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 80% for all samples for the Th analyses and greater than 40% for all U alpha spectrometry analyses. However, the sample-specific percent recovery for thorium results for all samples have greater than 10% uncertainty. **Therefore, it is recommended that all Th results for all samples be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the alpha spectra analyses.

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

In the ^{226}Ra analysis, the entire sample is de-emanated and no chemical separation takes place. Therefore, 100% recovery is assumed for all samples. The Matrix Spike Sample (MSS) for the ^{226}Ra analysis was within acceptable limits, indicating the procedure's recovery performance is acceptable.

4.0 ^{228}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{228}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{228}Ra. All samples with results less than 5 times the rinsate blank for ^{228}Ra should be qualified as estimated. All of the results for ^{228}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{228}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{228}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{228}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{228}Ra analysis were all above 77%. However there was greater than 10% uncertainty in the sample-specific chemical recoveries for the ^{228}Ra

analysis for sample TLW-0154. Therefore, it is recommended that the ^{228}Ra results for sample TLW-0154 be qualified as estimated (J).

5.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha or gross beta analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for the gross alpha/beta MSS is within acceptable limits for the gross alpha/beta analyses.

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

6.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

7.0 TOTAL URANIUM

Method Blank:

There was indication of blank contamination for the total uranium analysis.. All samples with total uranium results less than 5 times the blank should be qualified as estimated (J). All samples had total uranium results greater than 5 times the blank; therefore, no qualification of the data is necessary.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total uranium analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total uranium analysis.

Duplicate Analysis:

The duplicate DER for the total uranium analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total uranium analysis.

8.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The ^{238}U results for samples for all samples are in agreement with the corresponding ^{234}Th results within the uncertainties.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra (^{228}Ac) gamma activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another and no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha and gross beta DERs for all samples were less than 1.29 indicating that the gross alpha analyses are in agreement with the sum of the alpha or beta emitters within a 99% confidence level.

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were less than 1.29 indicating that the total activity analyses are in agreement with the total activity sums within a 99% confidence level.

49323001			TLW-0150					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								1.89E+00	1.57E+01	-6.47E+00
Ra-226	9.31E-01	3.91E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	4.80E-01	2.55E-01					J			
Th-230	2.96E+00	6.32E-01					J			
Th-232	3.12E-01	1.63E-01					J			
U-234	5.82E+01	8.77E+00								
U-235	2.45E+00	6.12E-01						0.00E+00	1.39E+01	1.13E+01
U-238	5.83E+01	8.79E+00								
Total U Alpha	**1.19E+02**	**1.24E+01**								
Alpha Sum	**2.30E+02**	**2.19E+01**								
Total U by KPA	175.00 µg/L	12.00 µg/L	164.00 µg/L	10.80 µg/L	**0.68**	**6.49**				
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	4.20E+00	1.17E+01	0.00E+00	6.80E+00	**0.31**	**200**	U			
Th-234 (Assumed from U-238)	5.83E+01	8.79E+00						1.26E+02	1.77E+02	3.62E+01
Pa-234m (Assumed from U-238)	5.83E+01	8.79E+00						0.00E+00	2.50E+02	0.00E+00
Ac-227										
Ra-228	7.12E-01	5.99E-01					J			
Pa-231	-3.13E+01	8.71E+01	7.17E+01	8.85E+01	**0.83**	**510**	U			
Beta Sum	**1.18E+02**	**2.00E+01**						**1.27E+02**	**3.07E+02**	**4.48E+01**
Total Activity Sum	**3.47E+02**	**2.97E+01**						**3.57E+02**	**3.07E+02**	
								DER (sums to gross)		
Gross Alpha	1.14E+02	7.08E+01	1.35E+02	8.11E+01	**0.20**	**16.9**		**1.56**	**(from gamma)**	
Gross Beta	1.27E+02	4.23E+01	1.56E+02	4.88E+01	**0.45**	**20.5**	J	**0.20**	**0.00**	
Total Activity	-1.38E+02	9.01E+02	-4.33E+01	8.99E+02	**0.07**	**104**	U	**0.54**	**0.52**	

49323002			TLW-0152					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								1.18E+01	1.55E+01	
Ra-226	5.88E-01	3.39E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	1.44E-01	1.62E-01					J			
Th-230	1.42E-01	1.03E-01					J			
Th-232	1.90E-01	1.11E-01					J			
U-234	7.43E+00	1.12E+00								
U-235	4.04E-01	1.38E-01						9.06E+00	1.46E+01	
U-238	5.98E+00	9.24E-01								
Total U Alpha	**1.38E+01**	**1.46E+00**								
Alpha Sum	**2.87E+01**	**1.13E+01**								
Total U by KPA	14.80 µg/L	0.95 µg/L								
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	2.62E+00	6.42E+00					U			
Th-234 (Assumed from U-238)	5.98E+00	9.24E-01						0.00E+00	1.24E+02	
Pa-234m (Assumed from U-238)	5.98E+00	9.24E-01						0.00E+00	2.54E+02	
Ac-227										
Ra-228	5.82E-01	5.80E-01	1.07E+00	6.14E-01	**0.58**	**59.1**	J			
Pa-231	1.29E+00	8.76E+01					U			
Beta Sum	**1.53E+01**	**1.24E+01**						**3.36E+00**	**2.83E+02**	
Total Activity Sum	**4.40E+01**	**1.68E+01**						**3.20E+01**	**2.83E+02**	
								DER (sums to gross)		
Gross Alpha	1.71E+01	4.03E+01					U	**0.28**	**(from gamma)**	
Gross Beta	1.33E+01	2.04E+01					UJ	**0.08**	**0.04**	
Total Activity	-8.39E+01	8.70E+02					U	**0.15**	**0.13**	

49323003			TLW-0154					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								-5.76E+00	1.37E+01	
Ra-226	4.41E-01	2.62E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	3.07E-02	6.83E-02					UJ			
Th-230	-9.51E-03	1.28E-01					UJ			
Th-232	1.48E-02	7.01E-02					UJ			
U-234	1.32E+01	1.92E+00								
U-235	5.56E-01	1.71E-01						8.87E+00	1.40E+01	
U-238	9.92E+00	1.47E+00								
Total U Alpha	**2.37E+01**	**2.42E+00**								
Alpha Sum	**3.86E+01**	**1.26E+01**								
Total U by KPA	27.00 µg/L	1.73 µg/L								
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	0.00E+00	7.50E+00					U			
Th-234 (Assumed from U-238)	9.92E+00	1.47E+00						1.50E+02	1.97E+02	
Pa-234m (Assumed from U-238)	9.92E+00	1.47E+00						0.00E+00	2.60E+02	
Ac-227										
Ra-228	1.03E+00	6.64E-01					J			
Pa-231	-4.00E+01	9.41E+01					U			
Beta Sum	**1.61E+01**	**1.37E+01**						**1.46E+02**	**3.26E+02**	
Total Activity Sum	**5.47E+01**	**1.86E+01**						**1.85E+02**	**3.27E+02**	
								DER (sums to gross)		
Gross Alpha	2.54E+01	4.93E+01					U	**0.26**	**(from gamma)**	
Gross Beta	1.24E+01	2.04E+01					UJ	**0.15**	**0.41**	
Total Activity	-1.09E+02	8.69E+02					U	**0.19**	**0.32**	

49323004			TLW-9178					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								-2.07E+00	7.58E+00	
Ra-226	8.08E-01	4.22E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	8.28E-01	2.58E-01					J			
Th-230	4.27E+00	7.97E-01					J			
Th-232	6.85E-01	2.25E-01					J			
U-234	5.90E+01	8.85E+00								
U-235	3.96E+00	8.48E-01						2.33E+00	2.46E+01	
U-238	5.77E+01	8.66E+00								
Total U Alpha	**1.21E+02**	**1.24E+01**								
Alpha Sum	**2.27E+02**	**2.44E+01**								
Total U by KPA	164.00 µg/L	10.40 µg/L								
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	0.00E+00	1.50E+01					U			
Th-234 (Assumed from U-238)	5.77E+01	8.66E+00						0.00E+00	1.37E+02	
Pa-234m (Assumed from U-238)	5.77E+01	8.66E+00						1.17E+02	3.24E+02	
Ac-227										
Ra-228	2.33E+00	9.21E-01					J			
Pa-231	-6.01E+01	1.07E+02					U			
Beta Sum	**1.11E+02**	**2.33E+01**						**1.12E+02**	**3.52E+02**	
Total Activity Sum	**3.37E+02**	**3.37E+01**						**3.39E+02**	**3.53E+02**	
								DER (sums to gross)		
Gross Alpha	1.11E+02	1.87E+02					U	**0.61**	**(from gamma)**	
Gross Beta	1.30E+02	1.09E+02					J	**0.17**	**0.05**	
Total Activity	-3.18E+02	9.00E+02					U	**0.73**	**0.68**	

