

# 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: 160-11319-1

Client Project/Site: HDP

For:

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

Attn: Brian Miller



Authorized for release by:  
4/27/2015 1:13:31 PM

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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: 160-11319-1

**Job ID: 160-11319-1**

**Laboratory: TestAmerica St. Louis**

**Narrative**

### CASE NARRATIVE

**Client: Perma-Fix Environmental Services Inc.**

**Project: HDP**

**Report Number: 160-11319-1**

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 04/14/2015; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the coolers at receipt was 18.0 C.

#### TECHNETIUM-99 (ICPMS)

Samples L10-13-01-B-E-S-00 (160-11319-1), L10-13-02-B-R-S-00 (160-11319-2), L10-13-03-B-E-S-00 (160-11319-3), L10-13-04-B-E-S-00 (160-11319-4), L10-13-05-B-R-S-00 (160-11319-5), L10-13-06-B-E-S-00 (160-11319-6), L10-13-07-B-R-S-00 (160-11319-7), L10-13-08-B-E-S-00 (160-11319-8), L10-13-09-B-E-S-00 (160-11319-9), L10-13-10-B-R-S-00 (160-11319-10), L10-13-11-B-E-S-00 (160-11319-11), L10-13-12-B-E-S-00 (160-11319-12), L10-13-13-B-R-B-00 (160-11319-13) and L10-13-07-B-R-Q-00 (160-11319-14) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 04/16/2015 and analyzed on 04/20/2015.

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: 160-11319-1

### Job ID: 160-11319-1 (Continued)

#### Laboratory: TestAmerica St. Louis (Continued)

Samples L10-13-01-B-E-S-00 (160-11319-1), L10-13-02-B-R-S-00 (160-11319-2), L10-13-03-B-E-S-00 (160-11319-3), L10-13-04-B-E-S-00 (160-11319-4), L10-13-05-B-R-S-00 (160-11319-5), L10-13-06-B-E-S-00 (160-11319-6), L10-13-07-B-R-S-00 (160-11319-7), L10-13-08-B-E-S-00 (160-11319-8), L10-13-09-B-E-S-00 (160-11319-9), L10-13-10-B-R-S-00 (160-11319-10), L10-13-11-B-E-S-00 (160-11319-11), L10-13-12-B-E-S-00 (160-11319-12), L10-13-13-B-R-B-00 (160-11319-13) and L10-13-07-B-R-Q-00 (160-11319-14) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 04/15/2015.

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 L10-13-01-B-E-S-00 (160-11319-1), L10-13-02-B-R-S-00 (160-11319-2), L10-13-03-B-E-S-00 (160-11319-3), L10-13-04-B-E-S-00 (160-11319-4), L10-13-05-B-R-S-00 (160-11319-5), L10-13-06-B-E-S-00 (160-11319-6), L10-13-07-B-R-S-00 (160-11319-7), L10-13-08-B-E-S-00 (160-11319-8), L10-13-09-B-E-S-00 (160-11319-9), L10-13-10-B-R-S-00 (160-11319-10), L10-13-11-B-E-S-00 (160-11319-11), L10-13-12-B-E-S-00 (160-11319-12), L10-13-13-B-R-B-00 (160-11319-13) and L10-13-07-B-R-Q-00 (160-11319-14) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 04/14/2015, and prepared and analyzed on 04/16/2015.

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



160-11319 Chain of Custody

**Chain of Custody Record**
**TestAmerica**

THE LEADER IN ENVIRONMENTAL TESTING

Earth City, MO 63045

phone 314.298.8566 fax

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

TestAmerica Laboratories, Inc.

