

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-10196-1

Client Project/Site: HDP

For:

Perma-Fix Environmental Services Inc.
2800 Solway Road
Knoxville, Tennessee 37931

Attn: Brian Miller



Authorized for release by:
1/28/2015 3:37:53 PM

Ivan Vania, Project Manager II
(314)298-8566
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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Job ID: 160-10196-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Perma-Fix Environmental Services Inc.

Project: HDP

Report Number: 160-10196-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 01/20/2015; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the coolers at receipt was 20.0 C.

TECHNETIUM-99 (ICPMS)

Samples L10-04-01-B-R-S-00 (160-10196-1), L10-04-02-B-E-S-00 (160-10196-2), L10-04-03-B-E-S-00 (160-10196-3), L10-04-04-B-R-S-00 (160-10196-4), L10-04-05-B-E-S-00 (160-10196-5), L10-04-06-B-E-S-00 (160-10196-6), L10-04-07-B-E-S-00 (160-10196-7), L10-04-08-B-E-S-00 (160-10196-8), L10-04-08-B-E-Q-00 (160-10196-9), L10-04-09-B-E-S-00 (160-10196-10), L10-04-10-B-R-S-00 (160-10196-11), L10-04-11-B-E-S-00 (160-10196-12) and L10-04-12-B-E-S-00 (160-10196-13) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 01/23/2015 and analyzed on 01/27/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

PERCENT SOLIDS

Case Narrative

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Job ID: 160-10196-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Samples L10-04-01-B-R-S-00 (160-10196-1), L10-04-02-B-E-S-00 (160-10196-2), L10-04-03-B-E-S-00 (160-10196-3), L10-04-04-B-R-S-00 (160-10196-4), L10-04-05-B-E-S-00 (160-10196-5), L10-04-06-B-E-S-00 (160-10196-6), L10-04-07-B-E-S-00 (160-10196-7), L10-04-08-B-E-S-00 (160-10196-8), L10-04-08-B-E-Q-00 (160-10196-9), L10-04-09-B-E-S-00 (160-10196-10), L10-04-10-B-R-S-00 (160-10196-11), L10-04-11-B-E-S-00 (160-10196-12) and L10-04-12-B-E-S-00 (160-10196-13) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 01/21/2015.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples L10-04-01-B-R-S-00 (160-10196-1), L10-04-02-B-E-S-00 (160-10196-2), L10-04-03-B-E-S-00 (160-10196-3), L10-04-04-B-R-S-00 (160-10196-4), L10-04-05-B-E-S-00 (160-10196-5), L10-04-06-B-E-S-00 (160-10196-6), L10-04-07-B-E-S-00 (160-10196-7), L10-04-08-B-E-S-00 (160-10196-8), L10-04-08-B-E-Q-00 (160-10196-9), L10-04-09-B-E-S-00 (160-10196-10), L10-04-10-B-R-S-00 (160-10196-11), L10-04-11-B-E-S-00 (160-10196-12) and L10-04-12-B-E-S-00 (160-10196-13) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 01/21/2015, prepared on 01/23/2015 and analyzed on 01/26/2015.

Preparation Batch 170027:

Radium-226 is reported in these samples at the client's request. Radium-226 is reported from the 609.31 keV line of bismuth-214. Because the samples have not had a 21-day ingrowth, the activity for radium-226 is an estimated value and may be biased low. This bias is caused by the disruption of secular equilibrium between radium-226 and bismuth-214 by the loss of radon-222 during sample preparation. (160-10196-13 DU), (LCS 160-170027/2-A), (MB 160-170027/1-A), L10-04-01-B-R-S-00 (160-10196-1), L10-04-02-B-E-S-00 (160-10196-2), L10-04-03-B-E-S-00 (160-10196-3), L10-04-04-B-R-S-00 (160-10196-4), L10-04-05-B-E-S-00 (160-10196-5), L10-04-06-B-E-S-00 (160-10196-6), L10-04-07-B-E-S-00 (160-10196-7), L10-04-08-B-E-Q-00 (160-10196-9), L10-04-08-B-E-S-00 (160-10196-8), L10-04-09-B-E-S-00 (160-10196-10), L10-04-10-B-R-S-00 (160-10196-11), L10-04-11-B-E-S-00 (160-10196-12), L10-04-12-B-E-S-00 (160-10196-13)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other:

Client Contact		Project Manager: Brian Miller		Site Contact: Ellen Jakub		Date: 01/20/15	
Perma-Fix Environmental Services		Tel/Fax: (314) 810-3333		Lab Contact: Ivan Vania		Carrier: Courier	
2800 Solway Road							
Knoxville, TN 37931							
Phone (865) 690-0501							
FAX (865) 539-9868							
Project Name: Hematite Decommissioning Project							
Site: Westinghouse Hematite, MO							
P O # 832953							