49323005			TLW-0151					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								-2.60E+00	7.39E+00	
Ra-226	4.53E-01	3.14E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	1.92E-01	1.57E-01					J			
Th-230	4.73E-01	1.98E-01					J			
Th-232	1.03E-01	1.03E-01					J			
U-234	4.68E+01	7.01E+00								
U-235	3.38E+00	7.44E-01						4.30E+00	1.53E+01	
U-238	4.69E+01	7.03E+00								
Total U Alpha	**9.71E+01**	**9.96E+00**								
Alpha Sum	**1.90E+02**	**1.95E+01**								
Total U by KPA	133.00 µg/L	8.81 µg/L								
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	0.00E+00	9.75E+00					U			
Th-234 (Assumed from U-238)	4.69E+01	7.03E+00						2.03E+01	1.07E+02	
Pa-234m (Assumed from U-238)	4.69E+01	7.03E+00						0.00E+00	3.39E+02	
Ac-227										
Ra-228	6.58E-01	7.39E-01					J			
Pa-231	5.80E+01	1.03E+02					U			
Beta Sum	**1.01E+02**	**1.86E+01**						**2.79E+01**	**3.56E+02**	
Total Activity Sum	**2.91E+02**	**2.70E+01**						**2.17E+02**	**3.56E+02**	
								DER (sums to gross)		
Gross Alpha	6.03E+01	1.45E+02					U	**0.88**	**(from gamma)**	
Gross Beta	1.13E+02	1.04E+02					J	**0.11**	**0.23**	
Total Activity	-3.58E+01	9.03E+02					U	**0.36**	**0.26**	

49323006			TLW-9180					FROM GAMMA		
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)
Am-241								6.41E+00	1.13E+01	
Ra-226	9.59E-01	4.17E-01					J			
Np-237										
Pu-238										
Pu-239										
Th-228	3.17E-01	1.77E-01					J			
Th-230	6.93E-01	2.46E-01					J			
Th-232	8.87E-02	9.00E-02					J			
U-234	5.41E+01	8.16E+00								
U-235	2.46E+00	6.11E-01						1.93E+00	2.25E+01	
U-238	5.37E+01	8.10E+00								
Total U Alpha	**1.10E+02**	**1.15E+01**								
Alpha Sum	**2.08E+02**	**2.05E+01**								
Total U by KPA	134.00 µg/L	9.10 µg/L								
Total U by KPA										
U-235 wt% (by alpha spect)										
U-233 wt%										
Total U Alpha (Calc)										
Total Radiological Sr										
Ac-228	0.00E+00	1.03E+01					U			
Th-234 (Assumed from U-238)	5.37E+01	8.10E+00						0.00E+00	1.06E+02	
Pa-234m (Assumed from U-238)	5.37E+01	8.10E+00						-1.85E+01	2.60E+02	
Ac-227										
Ra-228	5.31E-01	7.86E-01					UJ			
Pa-231	-1.02E+01	8.99E+01					U			
Beta Sum	**1.07E+02**	**1.88E+01**						**-1.92E+01**	**2.81E+02**	
Total Activity Sum	**3.15E+02**	**2.78E+01**						**1.89E+02**	**2.82E+02**	
								DER (sums to gross)		
Gross Alpha	8.33E+01	1.59E+02					U	**0.78**	**(from gamma)**	
Gross Beta	9.93E+01	9.60E+01					J	**0.08**	**0.40**	
Total Activity	1.43E+02	9.05E+02					U	**0.19**	**0.05**	

Radiological Analytical Data Verification
Comments on Data for SDG 49379

This sample delivery group (SDG) contained eighteen (18) individual water samples and two (2) equipment rinsate blanks from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra by beta counting, ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by General Engineering Laboratories. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLW-0155	49379001
TLW-0156	49379002
TLW-0157	49379003
TLW-0158	49379004
TLW-0159	49379005
TLW-0160	49379006
TLW-0162	49379007
TLW-0163	49379008
TLW-0164	49379009
TLW-0165	49379010
TLW-0166	49379011
TLW-0167	49379012
TLW-0168	49379013
TLW-0169	49379014
TLW-0170	49379015
TLW-0171	49379016
TLW-0172	49379017
TLW-0173	49379018
EQ-10	49379019
EQ-11	49379020

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$DER = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were declared to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was no indication of blank contamination in the gamma spectrometry method blanks.

Equipment Rinsate Blanks:

There was no indication of blank contamination in the gamma spectrometry equipment rinsate blanks.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all gamma spectrometry analyses.

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ac, $^{231/234m}$Pa, ^{234}Th and ^{235}U) were reported for all samples.

The laboratory was instructed to report any radioisotopes detected above the DL. Based on the gamma summary of nuclides report, ^{137}Cs peaks were identified in gamma spectrometry report for TLW-0155 and TLW-0165 but were not reported by the laboratory. The ^{137}Cs activities in these samples were higher than the required DL (1.65*TPU). In addition, ^{233}Pa was detected in sample TLW-0173 indicating the possible presence of ^{237}Np. **Both of the radioisotopes should**

have been included in the laboratory's report. Other peaks detected but not reported were mostly also detected in the blank. There were a few peaks detected that were not included in the blank; however, since there is not detector specific background information, their identification was uncertain and it is not recommended that they be included in the report.

The MDA is an estimate of the concentration of the analyte that must be present in order to have assurance that it will be statistically distinguished (with a given confidence) from the background. However, the software-calculated MDA does not reflect the selected instrument peak search sensitivity factor used by the analysis software to determine which peaks are reported as present. When the peak search sensitivity factor is set at a value greater than 2.3, the reported value is not an estimate of the true concentration nor is it an upper limit for the true concentration in the sample. The extent to which the reported value could be lower than the true 95% confident less than value depends on the sample background and the selected sensitivity factor. The laboratory used a peak search sensitivity factor of three. Therefore, there is a greater than 5% chance that concentrations greater than the reported less than value may be present in these samples.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was an indication of blank contamination for the ^{230}Th and ^{234}U analyses. All samples associated with these blanks with ^{230}Th or ^{234}U results less than 5 times the blank should be qualified as estimated (J). **Therefore, it is recommended that the ^{230}Th results for samples TLW-0155, TLW-0156, TLW-0157, TLW-0158, TLW-0160, TLW-0162, TLW-0165, TLW-0167, TLW-0169, TLW-0171, and TLW-0173 and the ^{234}U result for sample TLW-0171 be qualified and estimated (J).**

.

Equipment Rinsate Blanks:

There was an indication of contamination in one of the rinsate blanks for ^{230}Th. All samples with results less than 5 times the rinsate blank for ^{230}Th should be qualified as estimated. **Therefore, it is recommended that the ^{230}Th results for all samples be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 71% for all samples for the Th analyses and greater than 73% for all U alpha spectrometry analyses. However, the sample-specific percent recovery for thorium results for all samples have greater than 10% uncertainty. **Therefore, it is recommended that all Th results for all samples be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the alpha spectra analyses.

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

In the ^{226}Ra analysis, the entire sample is de-emanated and no chemical separation takes place. Therefore, 100% recovery is assumed for all samples. The Matrix Spike Sample (MSS) for the ^{226}Ra analysis was within acceptable limits, indicating the procedure's recovery performance is acceptable.

4.0 ^{228}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{228}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{228}Ra. All samples with results less than 5 times the rinsate blank for ^{228}Ra should be qualified as estimated. All of the results for ^{228}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{228}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{228}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{228}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{228}Ra analysis were all above 80%. However there was greater than 10% uncertainty in the sample-specific chemical recoveries for the ^{228}Ra analysis for sample TLW-0157. **Therefore, it is recommended that the ^{228}Ra results for sample TLW-0157 be qualified as estimated (J).**

5.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha or gross beta analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for one of the gross alpha/beta MSS (54%) and the MSD (51%) were not within acceptable limits for the gross alpha analyses. **Therefore, it is recommended that the gross alpha results for samples TLW-0156, TLW-0157, TLW-0158, TLW-0159, TLW-0162, and TLW-0173 be qualified as estimated (J).**

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

6.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

7.0 TOTAL URANIUM

Method Blank:

There was indication of blank contamination for the total uranium analysis.. All samples with total uranium results less than 5 times the blank should be qualified as estimated (J). **Therefore, it is recommended that the Total Uranium results for samples TLW-0158, TLW-0159, TLW-0168, TLW-0169, TLW-0170, and TLW-0171 be qualified as estimated (J)**.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total uranium analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total uranium analysis.

Duplicate Analysis:

The duplicate DER for the total uranium analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total uranium analysis.

8.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The ^{238}U results for samples for all samples are in agreement with the corresponding ^{234}Th results within the uncertainties.

^{228}Ra Gamma to ^{232}Th Alpha:

When comparing the ^{228}Ra activity to ^{232}Th alpha activity, it was assumed that the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another and no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha and gross beta DERs for all samples were less than 1.29 indicating that the gross alpha analyses are in agreement with the sum of the alpha or beta emitters within a 99% confidence level except for the gross beta results for TLW-0168. For this comparison, the activity of ^{228}Ra was used for the activity of ^{228}Ac in the beta sum assuming equilibrium since the sensitivity of the ^{228}Ra measurement is significantly lower. The disagreement may be due to some unidentified activity in the sample or due to sample heterogeneity. **Therefore, it is recommended that the possibility of unidentified activity for sample TLW-168 be further investigated in the future.**

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were less than 1.29 indicating that the total activity analyses are in agreement with the total activity sums within a 99% confidence level.