<b>Client Contact</b>		<b>Project Manager: Brian Miller</b>		<b>Site Contact: Ellen Jakub</b>		<b>Date: 04/14/2015</b>		<b>COC No: 041415-FSS1</b>			
Perma-Fix Environmental Services		Tel/Fax: (314) 810-3333		Lab Contact: Ivan Vanya		Carrier: Courier		1 of 2 COCs			
2800 Solway Road		<b>Analysis Turnaround Time</b>		Filtered Sample (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)				Sampler:			
Knoxville, TN 37931		<input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS						For Lab Use Only:			
(865) 690-0501 Phone		TAT if different from Below						Walk-in Client:			
(865) 539-9868 FAX		<input type="checkbox"/> 2 weeks <input checked="" type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day						Lab Sampling:			
Project Name: Hematite Decommissioning Project								Job / SDG No.:			
Site: Westinghouse Hematite, MO											
P O # 832953											
<b>Sample Identification</b>		<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type (C=Comp, G=Grab)</b>	<b>Matrix</b>	<b># of Cont.</b>				<b>Sample Specific Notes:</b>	
L10-13-01-B-E-S-00		4/10/15	1525	C	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-02-B-R-S-00		4/10/15	1610	C	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-03-B-E-S-00		4/10/15	1620	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-04-B-E-S-00		4/10/15	1535	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-05-B-R-S-00		4/10/15	1630	C	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-06-B-E-S-00		4/10/15	1635	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-07-B-R-S-00		4/10/15	1510	C	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-08-B-E-S-00		4/10/15	1515	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-09-B-E-S-00		4/10/15	1540	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-10-B-R-S-00		4/10/15	1645	C	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-11-B-E-S-00		4/10/15	1650	G	Soil	1	N	X	X	X	Sampler Matt Cushman
L10-13-12-B-E-S-00		4/10/15	1550	G	Soil	1	N	X	X	X	Sampler Matt Cushman
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.							Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)				
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown							<input checked="" type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months				
Special Instructions/QC Requirements & Comments: Potential for Radiological Contamination											
Custody Seals Intact: <input checked="" 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		Date/Time: 4/14/15 0912		Received by: <i>John R. Settle</i>		Company: Crossroads			
Relinquished by: <i>John R. Settle</i>		Company: Crossroads		Date/Time: 4/14/15 1020		Received by: <i>Del Clarke</i>		Company: TA STL			
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:			

Hematite Decommissioning Project

Permafix (for Westinghouse) Non-Proprietary Class 3

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

Revision: 3

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:[illegible]



## Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-11319-1

Login Number: 11319

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= 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.	N/A	
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?	True	
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 <6mm (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: 160-11319-1

### 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: 160-11319-1

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: 160-11319-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-11319-1	L10-13-01-B-E-S-00	Solid	04/10/15 15:25	04/14/15 10:20
160-11319-2	L10-13-02-B-R-S-00	Solid	04/10/15 16:10	04/14/15 10:20
160-11319-3	L10-13-03-B-E-S-00	Solid	04/10/15 16:20	04/14/15 10:20
160-11319-4	L10-13-04-B-E-S-00	Solid	04/10/15 15:35	04/14/15 10:20
160-11319-5	L10-13-05-B-R-S-00	Solid	04/10/15 16:30	04/14/15 10:20
160-11319-6	L10-13-06-B-E-S-00	Solid	04/10/15 16:35	04/14/15 10:20
160-11319-7	L10-13-07-B-R-S-00	Solid	04/10/15 15:10	04/14/15 10:20
160-11319-8	L10-13-08-B-E-S-00	Solid	04/10/15 15:15	04/14/15 10:20
160-11319-9	L10-13-09-B-E-S-00	Solid	04/10/15 15:40	04/14/15 10:20
160-11319-10	L10-13-10-B-R-S-00	Solid	04/10/15 16:45	04/14/15 10:20
160-11319-11	L10-13-11-B-E-S-00	Solid	04/10/15 16:50	04/14/15 10:20
160-11319-12	L10-13-12-B-E-S-00	Solid	04/10/15 15:50	04/14/15 10:20
160-11319-13	L10-13-13-B-R-B-00	Solid	04/10/15 16:00	04/14/15 10:20
160-11319-14	L10-13-07-B-R-Q-00	Solid	04/10/15 15:10	04/14/15 10:20