Sample Identification				Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample	Perform MS/MSD (Ra-226, Th-232, U-238)	Gamma Spec (Ra-226, Th-232, U-238)	Alpha Spec (Ra-226, Th-232, U-238)	ICP/MS (Tc-99, Pb-210, U-235, U-238)	Gamma Spec (Ra-226, Th-232, U-238) (post-21 day)	Sample Specific Notes:										
L10-04-01-B-R-S-00				1/15/15	14:30	C	Soil	1	N	X	X	X	X	X											
L10-04-02-B-E-S-00				1/15/15	14:32	G	Soil	1	N	X	X	X	X	X											
L10-04-03-B-E-S-00				1/15/15	15:10	G	Soil	1	N	X	X	X	X	X											
L10-04-04-B-R-S-00				1/15/15	14:45	C	Soil	1	N	X	X	X	X	X											
L10-04-05-B-E-S-00				1/15/15	14:50	G	Soil	1	N	X	X	X	X	X											
L10-04-06-B-E-S-00				1/17/15	11:05	G	Soil	1	N	X	X	X	X	X											
L10-04-07-B-E-S-00				1/15/15	15:15	G	Soil	1	N	X	X	X	X	X											
L10-04-08-B-E-S-00				1/15/15	15:20	G	Soil	1	N	X	X	X	X	X											
L10-04-08-B-E-Q-00				1/15/15	15:20	G	Soil	1	N	X	X	X	X	X											
L10-04-09-B-E-S-00				1/17/15	14:10	G	Soil	1	N	X	X	X	X	X											
L10-04-10-B-R-S-00				1/15/15	15:25	C	Soil	1	N	X	X	X	X	X											
L10-04-11-B-E-S-00				1/15/15	15:27	G	Soil	1	N	X	X	X	X	X											

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160-10196 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other: None

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Special Instructions/QC Requirements & Comments: Dry and homogenize samples before analyses; potential for radiological contamination

Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No	Custody Seal No.:	Cooler Temp. (°C):	Obs'd:	Cor'd:	Therm ID No.:
Relinquished by: Brian Miller	Company: Perma-Fix	Date/Time: 1/20/15	Received by: Ellen	Company: Perma-Fix	Date/Time: 1/20/15
Relinquished by: Ellen	Company: Perma-Fix	Date/Time: 1/20/15	Received by: Ivan	Company: Perma-Fix	Date/Time: 1/20/15
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Hematite Decommissioning Project

Perma-Fix (for Westinghouse) Non-Proprietary Class 3

Procedure: HDP-PR-QA-006, Chain of Custody

Revision: 3

Earth City, MO 63045
phone 314.298.8566 fax

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other:

Client Contact Perma-Fix Environmental Services 2800 Solway Road Knoxville, TN 37931 (865) 690-0501 Phone (865) 539-9868 FAX Project Name: Hematite Decommissioning Project Site: Westinghouse Hematite, MO P O # 832953		Project Manager: Brian Miller Tel/Fax: (314) 810-3333 Analysis Turnaround Time <input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS TAT if different from Below _____ <input type="checkbox"/> 2 weeks <input checked="" type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day		Date: 1/20/15 Carrier: Courier Site Contact: Ellen Jakub Lab Contact: Ivan Vania		COC No: 012015-FSSI 2 of 2 COCs Sampler: _____ For Lab Use Only: Walk-in Client: _____ Lab Sampling: _____ Job / SDG No.: _____																											
Sample Identification L10-04-12-B-E-S-00		Sample Date 1/15/15		Sample Time 15:35		Sample Type (C=Comp, G=Grab) G		Matrix Soil		# of Cont. 1																							
		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">Perform MS / MSD (Y / N)</td> <td style="width:15%;">Gamma Spec (Ra-226, Th-232, U-235, U-238)</td> <td style="width:15%;">Alpha Spec</td> <td style="width:15%;">ICP/MS (Tc-99)</td> <td style="width:15%;">Gamma Spec (Ra-226, post-21 day ingrowth)</td> <td style="width:15%;"></td> <td style="width:15%;"></td> <td style="width:15%;"></td> <td style="width:15%;"></td> <td style="width:15%;"></td> <td style="width:15%;"></td> <td style="width:15%;"></td> </tr> <tr> <td>N</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>										Perform MS / MSD (Y / N)	Gamma Spec (Ra-226, Th-232, U-235, U-238)	Alpha Spec	ICP/MS (Tc-99)	Gamma Spec (Ra-226, post-21 day ingrowth)								N	X	X	X	X					
Perform MS / MSD (Y / N)	Gamma Spec (Ra-226, Th-232, U-235, U-238)	Alpha Spec	ICP/MS (Tc-99)	Gamma Spec (Ra-226, post-21 day ingrowth)																													
N	X	X	X	X																													
Sample Specific Notes: <div style="height: 100px; border: 1px solid black;"></div>																																	
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other _____ None _____																																	
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.																																	
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown																																	
Special Instructions/QC Requirements & Comments: Dry and homogenize samples prior to analyses; potential for radiological contamination																																	
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.: _____		Cooler Temp. (°C): Obs'd: _____ Cor'd: _____		Therm ID No.: _____																											
Relinquished by: <i>Brian Miller</i>		Company: Perma-Fix		Received by: <i>Ivan Vania</i>		Company: <i>Cellman</i>		Date/Time: 1/20/15																									
Relinquished by: <i>Brian Miller</i>		Company: Perma-Fix		Received by: <i>Ivan Vania</i>		Company: <i>Cellman</i>		Date/Time: 1/20/15																									
Relinquished by: <i>Brian Miller</i>		Company: Perma-Fix		Received in Laboratory by: _____		Company: _____		Date/Time: _____																									

Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-10196-1

Login Number: 10196

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Thermal preservation not required.
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Method	Method Description	Protocol	Laboratory
6020A	Metals (ICP/MS), Tc-99	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
6020A	Metals (ICP/MS), Tc-99 in Activity	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10196-1	L10-04-01-B-R-S-00	Solid	01/15/15 14:30	01/20/15 10:51
160-10196-2	L10-04-02-B-E-S-00	Solid	01/15/15 14:32	01/20/15 10:51
160-10196-3	L10-04-03-B-E-S-00	Solid	01/15/15 15:10	01/20/15 10:51
160-10196-4	L10-04-04-B-R-S-00	Solid	01/15/15 14:45	01/20/15 10:51
160-10196-5	L10-04-05-B-E-S-00	Solid	01/15/15 14:50	01/20/15 10:51
160-10196-6	L10-04-06-B-E-S-00	Solid	01/17/15 11:05	01/20/15 10:51
160-10196-7	L10-04-07-B-E-S-00	Solid	01/15/15 15:15	01/20/15 10:51
160-10196-8	L10-04-08-B-E-S-00	Solid	01/15/15 15:20	01/20/15 10:51
160-10196-9	L10-04-08-B-E-Q-00	Solid	01/15/15 15:20	01/20/15 10:51
160-10196-10	L10-04-09-B-E-S-00	Solid	01/17/15 14:10	01/20/15 10:51
160-10196-11	L10-04-10-B-R-S-00	Solid	01/15/15 15:25	01/20/15 10:51
160-10196-12	L10-04-11-B-E-S-00	Solid	01/15/15 15:27	01/20/15 10:51
160-10196-13	L10-04-12-B-E-S-00	Solid	01/15/15 15:35	01/20/15 10:51

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-01-B-R-S-00

Lab Sample ID: 160-10196-1

Date Collected: 01/15/15 14:30

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 73.4

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000076	0.000023	mg/Kg	☆	01/23/15 13:45	01/27/15 11:47	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.133	U	0.0612	0.0624	1.52	0.260	pCi/g	01/23/15 13:45	01/27/15 11:47	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					01/23/15 13:45	01/27/15 11:47	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.866		0.114	0.144		0.0993	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Americium 241	0.000889	U	0.0512	0.0512		0.0870	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Bismuth 212	1.19		0.416	0.434		0.348	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Bismuth 214	0.832		0.0943	0.128		0.0595	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Lead 212	0.804		0.0649	0.123		0.0572	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Lead 214	0.995		0.0890	0.136		0.0593	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Potassium 40	14.1		1.00	1.76		0.305	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Protactinium 234m	3.81	U	2.38	2.41		5.31	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Protactinium 231	0.215	U	0.169	0.170		0.957	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Radium 226	0.832		0.0943	0.128		0.0595	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Thorium 234	0.809		0.301	0.312		0.805	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Uranium 235	0.112	U	0.125	0.126		0.223	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Thorium 232	0.866		0.114	0.144		0.0993	pCi/g	01/23/15 12:21	01/26/15 16:07	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.257		0.0415	0.0493		0.0350	pCi/g	01/23/15 12:21	01/26/15 16:07	1

Client Sample ID: L10-04-02-B-E-S-00

Lab Sample ID: 160-10196-2

Date Collected: 01/15/15 14:32

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 77.7

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000073	0.000022	mg/Kg	☆	01/23/15 13:45	01/27/15 11:51	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.135	U	0.116	0.117	1.45	0.249	pCi/g	01/23/15 13:45	01/27/15 11:51	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					01/23/15 13:45	01/27/15 11:51	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-02-B-E-S-00

Lab Sample ID: 160-10196-2

Date Collected: 01/15/15 14:32

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.897		0.125	0.155		0.113	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Americium 241	-0.000304	U	0.0463	0.0463		0.0788	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Bismuth 212	0.901		0.346	0.358		0.321	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Bismuth 214	0.910		0.0971	0.136		0.0586	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Lead 212	0.865		0.0665	0.130		0.0556	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Lead 214	0.950		0.0923	0.135		0.0746	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Potassium 40	15.3		1.07	1.90		0.226	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Protactinium 234m	0.955	U	3.14	3.14		4.69	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Protactinium 231	-0.488	U	0.616	0.619		1.02	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Radium 226	0.910		0.0971	0.136		0.0586	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Thorium 234	0.563	U	0.264	0.270		0.698	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Uranium 235	0.0787	U	0.123	0.123		0.204	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Thorium 232	0.897		0.125	0.155		0.113	pCi/g	01/23/15 12:21	01/26/15 17:23	1
Other Detected										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.290		0.0519	0.0600		0.0400	pCi/g	01/23/15 12:21	01/26/15 17:23	1

Client Sample ID: L10-04-03-B-E-S-00

Lab Sample ID: 160-10196-3

Date Collected: 01/15/15 15:10

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 82.9

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000038	J	0.000067	0.000020	mg/Kg	☼	01/23/15 13:45	01/27/15 11:55	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Technetium 99	0.644		0.189	0.198	1.34	0.230	pCi/g	01/23/15 13:45	01/27/15 11:55	1
Carrier										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					01/23/15 13:45	01/27/15 11:55	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.971		0.156	0.184		0.114	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Americium 241	-0.00437	U	0.267	0.267		0.116	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Bismuth 212	1.26		0.602	0.616		0.545	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Bismuth 214	0.901		0.110	0.144		0.0714	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Lead 212	0.867		0.0815	0.139		0.0849	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Lead 214	0.941		0.105	0.143		0.0782	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Potassium 40	15.5		1.25	2.02		0.335	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Protactinium 234m	2.04	U	3.87	3.88		6.58	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Protactinium 231	0.253	U	0.247	0.249		1.11	pCi/g	01/23/15 12:21	01/26/15 17:24	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-03-B-E-S-00