49379001			TLW-0155					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.78E+00	3.78E+00	7.80E+00	1.37E+01	**0.67**	**318**	U
Ra-226	4.26E-01	3.04E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.75E-02	1.07E-01					U							
Th-230	4.61E-02	7.97E-02					U							
Th-232	-1.89E-02	5.18E-02					U							
U-234	1.33E+01	1.94E+00												
U-235	8.54E-01	2.25E-01						8.33E+00	2.07E+01	2.33E+00	1.27E+01	**0.25**	**113**	U
U-238	9.64E+00	1.45E+00												
Total U Alpha	**2.38E+01**	**2.43E+00**												
Alpha Sum	**8.88E+00**	**7.48E+01**												
Total U by KPA	27.00 µg/L	1.71 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	3.00E+00	7.28E+00	3.91E+00	8.38E+00	**0.08**	**26.3**	U							
Th-234 (Assumed from U-238)	9.64E+00	1.45E+00						1.22E+01	7.19E+01	1.57E+01	1.53E+02	**0.02**	**25.1**	U
Pa-234m (Assumed from U-238)	9.64E+00	1.45E+00						2.24E+02	3.31E+02	1.02E+01	3.72E+02	**0.43**	**183**	U
Ac-227														
Ra-228	-7.90E-02	5.66E-01					U							
Pa-231	-1.71E+01	8.31E+01	-1.84E+00	9.45E+01	**0.12**	**161**	U							
Beta Sum	**2.01E+01**	**1.25E+01**						**2.37E+02**	**3.39E+02**	**2.96E+01**	**4.02E+02**			
Total Activity Sum	**2.90E+01**	**7.59E+01**						**2.46E+02**	**3.47E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.97E+01	4.14E+01					U	**0.13**	**(from gamma)**		**75.7**			
Gross Beta	1.14E+01	1.88E+01					U	**0.39**	**0.66**		**55.5**			
Total Activity	-2.81E+02	8.66E+02					U	**0.36**	**0.56**		**246**			

49379002			TLW-0156					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								0.00E+00	1.20E+01					U
Ra-226	7.14E-01	3.35E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.58E-01	1.22E-01												
Th-230	8.12E-02	6.59E-02												
Th-232	1.34E-02	4.21E-02					U							
U-234	1.21E+01	1.81E+00												
U-235	7.38E-01	2.21E-01						4.09E+00	1.59E+01					U
U-238	1.06E+01	1.61E+00												
Total U Alpha	**2.34E+01**	**2.43E+00**												
Alpha Sum	**3.39E+01**	**8.73E+01**												
Total U by KPA	34.80 µg/L	2.20 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	3.21E+00	1.20E+01					U							
Th-234 (Assumed from U-238)	1.06E+01	1.61E+00						8.32E+01	1.68E+02					U
Pa-234m (Assumed from U-238)	1.06E+01	1.61E+00						0.00E+00	2.02E+02					U
Ac-227														
Ra-228	1.25E+00	6.62E-01												
Pa-231	1.06E+01	9.70E+01					U							
Beta Sum	**2.69E+01**	**1.69E+01**						**8.89E+01**	**2.63E+02**					
Total Activity Sum	**6.09E+01**	**8.90E+01**						**1.23E+02**	**2.77E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.11E+01	5.83E+01					U	**0.12**	**(from gamma)**		**46.7**			
Gross Beta	1.06E+01	2.75E+01					U	**0.51**	**0.30**		**87.0**			
Total Activity	1.06E+02	8.73E+02					U	**0.05**	**0.02**		**54.1**			

49379003			TLW-0157					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								7.88E+00	1.06E+01					U
Ra-226	3.87E-01	4.03E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	6.35E-02	2.15E-01					U							
Th-230	8.95E-02	1.12E-01					U							
Th-232	2.73E-02	5.37E-02					U							
U-234	1.30E+01	1.92E+00												
U-235	6.21E-01	1.92E-01						0.00E+00	1.61E+01					U
U-238	1.04E+01	1.57E+00												
Total U Alpha	**2.40E+01**	**2.49E+00**												
Alpha Sum	**-2.23E+01**	**7.76E+01**												
Total U by KPA	31.60 µg/L	1.99 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	5.81E-01	1.45E+01					U							
Th-234 (Assumed from U-238)	1.04E+01	1.57E+00						0.00E+00	9.81E+01					U
Pa-234m (Assumed from U-238)	1.04E+01	1.57E+00						0.00E+00	2.34E+02					U
Ac-227														
Ra-228	3.85E-02	5.95E-01					U							
Pa-231	-5.21E+01	8.62E+01					U							
Beta Sum	**1.52E+01**	**1.80E+01**						**-5.63E+00**	**2.54E+02**					
Total Activity Sum	**-7.13E+00**	**7.97E+01**						**-2.79E+01**	**2.66E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.65E+01	6.88E+01					U	**0.47**	**(from gamma)**		**2325**			
Gross Beta	5.22E+00	2.46E+01					U	**0.33**	**0.04**		**97.6**			
Total Activity	1.23E+02	8.73E+02					U	**0.15**	**0.17**		**225**			

49379004			TLW-0158					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								1.24E+00	1.06E+01					U
Ra-226	1.66E+00	6.44E-01	1.42E+00	6.06E-01	**0.27**	**15.6**								
Np-237														
Pu-238														
Pu-239														
Th-228	2.32E-01	2.34E-01												
Th-230	-2.86E-02	8.06E-02					U							
Th-232	9.22E-03	1.04E-01					U							
U-234	3.19E-01	1.20E-01												
U-235	-1.15E-02	3.11E-02					U	3.53E+00	1.36E+01					U
U-238	1.61E-01	8.38E-02												
Total U Alpha	**4.69E-01**	**1.50E-01**												
Alpha Sum	**1.00E+00**	**7.95E+01**												
Total U by KPA	0.50 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	6.40E+00					U							
Th-234 (Assumed from U-238)	1.61E-01	8.38E-02						1.40E+02	1.27E+02					
Pa-234m (Assumed from U-238)	1.61E-01	8.38E-02						0.00E+00	2.42E+02					U
Ac-227														
Ra-228	1.47E+00	1.06E+00	9.11E-01	6.73E-01	**0.45**	**47.0**								
Pa-231	-1.49E+00	8.83E+01					U							
Beta Sum	**1.61E+00**	**1.24E+01**						**1.41E+02**	**2.74E+02**					
Total Activity Sum	**2.61E+00**	**8.04E+01**						**1.42E+02**	**2.85E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-3.28E+00	4.67E+01					U	**0.05**	**(from gamma)**		**375**			
Gross Beta	2.29E+00	3.86E+01					U	**0.02**	**0.50**		**34.7**			
Total Activity	-2.81E+02	8.65E+02					U	**0.33**	**0.46**		**204**			

49379005			TLW-0159					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.38E+01	1.76E+01					U
Ra-226	7.32E-01	4.01E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.13E-02	2.08E-01					U							
Th-230	1.79E-01	1.76E-01												
Th-232	-4.98E-02	7.46E-02					U							
U-234	1.91E-01	1.08E-01												
U-235	7.22E-02	6.55E-02						-6.73E+00	1.66E+01					U
U-238	3.11E-02	5.52E-02					U							
Total U Alpha	**2.94E-01**	**1.38E-01**												
Alpha Sum	**2.32E+01**	**8.35E+01**												
Total U by KPA	0.38 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	7.74E+00					U							
Th-234 (Assumed from U-238)	3.11E-02	5.52E-02					U	-3.95E+01	1.51E+02					U
Pa-234m (Assumed from U-238)	3.11E-02	5.52E-02					U	0.00E+00	2.30E+02					U
Ac-227														
Ra-228	1.87E+00	1.18E+00												
Pa-231	2.44E+01	9.28E+01					U							
Beta Sum	**4.86E+00**	**1.36E+01**						**-3.47E+01**	**2.75E+02**					
Total Activity Sum	**2.80E+01**	**8.46E+01**						**-1.15E+01**	**2.88E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-1.04E+00	1.96E+01					U	**0.28**	**(from gamma)**		**219**			
Gross Beta	1.10E+00	1.63E+01					U	**0.18**	**0.13**		**126**			
Total Activity	2.11E+02	8.72E+02					U	**0.21**	**0.24**		**153**			

49379006			TLW-0160					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-4.35E+00	5.37E+00					U
Ra-226	1.17E+00	5.93E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.09E-01	2.70E-01												
Th-230	1.00E-01	1.22E-01					U							
Th-232	1.59E-01	1.28E-01												
U-234	4.26E+00	7.24E-01												
U-235	3.18E-01	1.31E-01						0.00E+00	1.66E+01					U
U-238	3.14E+00	5.66E-01												
Total U Alpha	**7.72E+00**	**9.28E-01**												
Alpha Sum	**5.27E+01**	**9.63E+01**												
Total U by KPA	5.68 µg/L	0.23 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.29E+00	1.67E+01					U							
Th-234 (Assumed from U-238)	3.14E+00	5.66E-01						7.29E+01	8.49E+01					
Pa-234m (Assumed from U-238)	3.14E+00	5.66E-01						0.00E+00	2.82E+02					U
Ac-227														
Ra-228	6.75E-01	5.94E-01												
Pa-231	4.81E+01	1.07E+02					U							
Beta Sum	**1.40E+01**	**2.11E+01**						**8.06E+01**	**2.95E+02**					
Total Activity Sum	**6.68E+01**	**9.86E+01**						**1.33E+02**	**3.11E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.03E+01	2.87E+01					U	**0.42**	**(from gamma)**		**135**			
Gross Beta	7.46E+00	1.64E+01					U	**0.25**	**0.25**		**61.1**			
Total Activity	-3.94E+02	8.62E+02					U	**0.53**	**0.58**		**282**			