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

**Client Sample ID: L10-13-01-B-E-S-00**

**Lab Sample ID: 160-11319-1**

**Date Collected: 04/10/15 15:25**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

**Percent Solids: 82.3**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000058	0.000017	mg/Kg	☆	04/16/15 11:19	04/20/15 11:25	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	0.241		0.0502	0.0549	1.15	0.198	pCi/g	04/16/15 11:19	04/20/15 11:25	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	105		30 - 110					04/16/15 11:19	04/20/15 11:25	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	1.10		0.132	0.174		0.117	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Americium 241	0.00282	U	0.0582	0.0582		0.0980	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Bismuth 212	1.09		0.340	0.358		0.328	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Bismuth 214	0.854		0.0842	0.122		0.0471	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Lead 212	1.13		0.0693	0.161		0.0526	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Lead 214	0.925		0.0759	0.122		0.0840	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Potassium 40	19.4		1.11	2.28		0.285	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Protactinium 234m	0.986	U	2.46	2.47		4.33	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Protactinium 231	0.537	U	0.313	0.318		1.03	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Radium 226	0.854		0.0842	0.122		0.0471	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Thorium 234	1.31		0.485	0.503		0.758	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Uranium 235	0.341		0.141	0.145		0.177	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Thorium 232	1.10		0.132	0.174		0.117	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.44		0.611	0.634		0.775	pCi/g	04/16/15 10:07	04/16/15 17:36	1
Tl-208	0.362		0.0438	0.0577		0.0298	pCi/g	04/16/15 10:07	04/16/15 17:36	1

**Client Sample ID: L10-13-02-B-R-S-00**

**Lab Sample ID: 160-11319-2**

**Date Collected: 04/10/15 16:10**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

**Percent Solids: 80.6**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000059	0.000018	mg/Kg	☆	04/16/15 11:19	04/20/15 11:29	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	0.266		0.140	0.142	1.18	0.201	pCi/g	04/16/15 11:19	04/20/15 11:29	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	105		30 - 110					04/16/15 11:19	04/20/15 11:29	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-02-B-R-S-00

Lab Sample ID: 160-11319-2

Date Collected: 04/10/15 16:10

Matrix: Solid

Date Received: 04/14/15 10:20

## 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	1.07		0.119	0.162		0.101	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Americium 241	0.00262	U	0.0578	0.0578		0.0976	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Bismuth 212	1.52		0.491	0.516		0.428	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Bismuth 214	0.721		0.0844	0.113		0.0583	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Lead 212	1.11		0.0716	0.160		0.0579	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Lead 214	0.877		0.0773	0.120		0.0688	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Potassium 40	18.6		1.11	2.20		0.324	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Protactinium 234m	2.74	U	3.03	3.04		5.01	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Protactinium 231	-0.654	U	0.651	0.655		1.06	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Radium 226	0.721		0.0844	0.113		0.0583	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Thorium 234	1.22		0.455	0.472		0.709	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Uranium 235	0.0551	U	0.123	0.124		0.225	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Thorium 232	1.07		0.119	0.162		0.101	pCi/g	04/16/15 10:07	04/16/15 18:10	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.64		0.627	0.656		0.773	pCi/g	04/16/15 10:07	04/16/15 18:10	1
Tl-208	0.351		0.0428	0.0562		0.0306	pCi/g	04/16/15 10:07	04/16/15 18:10	1

Client Sample ID: L10-13-03-B-E-S-00

Lab Sample ID: 160-11319-3

Date Collected: 04/10/15 16:20

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 80.8

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000062	0.000019	mg/Kg	☼	04/16/15 11:19	04/20/15 11:33	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	0.245		0.0776	0.0808	1.24	0.213	pCi/g	04/16/15 11:19	04/20/15 11:33	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	100		30 - 110					04/16/15 11:19	04/20/15 11:33	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		0.140	0.189		0.108	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Americium 241	-0.000239	U	0.0666	0.0666		0.108	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Bismuth 212	1.36		0.372	0.397		0.355	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Bismuth 214	0.897		0.0940	0.132		0.0668	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Lead 212	1.21		0.0764	0.175		0.0684	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Lead 214	1.08		0.0901	0.144		0.0687	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Potassium 40	21.7		1.19	2.49		0.394	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Protactinium 234m	1.75	U	2.77	2.78		4.64	pCi/g	04/16/15 10:07	04/16/15 19:16	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-03-B-E-S-00