Lab Sample ID: 160-10196-3

Date Collected: 01/15/15 15:10

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.901		0.110	0.144		0.0714	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Thorium 234	2.29		0.850	0.883		0.987	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Uranium 235	0.219	U	0.174	0.176		0.266	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Thorium 232	0.971		0.156	0.184		0.114	pCi/g	01/23/15 12:21	01/26/15 17:24	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.313		0.0555	0.0643		0.0426	pCi/g	01/23/15 12:21	01/26/15 17:24	1

Client Sample ID: L10-04-04-B-R-S-00

Lab Sample ID: 160-10196-4

Date Collected: 01/15/15 14:45

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 81.3

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000077		0.000068	0.000020	mg/Kg	☼	01/23/15 13:45	01/27/15 12:07	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	1.32		0.148	0.191	1.37	0.234	pCi/g	01/23/15 13:45	01/27/15 12:07	1
Carrier										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					01/23/15 13:45	01/27/15 12:07	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.785		0.110	0.136		0.107	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Americium 241	0.00389	U	0.0384	0.0384		0.0657	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Bismuth 212	1.02		0.392	0.406		0.344	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Bismuth 214	0.702		0.0954	0.120		0.0988	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Lead 212	0.809		0.0647	0.123		0.0467	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Lead 214	0.959		0.0941	0.137		0.0774	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Potassium 40	13.8		1.07	1.78		0.249	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Protactinium 234m	2.21	U	3.07	3.07		5.09	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Protactinium 231	-0.579	U	0.741	0.744		1.22	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Radium 226	0.702		0.0954	0.120		0.0988	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Thorium 234	1.48		0.509	0.532		0.781	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Uranium 235	0.197	U	0.132	0.134		0.221	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Thorium 232	0.785		0.110	0.136		0.107	pCi/g	01/23/15 12:21	01/26/15 18:00	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.253		0.0417	0.0493		0.0310	pCi/g	01/23/15 12:21	01/26/15 18:00	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-05-B-E-S-00

Lab Sample ID: 160-10196-5

Date Collected: 01/15/15 14:50

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 80.6

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000067	J	0.000069	0.000021	mg/Kg	☼	01/23/15 13:45	01/27/15 12:11	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	1.14		0.154	0.186	1.38	0.236	pCi/g	01/23/15 13:45	01/27/15 12:11	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					01/23/15 13:45	01/27/15 12:11	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.875		0.114	0.144		0.0955	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Americium 241	-0.00901	U	0.477	0.477		0.105	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Bismuth 212	0.529	U	0.353	0.357		0.536	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Bismuth 214	0.840		0.107	0.138		0.0692	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Lead 212	0.683		0.0701	0.113		0.0732	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Lead 214	0.856		0.0975	0.132		0.0707	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Potassium 40	12.2		1.05	1.64		0.166	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Protactinium 234m	2.36	U	2.87	2.88		4.69	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Protactinium 231	0.464	U	0.477	0.479		0.772	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Radium 226	0.840		0.107	0.138		0.0692	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Thorium 234	1.08		0.516	0.528		0.819	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Uranium 235	0.253		0.133	0.135		0.240	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Thorium 232	0.875		0.114	0.144		0.0955	pCi/g	01/23/15 12:21	01/26/15 18:01	1
Other Detected			Count Uncert.	Total Uncert.						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.235		0.0424	0.0489		0.0331	pCi/g	01/23/15 12:21	01/26/15 18:01	1

Client Sample ID: L10-04-06-B-E-S-00

Lab Sample ID: 160-10196-6

Date Collected: 01/17/15 11:05

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 69.9

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000078	0.000024	mg/Kg	☼	01/23/15 13:45	01/27/15 12:15	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.181	U	0.00404	0.0171	1.57	0.268	pCi/g	01/23/15 13:45	01/27/15 12:15	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	92		30 - 110					01/23/15 13:45	01/27/15 12:15	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-06-B-E-S-00

Lab Sample ID: 160-10196-6

Date Collected: 01/17/15 11:05

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.04		0.120	0.160		0.125	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Americium 241	-0.00449	U	0.0648	0.0648		0.109	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Bismuth 212	1.08		0.329	0.347		0.433	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Bismuth 214	0.930		0.103	0.141		0.0735	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Lead 212	1.04		0.0720	0.153		0.0663	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Lead 214	1.04		0.0945	0.143		0.0810	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Potassium 40	16.5		1.04	1.99		0.315	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Protactinium 234m	2.25	U	2.39	2.40		3.85	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Protactinium 231	0.313	U	0.182	0.185		1.17	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Radium 226	0.930		0.103	0.141		0.0735	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Thorium 234	1.55		0.551	0.574		0.858	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Uranium 235	0.358		0.147	0.152		0.193	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Thorium 232	1.04		0.120	0.160		0.125	pCi/g	01/23/15 12:21	01/26/15 18:37	1
Other Detected										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.385		0.0423	0.0582		0.0256	pCi/g	01/23/15 12:21	01/26/15 18:37	1