49379007			TLW-0162					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-2.04E+00	3.56E+00					U
Ra-226	1.64E-01	2.40E-01					U							
Np-237														
Pu-238														
Pu-239														
Th-228	2.92E-01	2.40E-01												
Th-230	7.64E-02	9.51E-02					U							
Th-232	4.66E-02	6.50E-02					U							
U-234	2.53E+00	4.63E-01												
U-235	1.60E-01	8.14E-02						2.19E+01	2.71E+01					U
U-238	1.98E+00	3.83E-01												
Total U Alpha	**4.67E+00**	**6.06E-01**												
Alpha Sum	**5.25E+00**	**7.23E+01**												
Total U by KPA	9.44 µg/L	0.60 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.60E+00	7.79E+00					U							
Th-234 (Assumed from U-238)	1.98E+00	3.83E-01						0.00E+00	4.94E+01					U
Pa-234m (Assumed from U-238)	1.98E+00	3.83E-01						0.00E+00	2.70E+02					U
Ac-227														
Ra-228	1.90E+00	1.04E+00												
Pa-231	0.00E+00	8.03E+01					U							
Beta Sum	**7.46E+00**	**1.24E+01**						**3.50E+00**	**2.75E+02**					
Total Activity Sum	**1.27E+01**	**7.33E+01**						**8.75E+00**	**2.84E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.60E+00	2.49E+01					U	**0.00**	**(from gamma)**		**6.47**			
Gross Beta	3.69E+00	1.17E+01					U	**0.22**	**0.00**		**67.6**			
Total Activity	1.30E+02	8.71E+02					U	**0.13**	**0.13**		**164**			

49379008			TLW-0163					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-2.44E+00	1.18E+01					U
Ra-226	5.97E-01	4.79E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.44E-02	1.99E-01					U							
Th-230	1.82E-01	1.98E-01												
Th-232	2.13E-02	6.95E-02					U							
U-234	3.94E+00	6.55E-01												
U-235	2.00E-01	9.37E-02						6.92E+00	1.88E+01					U
U-238	2.39E+00	4.40E-01												
Total U Alpha	**6.53E+00**	**7.95E-01**												
Alpha Sum	**2.92E+01**	**8.10E+01**												
Total U by KPA	7.47 µg/L	0.30 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	6.49E+00					U							
Th-234 (Assumed from U-238)	2.39E+00	4.40E-01						2.76E+01	1.55E+02					U
Pa-234m (Assumed from U-238)	2.39E+00	4.40E-01						1.46E+02	2.13E+02					U
Ac-227														
Ra-228	-7.35E-01	6.16E-01					U							
Pa-231	2.42E+01	9.00E+01					U							
Beta Sum	**6.95E+00**	**1.26E+01**						**1.76E+02**	**2.64E+02**					
Total Activity Sum	**3.61E+01**	**8.20E+01**						**2.05E+02**	**2.76E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	6.88E+00	2.32E+01					U	**0.26**	**(from gamma)**		**124**			
Gross Beta	4.86E+00	1.31E+01					U	**0.11**	**0.65**		**35.4**			
Total Activity	4.82E+02	8.77E+02					U	**0.51**	**0.30**		**172**			

49379009			TLW-0164					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-5.99E+00	1.06E+01					U
Ra-226	2.24E+00	6.41E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.05E-01	2.77E-01												
Th-230	3.97E-01	1.99E-01												
Th-232	1.57E-01	1.20E-01												
U-234	1.22E+01	1.88E+00												
U-235	5.60E-01	2.00E-01						1.30E+01	1.65E+01					U
U-238	9.99E+00	1.57E+00												
Total U Alpha	**2.28E+01**	**2.46E+00**												
Alpha Sum	**6.34E+00**	**7.76E+01**												
Total U by KPA	30.70 µg/L	1.96 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	2.01E+00	7.32E+00					U							
Th-234 (Assumed from U-238)	9.99E+00	1.57E+00						0.00E+00	1.53E+02					U
Pa-234m (Assumed from U-238)	9.99E+00	1.57E+00						1.09E+01	2.01E+02					U
Ac-227														
Ra-228	1.54E+00	1.05E+00												
Pa-231	-2.19E+01	8.62E+01					U							
Beta Sum	**2.09E+01**	**1.29E+01**						**1.18E+01**	**2.53E+02**					
Total Activity Sum	**2.72E+01**	**7.87E+01**						**1.82E+01**	**2.65E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.82E+01	6.94E+01					U	**0.21**	**(from gamma)**		**127**			
Gross Beta	2.73E+01	4.09E+01					U	**0.15**	**0.06**		**26.5**			
Total Activity	8.77E+02	8.86E+02						**0.96**	**0.93**		**188**			

49379010			TLW-0165					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.15E+00	1.12E+01					U
Ra-226	8.85E-01	4.94E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	5.61E-02	1.61E-01	8.87E-03	1.29E-01	**0.23**	**145**	U							
Th-230	-1.80E-03	5.21E-02	1.27E-02	4.12E-02	**0.22**	**266**	U							
Th-232	-2.43E-02	2.78E-02	-7.12E-03	1.40E-02	**0.55**	**109**	U							
U-234	1.04E+01	1.61E+00	1.11E+01	1.77E+00	**0.29**	**6.51**								
U-235	6.66E-01	2.15E-01	4.09E-01	1.82E-01	**0.91**	**47.8**		-3.29E-01	1.53E+01					U
U-238	8.93E+00	1.40E+00	9.89E+00	1.60E+00	**0.45**	**10.2**								
Total U Alpha	**2.00E+01**	**2.14E+00**	**2.14E+01**	**2.39E+00**										
Alpha Sum	**7.63E+01**	**8.08E+01**	**2.14E+01**	**2.40E+00**										
Total U by KPA	31.00 µg/L	1.97 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	7.29E+00					U							
Th-234 (Assumed from U-238)	8.93E+00	1.40E+00	9.89E+00	1.60E+00	**0.45**	**10.2**		0.00E+00	1.07E+02					U
Pa-234m (Assumed from U-238)	8.93E+00	1.40E+00	9.89E+00	1.60E+00	**0.45**	**10.2**		1.80E+02	2.36E+02					U
Ac-227														
Ra-228	3.08E-01	5.69E-01					U							
Pa-231	6.15E+01	8.97E+01					U							
Beta Sum	**2.55E+01**	**1.32E+01**	**1.98E+01**	**2.26E+00**				**1.88E+02**	**2.59E+02**					
Total Activity Sum	**1.02E+02**	**8.18E+01**	**4.12E+01**	**3.30E+00**				**2.64E+02**	**2.72E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.67E+01	5.00E+01					U	**0.63**	**(from gamma)**		**128**			
Gross Beta	1.12E+01	2.31E+01					U	**0.54**	**0.68**		**78.1**			
Total Activity	5.25E+02	8.79E+02					U	**0.48**	**0.28**		**135**			

49379011			TLW-0166					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								7.58E+00	1.49E+01					U
Ra-226	1.52E+00	5.62E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	3.28E-01	2.89E-01												
Th-230	2.65E-01	1.86E-01												
Th-232	1.22E-01	1.30E-01												
U-234	9.19E+00	1.47E+00												
U-235	7.09E-01	2.42E-01						-5.18E-01	1.44E+01					U
U-238	7.96E+00	1.30E+00												
Total U Alpha	**1.79E+01**	**1.98E+00**												
Alpha Sum	**3.85E+01**	**8.64E+01**												
Total U by KPA	22.50 µg/L	1.48 µg/L	25.30 µg/L	1.63 µg/L	**1.27**	**11.7**								
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	5.18E+00	7.53E+00					U							
Th-234 (Assumed from U-238)	7.96E+00	1.30E+00						1.44E+01	1.16E+02					U
Pa-234m (Assumed from U-238)	7.96E+00	1.30E+00						1.83E+02	2.73E+02					U
Ac-227														
Ra-228	2.49E+00	1.25E+00												
Pa-231	2.05E+01	9.60E+01					U							
Beta Sum	**2.61E+01**	**1.39E+01**						**2.08E+02**	**2.97E+02**					
Total Activity Sum	**6.46E+01**	**8.75E+01**						**2.46E+02**	**3.09E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.66E+01	3.68E+01					U	**0.23**	**(from gamma)**		**79.6**			
Gross Beta	8.02E+00	1.53E+01					U	**0.87**	**0.67**		**106**			
Total Activity	4.27E+02	8.78E+02					U	**0.41**	**0.19**		**147**			

49379012			TLW-0167					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-6.55E-01	5.36E+00					U
Ra-226	9.73E-01	5.08E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.67E-02	1.10E-01					U							
Th-230	1.39E-01	1.05E-01												
Th-232	-7.13E-03	1.40E-02					U							
U-234	9.32E+00	1.57E+00												
U-235	5.99E-01	2.39E-01						1.02E+01	2.52E+01					U
U-238	7.88E+00	1.37E+00												
Total U Alpha	**1.78E+01**	**2.10E+00**												
Alpha Sum	**-5.48E+01**	**9.36E+01**												
Total U by KPA	24.00 µg/L	1.52 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	5.56E+00	9.56E+00					U							
Th-234 (Assumed from U-238)	7.88E+00	1.37E+00						7.56E+01	1.22E+02					U
Pa-234m (Assumed from U-238)	7.88E+00	1.37E+00						1.86E+02	3.28E+02					U
Ac-227														
Ra-228	3.04E-01	5.76E-01					U							
Pa-231	-8.19E+01	1.04E+02					U							
Beta Sum	**1.18E+01**	**1.59E+01**						**2.58E+02**	**3.50E+02**					
Total Activity Sum	**-4.30E+01**	**9.50E+01**						**2.03E+02**	**3.63E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.36E+01	3.55E+01					U	**0.68**	**(from gamma)**		**332**			
Gross Beta	6.05E+00	1.59E+01					U	**0.26**	**0.72**		**64.4**			
Total Activity	5.57E+02	8.80E+02					U	**0.68**	**0.37**		**233**			