Client Sample ID: L10-04-07-B-E-S-00

Lab Sample ID: 160-10196-7

Date Collected: 01/15/15 15:15

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 77.2

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000074	0.000022	mg/Kg	☼	01/23/15 13:45	01/27/15 12:26	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Technetium 99	0.278		0.112	0.115	1.49	0.255	pCi/g	01/23/15 13:45	01/27/15 12:26	1
Carrier										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	87		30 - 110					01/23/15 13:45	01/27/15 12:26	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.786		0.144	0.165		0.0874	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Americium 241	-0.00559	U	0.0647	0.0647		0.109	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Bismuth 212	0.648		0.386	0.392		0.578	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Bismuth 214	0.926		0.117	0.152		0.0775	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Lead 212	1.05		0.0794	0.158		0.0617	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Lead 214	1.02		0.0919	0.141		0.0774	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Potassium 40	17.3		1.26	2.18		0.277	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Protactinium 234m	0.000	U	1.09	1.09		7.09	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Protactinium 231	0.441	U	0.235	0.240		1.24	pCi/g	01/23/15 12:21	01/26/15 18:35	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-07-B-E-S-00

Lab Sample ID: 160-10196-7

Date Collected: 01/15/15 15:15

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.926		0.117	0.152		0.0775	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Thorium 234	0.706	U	0.340	0.348		0.919	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Uranium 235	0.0907	U	0.133	0.133		0.238	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Thorium 232	0.786		0.144	0.165		0.0874	pCi/g	01/23/15 12:21	01/26/15 18:35	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.310		0.0519	0.0610		0.0385	pCi/g	01/23/15 12:21	01/26/15 18:35	1

Client Sample ID: L10-04-08-B-E-S-00

Lab Sample ID: 160-10196-8

Date Collected: 01/15/15 15:20

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 84.1

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.00010		0.000067	0.000020	mg/Kg	☆	01/23/15 13:45	01/27/15 12:30	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	1.72		0.177	0.238	1.33	0.228	pCi/g	01/23/15 13:45	01/27/15 12:30	1
Carrier										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					01/23/15 13:45	01/27/15 12:30	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.637		0.150	0.164		0.163	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Americium 241	0.0125	U	0.0643	0.0643		0.109	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Bismuth 212	1.24		0.493	0.509		0.472	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Bismuth 214	0.907		0.112	0.147		0.0678	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Lead 212	0.830		0.0782	0.133		0.0792	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Lead 214	0.865		0.103	0.136		0.0784	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Potassium 40	15.3		1.21	1.98		0.176	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Protactinium 234m	3.92	U	3.59	3.62		5.67	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Protactinium 231	0.499	U	0.336	0.341		1.19	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Radium 226	0.907		0.112	0.147		0.0678	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Thorium 234	1.59		0.754	0.772		0.928	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Uranium 235	0.122	U	0.140	0.140		0.265	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Thorium 232	0.637		0.150	0.164		0.163	pCi/g	01/23/15 12:21	01/26/15 18:36	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.301		0.0523	0.0609		0.0404	pCi/g	01/23/15 12:21	01/26/15 18:36	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-08-B-E-Q-00

Lab Sample ID: 160-10196-9

Date Collected: 01/15/15 15:20

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 82.3

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000079		0.000067	0.000020	mg/Kg	☼	01/23/15 13:45	01/27/15 12:34	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	1.35		0.117	0.171	1.35	0.230	pCi/g	01/23/15 13:45	01/27/15 12:34	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					01/23/15 13:45	01/27/15 12:34	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.872		0.201	0.219		0.154	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Americium 241	0.0284	U	0.0652	0.0652		0.109	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Bismuth 212	0.624		0.368	0.374		0.547	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Bismuth 214	0.765		0.104	0.131		0.0742	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Lead 212	0.866		0.0770	0.136		0.0745	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Lead 214	0.870		0.104	0.138		0.0737	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Potassium 40	14.8		1.17	1.92		0.171	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Protactinium 234m	0.522	U	3.28	3.28		5.86	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Protactinium 231	0.283	U	0.179	0.182		1.35	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Radium 226	0.765		0.104	0.131		0.0742	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Thorium 234	1.20		0.556	0.570		0.882	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Uranium 235	0.105	U	0.153	0.153		0.258	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Thorium 232	0.872		0.201	0.219		0.154	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Other Detected			Count Uncert.	Total Uncert.						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.314		0.0510	0.0605		0.0373	pCi/g	01/23/15 12:21	01/26/15 19:12	1

Client Sample ID: L10-04-09-B-E-S-00

Lab Sample ID: 160-10196-10

Date Collected: 01/17/15 14:10

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 75.1

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.00046		0.000075	0.000022	mg/Kg	☼	01/23/15 13:45	01/27/15 12:38	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	7.86		0.197	0.750	1.49	0.256	pCi/g	01/23/15 13:45	01/27/15 12:38	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					01/23/15 13:45	01/27/15 12:38	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-09-B-E-S-00

Lab Sample ID: 160-10196-10

Date Collected: 01/17/15 14:10

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.706		0.143	0.160		0.115	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Americium 241	0.0201	U	0.0611	0.0611		0.102	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Bismuth 212	0.515	U	0.348	0.352		0.526	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Bismuth 214	0.615		0.0953	0.115		0.0612	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Lead 212	0.608		0.0702	0.105		0.0782	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Lead 214	0.696		0.0890	0.115		0.0704	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Potassium 40	11.4		1.05	1.57		0.262	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Protactinium 234m	0.992	U	3.15	3.16		5.55	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Protactinium 231	0.197	U	0.173	0.175		1.05	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Radium 226	0.615		0.0953	0.115		0.0612	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Thorium 234	1.58		0.552	0.576		0.850	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Uranium 235	0.151	U	0.125	0.126		0.207	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Thorium 232	0.706		0.143	0.160		0.115	pCi/g	01/23/15 12:21	01/26/15 19:51	1
Other Detected										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.232		0.0532	0.0584		0.0439	pCi/g	01/23/15 12:21	01/26/15 19:51	1

Client Sample ID: L10-04-10-B-R-S-00

Lab Sample ID: 160-10196-11

Date Collected: 01/15/15 15:25

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 81.9

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000067	0.000020	mg/Kg	☼	01/23/15 13:45	01/27/15 12:42	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Technetium 99	0.0134	U	0.0372	0.0373	1.35	0.231	pCi/g	01/23/15 13:45	01/27/15 12:42	1
Carrier										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					01/23/15 13:45	01/27/15 12:42	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.15		0.127	0.173		0.128	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Americium 241	-0.00565	U	0.0691	0.0691		0.116	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Bismuth 212	1.39		0.507	0.527		0.445	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Bismuth 214	0.883		0.109	0.143		0.0811	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Lead 212	1.08		0.0791	0.161		0.0801	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Lead 214	1.13		0.0969	0.152		0.0820	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Potassium 40	21.1		1.16	2.46		0.118	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Protactinium 234m	10.7		4.38	4.51		3.64	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Protactinium 231	0.248	U	0.187	0.189		1.15	pCi/g	01/23/15 12:21	01/26/15 19:13	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-10-B-R-S-00

Lab Sample ID: 160-10196-11

Date Collected: 01/15/15 15:25

Matrix: Solid

Date Received: 01/20/15 10:51

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.883		0.109	0.143		0.0811	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Thorium 234	4.66		0.940	1.06		1.05	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Uranium 235	0.335		0.142	0.146		0.220	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Thorium 232	1.15		0.127	0.173		0.128	pCi/g	01/23/15 12:21	01/26/15 19:13	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.391		0.0515	0.0655		0.0378	pCi/g	01/23/15 12:21	01/26/15 19:13	1

Client Sample ID: L10-04-11-B-E-S-00

Lab Sample ID: 160-10196-12

Date Collected: 01/15/15 15:27

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 81.7

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000069	0.000021	mg/Kg	☼	01/23/15 13:45	01/27/15 12:45	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.0221	U	0.0622	0.0622	1.38	0.236	pCi/g	01/23/15 13:45	01/27/15 12:45	1
Carrier										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					01/23/15 13:45	01/27/15 12:45	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.27		0.142	0.192		0.116	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Americium 241	-0.0226	U	0.0584	0.0585		0.0979	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Bismuth 212	1.33		0.432	0.454		0.421	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Bismuth 214	1.03		0.126	0.165		0.0868	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Lead 212	1.19		0.0839	0.176		0.0625	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Lead 214	1.17		0.105	0.161		0.0804	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Potassium 40	21.0		1.39	2.56		0.277	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Protactinium 234m	14.4		4.92	5.13		4.67	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Protactinium 231	-0.651	U	0.838	0.842		1.38	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Radium 226	1.03		0.126	0.165		0.0868	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Thorium 234	3.97		0.680	0.797		0.938	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Uranium 235	0.378		0.175	0.179		0.232	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Thorium 232	1.27		0.142	0.192		0.116	pCi/g	01/23/15 12:21	01/26/15 19:12	1
Other Detected										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.417		0.0569	0.0715		0.0386	pCi/g	01/23/15 12:21	01/26/15 19:12	1

TestAmerica St. Louis

Client Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Client Sample ID: L10-04-12-B-E-S-00

Lab Sample ID: 160-10196-13

Date Collected: 01/15/15 15:35

Matrix: Solid

Date Received: 01/20/15 10:51

Percent Solids: 81.7

Method: 6020A - Metals (ICP/MS), Tc-99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000076	0.000023	mg/Kg	☼	01/23/15 13:45	01/27/15 12:49	1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.0106	U	0.0773	0.0773	1.52	0.260	pCi/g	01/23/15 13:45	01/27/15 12:49	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	80		30 - 110					01/23/15 13:45	01/27/15 12:49	1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.23		0.165	0.207		0.102	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Americium 241	-0.00112	U	0.0618	0.0618		0.104	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Bismuth 212	1.39		0.402	0.427		0.363	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Bismuth 214	0.983		0.0968	0.141		0.0635	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Lead 212	1.12		0.0741	0.162		0.0704	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Lead 214	1.09		0.0893	0.144		0.0724	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Potassium 40	20.2		1.14	2.36		0.305	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Protactinium 234m	1.81	U	1.74	1.74		5.30	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Protactinium 231	0.397	U	0.221	0.225		1.08	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Radium 226	0.983		0.0968	0.141		0.0635	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Thorium 234	0.927		0.276	0.293		0.789	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Uranium 235	0.0487	U	0.143	0.143		0.240	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Thorium 232	1.23		0.165	0.207		0.102	pCi/g	01/23/15 12:21	01/26/15 19:48	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.362		0.0508	0.0632		0.0381	pCi/g	01/23/15 12:21	01/26/15 19:48	1