49379013			TLW-0168					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-6.55E-01	4.11E+00					U
Ra-226	5.06E-01	3.72E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	4.01E-01	2.52E-01												
Th-230	4.35E-01	2.17E-01												
Th-232	3.05E-01	1.78E-01												
U-234	1.85E-01	1.29E-01												
U-235	4.27E-02	5.98E-02					U	7.50E+00	1.76E+01					U
U-238	1.28E-01	9.84E-02												
Total U Alpha	**3.56E-01**	**1.73E-01**												
Alpha Sum	**-5.87E+01**	**8.78E+01**												
Total U by KPA	1.13 µg/L	0.07 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.33E+01	1.37E+01												
Th-234 (Assumed from U-238)	1.28E-01	9.84E-02						0.00E+00	5.86E+01					U
Pa-234m (Assumed from U-238)	1.28E-01	9.84E-02						1.10E+02	2.45E+02					U
Ac-227														
Ra-228	8.72E-01	9.24E-01												
Pa-231	-6.75E+01	9.75E+01					U							
Beta Sum	**6.33E+00**	**1.80E+01**						**1.16E+02**	**2.53E+02**					
Total Activity Sum	**-5.24E+01**	**8.96E+01**						**5.73E+01**	**2.67E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	9.08E+00	1.17E+01					U	**0.77**	**(from gamma)**		**273**			
Gross Beta	1.57E+01	8.04E+00						**0.47**	**0.40**		**85**			
Total Activity	-6.35E+02	8.61E+02					U	**0.67**	**0.77**		**169**			

49379014			TLW-0169					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								5.59E+00	1.17E+01					U
Ra-226	7.02E-01	3.80E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.71E-01	2.35E-01					U							
Th-230	8.40E-02	1.05E-01					U							
Th-232	-1.84E-02	2.58E-02					U							
U-234	1.72E-01	1.09E-01												
U-235	2.56E-02	6.58E-02					U	5.32E+00	1.34E+01					U
U-238	6.85E-02	8.99E-02					U							
Total U Alpha	**2.66E-01**	**1.56E-01**												
Alpha Sum	**-6.23E+01**	**8.86E+01**												
Total U by KPA	0.40 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	1.10E+01					U							
Th-234 (Assumed from U-238)	6.85E-02	8.99E-02					U	1.06E+02	1.67E+02					U
Pa-234m (Assumed from U-238)	6.85E-02	8.99E-02					U	8.37E+01	2.12E+02					U
Ac-227														
Ra-228	1.03E+00	7.82E-01												
Pa-231	-7.06E+01	9.84E+01					U							
Beta Sum	**-7.31E+00**	**1.62E+01**						**1.82E+02**	**2.70E+02**					
Total Activity Sum	**-6.96E+01**	**9.00E+01**						**1.20E+02**	**2.84E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-1.05E-01	6.80E+00					U	**0.70**	**(from gamma)**		**199**			
Gross Beta	3.98E+00	7.97E+00					U	**0.63**	**0.66**		**679**			
Total Activity	5.68E+01	8.73E+02					U	**0.14**	**0.07**		**1969**			

49379015			TLW-0170					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								2.21E+00	1.01E+01					U
Ra-226	5.84E-01	3.33E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.74E-01	1.48E-01	2.25E-01	2.11E-01	**0.20**	**25.6**								
Th-230	2.20E-01	1.22E-01	3.20E-01	1.79E-01	**0.46**	**37.0**								
Th-232	1.03E-01	7.89E-02	1.26E-01	1.14E-01	**0.17**	**20.1**								
U-234	1.79E-01	1.67E-01	2.29E-01	1.73E-01	**0.21**	**24.5**								
U-235	4.35E-02	9.84E-02	-7.86E-03	1.55E-02	**0.52**	**288**	U	-1.45E+00	1.54E+01					U
U-238	1.11E-01	1.37E-01	1.40E-01	1.47E-01	**0.14**	**23.1**	U							
Total U Alpha	**3.34E-01**	**2.37E-01**	**3.61E-01**	**2.28E-01**										
Alpha Sum	**-2.32E+01**	**7.99E+01**	**1.03E+00**	**3.76E-01**										
Total U by KPA	0.30 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	6.97E+00					U							
Th-234 (Assumed from U-238)	1.11E-01	1.37E-01	1.40E-01	1.47E-01	**0.14**	**23.1**	U	0.00E+00	9.50E+01					U
Pa-234m (Assumed from U-238)	1.11E-01	1.37E-01	1.40E-01	1.47E-01	**0.14**	**23.1**	U	0.00E+00	2.29E+02					U
Ac-227														
Ra-228	2.11E+00	1.08E+00												
Pa-231	-2.74E+01	8.88E+01					U							
Beta Sum	**-9.56E-01**	**1.28E+01**	**2.80E-01**	**2.08E-01**				**-1.18E+00**	**2.48E+02**					
Total Activity Sum	**-2.42E+01**	**8.09E+01**	**1.31E+00**	**4.30E-01**				**-2.44E+01**	**2.61E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	8.61E-01	7.58E+00					U	**0.30**	**(from gamma)**		**215**			
Gross Beta	6.63E+00	8.98E+00					U	**0.49**	**0.03**		**267**			
Total Activity	5.33E+02	9.00E+02	1.22E+03	9.11E+02	**0.54**	**78.4**	U	**0.62**	**0.59**		**219**			

49379016			TLW-0171					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.53E+01	1.16E+01					U
Ra-226	6.46E-01	3.69E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.06E-01	1.47E-01					U							
Th-230	6.00E-02	6.97E-02												
Th-232	2.25E-02	4.44E-02					U							
U-234	7.12E-02	1.27E-01					U							
U-235	-2.22E-02	2.53E-02					U	-1.17E+01	1.30E+01					U
U-238	-1.47E-02	6.35E-02					U							
Total U Alpha	**3.43E-02**	**1.44E-01**												
Alpha Sum	**2.59E+01**	**8.00E+01**												
Total U by KPA	0.24 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	9.11E+00					U							
Th-234 (Assumed from U-238)	-1.47E-02	6.35E-02					U	5.49E+01	1.08E+02					U
Pa-234m (Assumed from U-238)	-1.47E-02	6.35E-02					U	1.71E+02	2.32E+02					U
Ac-227														
Ra-228	1.23E+00	8.26E-01												
Pa-231	2.78E+01	8.89E+01					U							
Beta Sum	**4.54E+00**	**1.41E+01**						**2.30E+02**	**2.56E+02**					
Total Activity Sum	**3.04E+01**	**8.12E+01**						**2.56E+02**	**2.68E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-5.85E-02	5.15E+00					U	**0.32**	**(from gamma)**		**201**			
Gross Beta	3.50E+00	7.00E+00					U	**0.07**	**0.89**		**25.8**			
Total Activity	2.62E+02	8.95E+02					U	**0.26**	**0.01**		**158**			

49379017			TLW-0172					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.90E+00	1.43E+01					U
Ra-226	1.52E+00	4.76E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	2.49E-01	1.85E-01												
Th-230	3.18E-01	1.66E-01												
Th-232	3.09E-01	1.67E-01												
U-234	1.44E+01	2.54E+00												
U-235	3.90E-01	2.33E-01						5.28E+00	1.40E+01					U
U-238	1.23E+01	2.22E+00												
Total U Alpha	**2.71E+01**	**3.38E+00**												
Alpha Sum	**7.19E+01**	**8.77E+01**												
Total U by KPA	30.10 µg/L	1.92 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	2.82E-02	1.04E+01					U							
Th-234 (Assumed from U-238)	1.23E+01	2.22E+00						0.00E+00	1.18E+02					U
Pa-234m (Assumed from U-238)	1.23E+01	2.22E+00						2.77E+01	2.22E+02					U
Ac-227														
Ra-228	3.17E+00	1.39E+00												
Pa-231	4.71E+01	9.74E+01					U							
Beta Sum	**3.35E+01**	**1.60E+01**						**3.66E+01**	**2.52E+02**					
Total Activity Sum	**1.05E+02**	**8.92E+01**						**1.08E+02**	**2.67E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.68E+01	6.66E+01					U	**0.41**	**(from gamma)**		**91.4**			
Gross Beta	2.18E+01	3.72E+01					U	**0.29**	**0.06**		**42.2**			
Total Activity	-9.90E+00	8.92E+02					U	**0.13**	**0.13**		**241**			

49379018			TLW-0173					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-9.90E+00	1.42E+01					U
Ra-226	6.78E-01	4.26E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	1.15E-01	1.21E-01												
Th-230	5.23E-02	7.32E-02					U							
Th-232	8.65E-03	3.84E-02					U							
U-234	1.22E+01	2.14E+00												
U-235	7.90E-01	3.23E-01						0.00E+00	1.28E+01					U
U-238	1.16E+01	2.05E+00												
Total U Alpha	**2.46E+01**	**2.98E+00**												
Alpha Sum	**8.96E+01**	**8.15E+01**												
Total U by KPA	32.10 µg/L	2.03 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.15E+00	1.04E+01					U							
Th-234 (Assumed from U-238)	1.16E+01	2.05E+00						8.71E+01	1.59E+02					U
Pa-234m (Assumed from U-238)	1.16E+01	2.05E+00						2.43E+01	2.27E+02					U
Ac-227														
Ra-228	1.36E+00	1.06E+00												
Pa-231	7.13E+01	9.05E+01					U							
Beta Sum	**3.43E+01**	**1.54E+01**						**1.22E+02**	**2.78E+02**					
Total Activity Sum	**1.24E+02**	**8.29E+01**						**2.12E+02**	**2.89E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.39E+01	6.29E+01	2.36E+01	6.22E+01	**0.00**	**1.26**	U	**0.64**	**(from gamma)**		**116**			
Gross Beta	7.05E+00	2.40E+01	9.50E+00	2.83E+01	**0.07**	**29.6**	U	**0.96**	**0.41**		**132**			
Total Activity	6.99E+02	9.03E+02					U	**0.63**	**0.51**		**140**			