QC Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Method: 6020A - Metals (ICP/MS), Tc-99

Lab Sample ID: MB 160-170039/1-A
Matrix: Solid
Analysis Batch: 170638

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 170039

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000054	0.000016	mg/Kg		01/23/15 13:45	01/27/15 11:40	1

Lab Sample ID: LCS 160-170039/2-A
Matrix: Solid
Analysis Batch: 170638

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 170039

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00124	0.00125		mg/Kg		101	80 - 120

Lab Sample ID: 160-10196-3 MS
Matrix: Solid
Analysis Batch: 170638

Client Sample ID: L10-04-03-B-E-S-00
Prep Type: Total/NA
Prep Batch: 170039

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.000038	J	0.00148	0.00157		mg/Kg	☼	104	75 - 125

Lab Sample ID: 160-10196-3 MSD
Matrix: Solid
Analysis Batch: 170638

Client Sample ID: L10-04-03-B-E-S-00
Prep Type: Total/NA
Prep Batch: 170039

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Technetium 99	0.000038	J	0.00148	0.00158		mg/Kg	☼	104	75 - 125	1	30

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Lab Sample ID: MB 160-170039/1-A
Matrix: Solid
Analysis Batch: 170639

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 170039

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.002420	U	0.0596	0.0596	1.09	0.186	pCi/g	01/23/15 13:45	01/27/15 11:40	1

Carrier	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	92		30 - 110	01/23/15 13:45	01/27/15 11:40	1

Lab Sample ID: LCS 160-170039/2-A
Matrix: Solid
Analysis Batch: 170639

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 170039

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	21.2	21.39		2.11	1.13	0.194	pCi/g	101	80 - 120

Carrier	LCS %Yield	LCS Qualifier	Limits
Re	89		30 - 110

TestAmerica St. Louis

QC Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity (Continued)

Lab Sample ID: 160-10196-3 MS

Matrix: Solid

Analysis Batch: 170639

Client Sample ID: L10-04-03-B-E-S-00

Prep Type: Total/NA

Prep Batch: 170039

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	0.644		25.3	26.82		2.53	1.33	0.228	pCi/g	104	75 - 125
Carrier	MS %Yield	MS Qualifier	Limits								
Re	90		30 - 110								

Lab Sample ID: 160-10196-3 MSD

Matrix: Solid

Analysis Batch: 170639

Client Sample ID: L10-04-03-B-E-S-00

Prep Type: Total/NA

Prep Batch: 170039

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Technetium 99	0.644		25.4	26.97		2.54	1.34	0.229	pCi/g	104	75 - 125	0.03	1
Carrier	MSD %Yield	MSD Qualifier	Limits										
Re	90		30 - 110										

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-170027/1-A

Matrix: Solid

Analysis Batch: 170227

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 170027

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	-0.001871	U	0.0328	0.0328		0.0651	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Americium 241	0.001362	U	0.0112	0.0112		0.0205	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Bismuth 212	0.01122	U	0.0681	0.0681		0.142	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Bismuth 214	-0.004751	U	0.0258	0.0258		0.0357	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Lead 212	-0.006306	U	0.0531	0.0531		0.0249	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Lead 214	-0.001736	U	0.0206	0.0206		0.0322	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Potassium 40	-0.07351	U	2.94	2.94		0.220	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Protactinium 234m	0.1451	U	1.16	1.16		2.28	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Protactinium 231	0.001764	U	0.209	0.209		0.391	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Radium 226	-0.004751	U	0.0258	0.0258		0.0357	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Thorium 234	-0.02124	U	0.173	0.173		0.277	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Uranium 235	0.004189	U	0.00991	0.00992		0.0697	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Thorium 232	-0.001871	U	0.0328	0.0328		0.0651	pCi/g	01/23/15 12:21	01/26/15 16:09	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/g	01/23/15 12:21	01/26/15 16:09	1

TestAmerica St. Louis

QC Sample Results

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-170027/2-A
Matrix: Solid
Analysis Batch: 170228

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 170027

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	94.65		9.86		0.608	pCi/g	94	87 - 116
Cesium 137	35.0	32.88		3.45	0.200	0.210	pCi/g	94	87 - 120
Cobalt 60	37.0	34.82		3.52		0.127	pCi/g	94	87 - 115

Lab Sample ID: 160-10196-13 DU
Matrix: Solid
Analysis Batch: 170230

Client Sample ID: L10-04-12-B-E-S-00
Prep Type: Total/NA
Prep Batch: 170027

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.23		1.208		0.175		0.102	pCi/g	0.05	1
Americium 241	-0.00112	U	-0.01267	U	0.0641		0.107	pCi/g	0.09	1
Bismuth 212	1.39		1.259		0.340		0.354	pCi/g	0.17	1
Bismuth 214	0.983		0.9695		0.139		0.0651	pCi/g	0.05	1
Lead 212	1.12		1.242		0.177		0.0586	pCi/g	0.37	1
Lead 214	1.09		1.117		0.145		0.0672	pCi/g	0.09	1
Potassium 40	20.2		19.31		2.28		0.304	pCi/g	0.20	1
Protactinium 234m	1.81	U	3.033	U	3.09		4.96	pCi/g	0.25	1
Protactinium 231	0.397	U	0.4771	U	0.247		1.14	pCi/g	0.17	1
Radium 226	0.983		0.9695		0.139		0.0651	pCi/g	0.05	1
Thorium 234	0.927		0.9391		0.528		0.759	pCi/g	0.01	1
Uranium 235	0.0487	U	0.08099	U	0.138		0.236	pCi/g	0.11	1
Thorium 232	1.23		1.208		0.175		0.102	pCi/g	0.05	1
Total										
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.362		0.3929		0.0645		0.0349	pCi/g	0.24	1

QC Association Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Metals

Prep Batch: 170039

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	None	
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	None	
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	None	
160-10196-3 MS	L10-04-03-B-E-S-00	Total/NA	Solid	None	
160-10196-3 MSD	L10-04-03-B-E-S-00	Total/NA	Solid	None	
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	None	
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	None	
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	None	
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	None	
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	None	
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	None	
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	None	
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	None	
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	None	
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	None	
LCS 160-170039/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-170039/1-A	Method Blank	Total/NA	Solid	None	

Analysis Batch: 170638

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	6020A	170039
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-3 MS	L10-04-03-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-3 MSD	L10-04-03-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	6020A	170039
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	6020A	170039
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	6020A	170039
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	6020A	170039
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	6020A	170039
LCS 160-170039/2-A	Lab Control Sample	Total/NA	Solid	6020A	170039
MB 160-170039/1-A	Method Blank	Total/NA	Solid	6020A	170039

General Chemistry

Analysis Batch: 169554

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	Moisture	
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	Moisture	
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	Moisture	

TestAmerica St. Louis

QC Association Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

General Chemistry (Continued)

Analysis Batch: 169554 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	Moisture	
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	Moisture	
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	Moisture	
160-10196-13 DU	L10-04-12-B-E-S-00	Total/NA	Solid	Moisture	

Rad

Leach Batch: 169559

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	Dry and Grind	
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10196-13 DU	L10-04-12-B-E-S-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 170027

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
160-10196-13 DU	L10-04-12-B-E-S-00	Total/NA	Solid	Fill_Geo-0	169559
LCS 160-170027/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-170027/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Prep Batch: 170039

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-1	L10-04-01-B-R-S-00	Total/NA	Solid	None	
160-10196-2	L10-04-02-B-E-S-00	Total/NA	Solid	None	
160-10196-3	L10-04-03-B-E-S-00	Total/NA	Solid	None	

TestAmerica St. Louis

QC Association Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Rad (Continued)

Prep Batch: 170039 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10196-3 MS	L10-04-03-B-E-S-00	Total/NA	Solid	None	
160-10196-3 MSD	L10-04-03-B-E-S-00	Total/NA	Solid	None	
160-10196-4	L10-04-04-B-R-S-00	Total/NA	Solid	None	
160-10196-5	L10-04-05-B-E-S-00	Total/NA	Solid	None	
160-10196-6	L10-04-06-B-E-S-00	Total/NA	Solid	None	
160-10196-7	L10-04-07-B-E-S-00	Total/NA	Solid	None	
160-10196-8	L10-04-08-B-E-S-00	Total/NA	Solid	None	
160-10196-9	L10-04-08-B-E-Q-00	Total/NA	Solid	None	
160-10196-10	L10-04-09-B-E-S-00	Total/NA	Solid	None	
160-10196-11	L10-04-10-B-R-S-00	Total/NA	Solid	None	
160-10196-12	L10-04-11-B-E-S-00	Total/NA	Solid	None	
160-10196-13	L10-04-12-B-E-S-00	Total/NA	Solid	None	
LCS 160-170039/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-170039/1-A	Method Blank	Total/NA	Solid	None	

Tracer/Carrier Summary

Client: Perma-Fix Environmental Services Inc.
Project/Site: HDP

TestAmerica Job ID: 160-10196-1

Method: 6020A - Metals (ICP/MS), Tc-99 in Activity

Matrix: Solid

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)	
Lab Sample ID	Client Sample ID	Re (30-110)	
160-10196-1	L10-04-01-B-R-S-00	91	
160-10196-2	L10-04-02-B-E-S-00	89	
160-10196-3	L10-04-03-B-E-S-00	90	
160-10196-3 MS	L10-04-03-B-E-S-00	90	
160-10196-3 MSD	L10-04-03-B-E-S-00	90	
160-10196-4	L10-04-04-B-R-S-00	90	
160-10196-5	L10-04-05-B-E-S-00	89	
160-10196-6	L10-04-06-B-E-S-00	92	
160-10196-7	L10-04-07-B-E-S-00	87	
160-10196-8	L10-04-08-B-E-S-00	90	
160-10196-9	L10-04-08-B-E-Q-00	90	
160-10196-10	L10-04-09-B-E-S-00	89	
160-10196-11	L10-04-10-B-R-S-00	90	
160-10196-12	L10-04-11-B-E-S-00	89	
160-10196-13	L10-04-12-B-E-S-00	80	
LCS 160-170039/2-A	Lab Control Sample	89	
MB 160-170039/1-A	Method Blank	92	

Tracer/Carrier Legend

Re = Re