49379019			EQ-10					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								4.28E+00	1.47E+01					U
Ra-226	4.88E-01	3.37E-01												
Np-237														
Pu-238														
Pu-239														
Th-228	7.61E-02	1.23E-01					U							
Th-230	2.58E-01	1.43E-01												
Th-232	1.52E-02	2.99E-02					U							
U-234	1.66E-02	8.91E-02					U							
U-235	2.26E-02	6.01E-02					U	1.13E+01	1.45E+01					U
U-238	2.25E-02	5.99E-02					U							
Total U Alpha	**6.17E-02**	**1.23E-01**												
Alpha Sum	**-1.80E+01**	**7.55E+01**												
Total U by KPA	0.26 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	1.18E+00	6.55E+00					U							
Th-234 (Assumed from U-238)	2.25E-02	5.99E-02					U	3.65E+01	1.47E+02					U
Pa-234m (Assumed from U-238)	2.25E-02	5.99E-02					U	1.30E+02	2.10E+02					U
Ac-227														
Ra-228	1.76E+00	1.13E+00	1.03E-01	7.70E-01	**1.21**	**178**								
Pa-231	-2.10E+01	8.39E+01					U							
Beta Sum	**4.65E-01**	**1.21E+01**						**1.67E+02**	**2.57E+02**					
Total Activity Sum	**-1.75E+01**	**7.65E+01**						**1.49E+02**	**2.68E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.78E-01	1.27E+01					U	**0.24**	**(from gamma)**		**206**			
Gross Beta	-1.93E-01	1.59E+01					U	**0.03**	**0.65**		**484**			
Total Activity	3.77E+02	8.97E+02					U	**0.44**	**0.24**		**220**			

49379020			EQ-11					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								8.10E+00	1.53E+01					U
Ra-226	3.22E-01	3.53E-01	2.25E-01	2.55E-01	**0.22**	**35.5**								
Np-237														
Pu-238														
Pu-239														
Th-228	-1.68E-03	1.35E-01					U							
Th-230	6.36E-02	9.73E-02					U							
Th-232	1.83E-02	3.60E-02					U							
U-234	-6.34E-03	7.05E-02					U							
U-235	8.90E-03	6.75E-02					U	3.14E+01	3.81E+01					U
U-238	6.47E-02	1.12E-01					U							
Total U Alpha	**6.73E-02**	**1.49E-01**												
Alpha Sum	**2.81E+01**	**7.74E+01**												
Total U by KPA	0.23 µg/L	0.02 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Ac-228	0.00E+00	1.36E+01					U							
Th-234 (Assumed from U-238)	6.47E-02	1.12E-01					U	2.12E+01	1.98E+02					U
Pa-234m (Assumed from U-238)	6.47E-02	1.12E-01					U	0.00E+00	1.78E+02					U
Ac-227														
Ra-228	-3.55E-01	6.85E-01					U							
Pa-231	3.07E+01	8.60E+01					U							
Beta Sum	**3.46E+00**	**1.71E+01**						**2.45E+01**	**2.67E+02**					
Total Activity Sum	**3.16E+01**	**7.93E+01**						**5.26E+01**	**2.78E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.46E-01	1.52E+01					U	**0.35**	**(from gamma)**		**197**			
Gross Beta	-9.06E-02	2.10E+01					U	**0.13**	**0.09**		**211**			
Total Activity	5.08E+02	9.00E+02					U	**0.53**	**0.48**		**177**			

Radiological Analytical Data Verification
Comments on Data for SDG 49386

This sample delivery group (SDG) contained eight individual water samples from the Town of Tonawanda Landfill Vicinity FUSRAP Property for radiological analysis. The requested analyses from [Statement of Work for Radiological and Chemical Analytical Laboratory Services Town of Tonawanda Landfill Vicinity FUSRAP Property Tonawanda, NY, April 2001] were $^{234/235/238}$U and $^{228/230/232}$Th by alpha spectrometry; ^{228}Ra by beta counting; ^{228}Ac, ^{234}Th, $^{231/234m}$Pa, ^{235}U and ^{241}Am and any radioisotopes detected above the decision level (DL) by gamma spectrometry; ^{226}Ra by radon emanation; gross alpha/beta by gas proportional counting; and total activity by liquid scintillation counting were requested for all samples. All of the analyses requested by the statement of work (SOW) were performed and reported by General Engineering Laboratories. The uncertainties and results were provided in the Sample Result Summary, Certificate of Analysis, or in the raw data; therefore, the gross alpha/beta and total activity analyses can be compared to the sum of the individual results using the propagated uncertainties to determine if the differences are statistically significant.

Client Identification	Laboratory Identification
TLW-9179	49386001
TLW-9181	49386002
TLW-0153	49386003
TLW-0174	49386004
TLW-0175	49386005
TLW-0177	49386006
TLW-0161	49386007
TLW-0176	49386008

The duplicate results were evaluated by calculation of the duplicate error ratio (DER). The DER is defined in the following equation:

$$\text{DER} = \frac{|S - D|}{\sqrt{(2\sigma_S)^2 + (2\sigma_D)^2}}$$

Where,

S = First Sample Value (original)
D = Second Sample Value (duplicate)
$2\sigma_S$ = First Sample Uncertainty
$2\sigma_D$ = Second Sample Uncertainty.

A DER of less than 1.29 indicates that the duplicate analyses agree at the 99% confidence level. The uncertainties reported were declared to be 2 sigma. The attached sheets show the DER results with the results for each sample.

1.0 GAMMA SPECTROMETRY ANALYSIS

Method Blank

There was an indication of blank contamination in the gamma spectrometry method blanks for ^{40}K. All samples with ^{40}K results less than 5 times the blank should be qualified as estimated (J). **All samples had ^{40}K results less than 5 times the blank; therefore, it is recommended that the ^{40}K results for all samples be qualified as estimated (J).** There was no indication of blank contamination for any of the target radionuclides. However, there was an indication of contamination for other non-reported radionuclides including ^{137}Cs.

Equipment Rinsate Blanks:

There was no indication of blank contamination in the gamma spectrometry equipment rinsate blanks.

Laboratory Control Sample:

The percent recoveries for the laboratory control sample (LCS) are within acceptable limits.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all gamma spectrometry analyses except for ^{228}Ac, which had a DER of 1.45 and an RPD of 154%. **Therefore, it is recommended that ^{228}Ac results for all samples be qualified as estimated (J).**

Identification and Quantification:

As the following tables show, all target radionuclides (^{241}Am, ^{228}Ac, $^{231/234m}Pa$, ^{234}Th and ^{235}U) were reported in all samples.

The laboratory was instructed to report any radioisotopes detected above the decision level. Several peaks were detected but not reported. They were mostly also detected in the blank. There were a few peaks detected that were not included in the blank; however, since there is not detector specific background information, their identification was uncertain and it is not recommended that they be included in the report.

2.0 ALPHA SPECTROMETRY

Method Blank:

There was no indication of blank contamination for the alpha spectrometry analyses.

Equipment Rinsate Blanks:

There was an indication of contamination in one of the rinsate blanks for ^{230}Th. All samples with results less than 5 times the rinsate blank for ^{230}Th should be qualified as estimated. All samples had results less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{230}Th results for all samples be qualified as estimated (J).**

Laboratory Control Sample:

The percent recoveries for the LCSs are within acceptable limits for all the alpha spectrometry analyses.

Duplicate Analysis:

The DERs and/or RPDs are within acceptable limits for all alpha spectrometry analyses.

Sample-Specific Chemical Recovery:

The tracer recoveries were greater than 35% for all samples for the Th analyses and greater than 77% for all U alpha spectrometry analyses. However, the sample-specific percent recovery for the thorium results for all samples have greater than 10% uncertainty. **Therefore, it is recommended that all Th results for all samples be qualified as estimated (J).**

Spectral Analysis:

No spectral interferences were observed in the alpha spectra analyses.

Several of the isotopic thorium alpha spectra show at least two extra peaks. These peaks are in the 5.7 MeV, 5.8 MeV and 6.3 MeV, regions. The first peak is identified as ^{224}Ra and it is assumed that the other two peaks can be attributed to ^{225}Ac and ^{221}Fr, which are progeny of the ^{229}Th tracer. There is no indication of interference with the quantitation of the isotopic thorium results. No further qualification of the isotopic thorium results is required.

Quantitation

The uncertainty reported for ^{232}Th for sample TLW-9181 was 0.0. This indicates that the uncertainty was calculated incorrectly for this sample. **Therefore, it is recommended that the uncertainty for the ^{232}Th for sample TLW-9181 be qualified as estimated (J).**

3.0 ^{226}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{226}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{226}Ra. All samples with results less than 5 times the rinsate blank for ^{226}Ra should be qualified as estimated. All of the results for ^{226}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{226}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{226}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{226}Ra analysis is within acceptable limits.

Chemical Recoveries:

In the ^{226}Ra analysis, the entire sample is de-emanated and no chemical separation takes place. Therefore, 100% recovery is assumed for all samples. Th MSS for the ^{226}Ra analysis was within acceptable limits, indicating the procedure's recovery performance is acceptable.

4.0 ^{228}Ra ANALYSES

Method Blank:

There was no indication of blank contamination in the ^{228}Ra analysis.

Equipment Rinsate Blank:

There was indication of contamination in the rinsate blank for ^{228}Ra. All samples with results less than 5 times the rinsate blank for ^{228}Ra should be qualified as estimated. All of the results for ^{228}Ra were less than 5 times the rinsate blank. **Therefore, it is recommended that the ^{228}Ra results for all samples be qualified as estimated (J)**.

Laboratory Control Sample:

The percent recoveries for the LCSs for the ^{228}Ra analyses were within acceptable limits.

Duplicate Analysis:

The duplicate DER for the ^{228}Ra analysis is within acceptable limits.

Chemical Recoveries:

The sample-specific chemical recoveries for the ^{228}Ra analysis were all above 78%. However there was greater than 10% uncertainty in the sample-specific chemical recoveries for the ^{228}Ra analysis for samples TLW-9181 and TLW-0161. Also, sample TLW-0177 was corrected for 140% recovery, which produces a negative bias on the results. **Therefore, it is recommended that the ^{228}Ra results for samples TLW-9181, TLW-0161, and TLW-0177 be qualified as estimated (J).**

5.0 GROSS ALPHA AND BETA ANALYSIS

Method Blank:

There was no indication of blank contamination in the gross alpha or gross beta analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for gross alpha/beta analyses.

Laboratory Control Sample:

The percent recovery for the gross alpha/beta LCS is within acceptable limits for the gross alpha/beta analyses.

Duplicate Analysis:

The duplicate DERs for the gross alpha/beta analyses are within acceptable limits.

Matrix Spike Sample:

The percent recovery for the gross alpha/beta MSS (54%) and the MSD (51%) were not within acceptable limits for the gross alpha analyses. **Therefore, it is recommended that the gross alpha and gross alpha results for all samples be qualified as estimated (J).**

Quantification:

It is recommended that the gross beta analysis results for all samples be qualified as estimated (J) because the gross beta analysis was performed by gas proportional counting, which is not quantitative and does not include volatile radionuclides (e.g., ^{3}H and ^{99}Tc).

6.0 TOTAL ACTIVITY:

Method Blank:

There was no indication of blank contamination in the total activity analysis.

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total activity analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total activity analysis.

Duplicate Analysis:

The duplicate DER for the total activity analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total activity analysis.

7.0 TOTAL URANIUM

Method Blank:

There was indication of blank contamination for the total uranium analysis.. All samples with total uranium results less than 5 times the blank should be qualified as estimated (J). All samples had total uranium results greater than 5 times the blank except TLW-0177. **Therefore, it is recommended that the total uranium result for sample TLW-0177 be qualified as estimated (J).**

Equipment Rinsate Blank:

There was no indication of contamination in the rinsate blank for the total uranium analysis.

Laboratory Control Sample:

The percent recovery for the total activity LCS is within acceptable limits for the total uranium analysis.

Duplicate Analysis:

The duplicate DER for the total uranium analysis is within acceptable limits.

Matrix Spike Sample:

The matrix spike was within acceptable limits for the total uranium analysis.

8.0 DATA INTERCOMPARISON:

U Alpha to U Gamma:

The ^{238}U results for all samples are in agreement with the corresponding ^{234}Th results within the uncertainties.

^{228}Ra to ^{232}Th Alpha:

The ^{228}Ra activity was compared to ^{232}Th alpha activity to see if the radium and thorium were in equilibrium. The activities are all within the uncertainties of the measurements for all samples except TLW-9181, TLW-0153, and TLW-0161. These samples had ^{228}Ra results that are statistically greater than the ^{232}Th results. This may indicate lack of equilibrium or sample heterogeneity.

^{231}Pa Gamma to ^{235}U Alpha:

When comparing the ^{231}Pa activity to the ^{235}U activity, it was noted that all results agree within the uncertainty with one another and no qualification of the data is necessary.

Alpha/Beta Sums to Gross Alpha/Beta Analysis:

The comparison of alpha and beta emitter sums to the gross alpha and beta analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the alpha and beta sums were statistically different from the gross alpha and beta analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the gross analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The gross alpha and gross beta DERs for all samples were less than 1.29 indicating that the gross alpha analyses are in agreement with the sum of the alpha or beta emitters within a 99% confidence level.

Total Activity Sums to Total Activity Analysis:

The comparison of the total activity sums to the total activity analyses was performed in the same way that the duplicates were evaluated. The DER equation was used to determine if the total activity sums were statistically different from the total activity analysis results at the 99% confidence level. If the DER was greater than 1.29, the sums and the total activity analyses were assumed not to be in agreement. The results are shown on the attached sheets.

The DERs for all samples were less than 1.29 indicating that the total activity analyses are in agreement with the total activity sums within a 99% confidence level.

49386001			TLW-09179					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								4.96E+00	1.43E+01	2.45E+00	7.41E+00	**0.16**	**67.7**	U
Ra-226	1.68E+00	4.90E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	4.60E-01	2.53E-01					J							
Th-230	3.26E-01	1.82E-01					J							
Th-232	2.81E-01	1.50E-01					J							
U-234	1.36E+01	2.34E+00												
U-235	5.41E-01	2.56E-01						4.83E+00	1.93E+01	2.24E+00	8.67E+00	**0.12**	**73.3**	U
U-238	1.16E+01	2.04E+00												
Total U Alpha	**2.57E+01**	**3.11E+00**												
Alpha Sum	**8.31E+01**	**8.02E+01**												
Total U by KPA	35.60 µg/L	2.25 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40			1.41E+01	1.29E+01			J							
Th-234 (Assumed from U-238)	1.16E+01	2.04E+00						7.28E+01	1.70E+02	1.74E+02	1.20E+02	**0.49**	**82.0**	U
Pa-234m (Assumed from U-238)	1.16E+01	2.04E+00						2.12E+02	2.86E+02	6.55E+01	1.97E+02	**0.42**	**106**	U
Ac-227														
Ac-228	1.50E+01	7.27E+00	1.95E+00	5.27E+00	**1.45**	**154**	J							
Ra-228	1.19E+00	9.17E-01					J							
Pa-231	6.07E+01	8.90E+01	2.25E+00	4.01E+01	**0.60**	**186**	U							
Beta Sum	**4.67E+01**	**1.33E+01**						**2.93E+02**	**3.33E+02**	**2.54E+02**	**2.31E+02**			
Total Activity Sum	**1.30E+02**	**8.13E+01**						**3.76E+02**	**3.42E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.60E+01	6.70E+01					UJ	**0.55**	**(from gamma)**		**105**			
Gross Beta	8.60E+00	3.00E+01					UJ	**1.16**	**0.85**		**138**			
Total Activity	1.19E+03	9.13E+02						**1.16**	**0.83**		**161**			

49386002			TLW-9181					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-2.42E-01	6.45E+00					U
Ra-226	8.76E-01	4.30E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	7.72E-02	1.09E-01					U							
Th-230	6.34E-03	7.37E-02					UJ							
Th-232	0.00E+00	0.00E+00					J(u)							
U-234	1.25E+01	2.24E+00												
U-235	4.79E-01	2.57E-01						0.00E+00	6.61E+00					U
U-238	1.08E+01	1.99E+00												
Total U Alpha	**2.38E+01**	**3.01E+00**												
Alpha Sum	**7.05E+01**	**5.89E+01**												
Total U by KPA	37.70 µg/L	2.39 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	1.08E+01	1.99E+00						1.63E+01	7.75E+01					U
Pa-234m (Assumed from U-238)	1.08E+01	1.99E+00						2.35E+01	9.98E+01					U
Ac-227														
Ac-228	0.00E+00	5.36E+00					UJ							
Ra-228	1.77E+00	8.67E-01					J							
Pa-231	5.09E+01	6.54E+01					U							
Beta Sum	**2.95E+01**	**9.95E+00**						**4.77E+01**	**1.27E+02**					
Total Activity Sum	**1.00E+02**	**5.98E+01**						**1.18E+02**	**1.40E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	2.97E+01	6.67E+01					UJ	**0.46**	**(from gamma)**		**81.5**			
Gross Beta	7.84E+00	2.66E+01					UJ	**0.76**	**0.31**		**116**			
Total Activity	6.48E+02	9.01E+02					U	**0.61**	**0.58**		**147**			

49386003			TLW-0153					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								3.90E+00	7.37E+00					U
Ra-226	6.17E-01	3.52E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	5.35E-03	1.07E-01					uj							
Th-230	6.60E-02	8.09E-02					UJ							
Th-232	-6.84E-03	3.46E-02					uj							
U-234	6.34E+00	1.33E+00												
U-235	3.55E-01	2.32E-01						2.87E+00	5.65E+00					U
U-238	5.05E+00	1.12E+00												
Total U Alpha	**1.17E+01**	**1.75E+00**												
Alpha Sum	**1.24E+01**	**5.43E+01**												
Total U by KPA	15.40 µg/L	0.98 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
Tc-99														
Th-234 (Assumed from U-238)	5.05E+00	1.12E+00						0.00E+00	9.10E+01					U
Pa-234m (Assumed from U-238)	5.05E+00	1.12E+00						5.64E+01	1.00E+02					U
Ac-227														
Ac-228	4.50E-01	4.86E+00					UJ							
Ra-228	2.09E+00	9.85E-01					J							
Pa-231	0.00E+00	6.03E+01					U							
Beta Sum	**1.26E+01**	**8.91E+00**						**5.85E+01**	**1.35E+02**					
Total Activity Sum	**2.51E+01**	**5.50E+01**						**7.09E+01**	**1.46E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	1.11E+01	3.23E+01					UJ	**0.02**	**(from gamma)**		**11.3**			
Gross Beta	5.42E+00	1.35E+01					UJ	**0.45**	**0.39**		**80.0**			
Total Activity	9.45E+02	9.07E+02						**1.01**	**0.95**		**190**			

49386004			TLW-0174					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-1.18E+01	6.93E+00					U
Ra-226	3.01E-01	2.56E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	3.74E-01	1.88E-01					J							
Th-230	3.07E-01	1.56E-01					J							
Th-232	1.50E-01	9.56E-02					J							
U-234	1.79E+00	5.69E-01												
U-235	1.11E-01	1.48E-01					U	9.10E-02	9.25E+00					U
U-238	1.41E+00	4.96E-01												
Total U Alpha	**3.31E+00**	**7.69E-01**												
Alpha Sum	**-1.69E+00**	**5.26E+01**												
Total U by KPA	3.62 µg/L	0.18 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	8.79E+01	2.97E+01					J							
Th-234 (Assumed from U-238)	1.41E+00	4.96E-01						0.00E+00	5.99E+01					U
Pa-234m (Assumed from U-238)	1.41E+00	4.96E-01						0.00E+00	1.86E+02					U
Ac-227														
Ac-228	2.88E+00	5.21E+00					UJ							
Ra-228	3.24E-01	6.47E-01					UJ							
Pa-231	-6.81E+00	5.84E+01					U							
Beta Sum	**9.31E+01**	**3.10E+01**						**8.74E+01**	**1.98E+02**					
Total Activity Sum	**9.14E+01**	**6.10E+01**						**8.57E+01**	**2.05E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-4.96E-01	7.97E+01					UJ	**0.01**	**(from gamma)**		**109**			
Gross Beta	1.11E+02	1.17E+02					J	**0.15**	**0.10**		**17.5**			
Total Activity	-3.43E+02	9.45E+02					U	**0.46**	**0.44**		**345**			

49386005			TLW-0175					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-4.89E+00	7.39E+00					U
Ra-226	4.49E-01	2.93E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.94E-01	1.64E-01					J							
Th-230	1.22E-01	9.22E-02					J							
Th-232	5.20E-02	7.29E-02					UJ							
U-234	1.75E+00	6.10E-01												
U-235	8.12E-02	1.94E-01					U	-1.76E+00	6.93E+00					U
U-238	2.04E+00	6.38E-01												
Total U Alpha	**3.87E+00**	**9.04E-01**												
Alpha Sum	**-2.98E+01**	**4.23E+01**												
Total U by KPA	2.90 µg/L	0.11 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	9.56E+01	2.50E+01					J							
Th-234 (Assumed from U-238)	2.04E+00	6.38E-01						3.58E+01	7.30E+01					U
Pa-234m (Assumed from U-238)	2.04E+00	6.38E-01						-8.51E+00	1.25E+02					U
Ac-227														
Ac-228	2.67E+00	5.55E+00					UJ							
Ra-228	3.43E-01	5.66E-01					UJ							
Pa-231	-3.83E+01	4.70E+01					U							
Beta Sum	**9.81E+01**	**2.62E+01**						**1.19E+02**	**1.47E+02**					
Total Activity Sum	**6.83E+01**	**4.98E+01**						**8.89E+01**	**1.53E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-6.91E-01	8.00E+01					UJ	**0.32**	**(from gamma)**		**191**			
Gross Beta	1.01E+02	1.14E+02					J	**0.02**	**0.09**		**2.92**			
Total Activity	-4.43E+01	9.40E+02					U	**0.12**	**0.14**		**938**			

49386006			TLW-0177					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								4.69E+00	7.45E+00					U
Ra-226	4.57E-01	3.35E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.36E-01	1.30E-01					J							
Th-230	6.25E-02	8.50E-02					UJ							
Th-232	5.38E-02	6.15E-02					J							
U-234	5.10E-01	2.74E-01												
U-235	4.15E-02	9.38E-02					U	6.06E+00	9.55E+00					U
U-238	6.14E-01	2.91E-01												
Total U Alpha	**1.17E+00**	**4.11E-01**												
Alpha Sum	**1.55E+01**	**3.83E+01**												
Total U by KPA	1.62 µg/L	0.07 µg/L					J							
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	8.12E+01	2.58E+01					J							
Th-234 (Assumed from U-238)	6.14E-01	2.91E-01						1.48E+01	4.32E+01					U
Pa-234m (Assumed from U-238)	6.14E-01	2.91E-01						-8.86E+00	1.10E+02					U
Ac-227														
Ac-228	0.00E+00	3.69E+00					UJ							
Ra-228	9.84E-02	7.92E-01					UJ							
Pa-231	1.51E+01	4.26E+01					U							
Beta Sum	**8.43E+01**	**2.66E+01**						**8.91E+01**	**1.21E+02**					
Total Activity Sum	**9.98E+01**	**4.67E+01**						**1.05E+02**	**1.27E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	-6.74E-01	2.89E+01					UJ	**0.34**	**(from gamma)**		**218**			
Gross Beta	1.35E+02	7.73E+01					J	**0.62**	**0.32**		**46.2**			
Total Activity	7.50E+02	9.07E+02						**0.72**	**0.70**		**153**			

49386007			TLW-0161					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								-3.20E+00	8.27E+00					U
Ra-226	7.38E-01	3.65E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.02E-01	1.69E-01					UJ							
Th-230	7.87E-02	7.98E-02					J							
Th-232	-1.59E-02	2.22E-02					UJ							
U-234	4.15E+00	9.60E-01												
U-235	1.18E-01	1.51E-01					U	6.58E+00	9.22E+00					U
U-238	2.64E+00	7.08E-01												
Total U Alpha	**6.91E+00**	**1.20E+00**												
Alpha Sum	**-1.21E+01**	**3.58E+01**												
Total U by KPA	5.42 µg/L	0.22 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	9.49E-01	1.85E+01					UJ							
Th-234 (Assumed from U-238)	2.64E+00	7.08E-01						-2.97E+00	6.74E+01					U
Pa-234m (Assumed from U-238)	2.64E+00	7.08E-01						0.00E+00	1.19E+02					U
Ac-227														
Ac-228	2.52E+00	3.37E+00					UJ							
Ra-228	1.52E+00	8.42E-01					J							
Pa-231	-2.21E+01	3.97E+01					U							
Beta Sum	**7.62E+00**	**1.94E+01**						**-3.15E+00**	**1.38E+02**					
Total Activity Sum	**-4.46E+00**	**4.07E+01**						**-1.52E+01**	**1.43E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	4.94E+00	2.20E+01					UJ	**0.41**	**(from gamma)**		**477**			
Gross Beta	5.59E+00	1.57E+01					UJ	**0.08**	**0.06**		**30.70**			
Total Activity	1.31E+02	8.91E+02					U	**0.15**	**0.16**		**214**			

49386008			TLW-0176					FROM GAMMA						
Analyses	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q	Result (pCi/L)	Uncertainty (pCi/L)	Duplicate Result (pCi/L)	Duplicate Uncertainty (pCi/L)	DER	RPD	Val Q
Am-241								2.45E+00	1.84E+01					U
Ra-226	7.34E-01	4.09E-01					J							
Np-237														
Pu-238														
Pu-239														
Th-228	1.52E+00	4.93E-01					J							
Th-230	1.08E+00	4.00E-01					J							
Th-232	1.09E+00	3.89E-01					J							
U-234	1.15E+00	4.39E-01												
U-235	5.45E-02	1.03E-01					U	2.52E+00	1.38E+01					U
U-238	1.56E+00	5.22E-01												
Total U Alpha	**2.76E+00**	**6.90E-01**												
Alpha Sum	**-2.87E+01**	**8.20E+01**												
Total U by KPA	4.53 µg/L	0.30 µg/L												
Total U by KPA														
U-235 wt% (by alpha spect)														
U-233 wt%														
Total U Alpha (Calc)														
Total Radiological Sr														
K-40	2.74E+02	6.59E+01					J							
Th-234 (Assumed from U-238)	1.56E+00	5.22E-01						-2.29E+01	1.43E+02					U
Pa-234m (Assumed from U-238)	1.56E+00	5.22E-01						7.98E+01	2.14E+02					U
Ac-227														
Ac-228	4.09E+00	6.80E+00					UJ							
Ra-228	1.58E+00	1.32E+00					J							
Pa-231	-3.99E+01	9.11E+01					U							
Beta Sum	**2.78E+02**	**6.72E+01**						**3.28E+02**	**2.66E+02**					
Total Activity Sum	**2.49E+02**	**1.06E+02**						**2.99E+02**	**2.78E+02**					
								DER (sums to gross)			**RPD (sums to gross)**			
Gross Alpha	5.71E-01	1.27E+02					UJ	**0.19**	**(from gamma)**		**208**			
Gross Beta	1.60E+02	1.37E+02					J	**0.77**	**0.56**		**53.9**			
Total Activity	3.64E+02	9.06E+02					U	**0.13**	**0.07**		**37.4**			