Lab Sample ID: 160-11319-3

Date Collected: 04/10/15 16:20

Matrix: Solid

Date Received: 04/14/15 10:20

## 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
Protactinium 231	0.425	U	0.246	0.251		1.13	pCi/g	04/16/15 10:07	04/16/15 19:16	1
<b>Radium 226</b>	<b>0.897</b>		0.0940	0.132		0.0668	pCi/g	04/16/15 10:07	04/16/15 19:16	1
<b>Thorium 234</b>	<b>1.11</b>		0.526	0.539		0.843	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Uranium 235	0.127	U	0.146	0.146		0.229	pCi/g	04/16/15 10:07	04/16/15 19:16	1
<b>Thorium 232</b>	<b>1.27</b>		0.140	0.189		0.108	pCi/g	04/16/15 10:07	04/16/15 19:16	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.14		0.603	0.617		0.801	pCi/g	04/16/15 10:07	04/16/15 19:16	1
Tl-208	0.405		0.0458	0.0619		0.0314	pCi/g	04/16/15 10:07	04/16/15 19:16	1

Client Sample ID: L10-13-04-B-E-S-00

Lab Sample ID: 160-11319-4

Date Collected: 04/10/15 15:35

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 79.8

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000059	0.000018	mg/Kg	☼	04/16/15 11:19	04/20/15 11:38	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	0.104	U	0.0954	0.0959	1.19	0.203	pCi/g	04/16/15 11:19	04/20/15 11:38	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	106		30 - 110					04/16/15 11:19	04/20/15 11:38	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
<b>Actinium 228</b>	<b>1.23</b>		0.112	0.168		0.0958	pCi/g	04/16/15 10:07	04/16/15 19:17	1
Americium 241	-0.0286	U	0.0621	0.0622		0.103	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Bismuth 212</b>	<b>1.45</b>		0.369	0.398		0.336	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Bismuth 214</b>	<b>0.903</b>		0.0930	0.132		0.0601	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Lead 212</b>	<b>1.23</b>		0.0738	0.175		0.0543	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Lead 214</b>	<b>1.00</b>		0.0835	0.133		0.0714	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Potassium 40</b>	<b>18.3</b>		1.15	2.19		0.411	pCi/g	04/16/15 10:07	04/16/15 19:17	1
Protactinium 234m	1.54	U	2.68	2.69		4.61	pCi/g	04/16/15 10:07	04/16/15 19:17	1
Protactinium 231	0.744	U	0.261	0.273		1.06	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Radium 226</b>	<b>0.903</b>		0.0930	0.132		0.0601	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Thorium 234</b>	<b>1.09</b>		0.316	0.336		0.832	pCi/g	04/16/15 10:07	04/16/15 19:17	1
Uranium 235	0.148	U	0.153	0.154		0.224	pCi/g	04/16/15 10:07	04/16/15 19:17	1
<b>Thorium 232</b>	<b>1.23</b>		0.112	0.168		0.0958	pCi/g	04/16/15 10:07	04/16/15 19:17	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

**Client Sample ID: L10-13-04-B-E-S-00**

**Lab Sample ID: 160-11319-4**

**Date Collected: 04/10/15 15:35**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

<i>Other Detected</i>			<i>Count</i>	<i>Total</i>						
<i>Radionuclides</i>	<i>Result</i>	<i>Qualifier</i>	<i>Uncert.</i>	<i>Uncert.</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Pb-210	1.56		0.613	0.640		0.791	pCi/g	04/16/15 10:07	04/16/15 19:17	1
Tl-208	0.351		0.0458	0.0585		0.0343	pCi/g	04/16/15 10:07	04/16/15 19:17	1

**Client Sample ID: L10-13-05-B-R-S-00**

**Lab Sample ID: 160-11319-5**

**Date Collected: 04/10/15 16:30**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

**Percent Solids: 87.6**

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

<i>Analyte</i>	<i>Result</i>	<i>Qualifier</i>	<i>RL</i>	<i>MDL</i>	<i>Unit</i>	<i>D</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Technetium 99	ND		0.000057	0.000017	mg/Kg	☼	04/16/15 11:19	04/20/15 11:42	1

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

<i>Analyte</i>	<i>Result</i>	<i>Qualifier</i>	<i>Count</i>	<i>Total</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
			<i>Uncert.</i>	<i>Uncert.</i>						
			<i>(2σ+/-)</i>	<i>(2σ+/-)</i>						
Technetium 99	0.0710	U	0.0777	0.0780	1.13	0.194	pCi/g	04/16/15 11:19	04/20/15 11:42	1
<i>Carrier</i>	<i>%Yield</i>	<i>Qualifier</i>	<i>Limits</i>					<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Re	100		30 - 110					04/16/15 11:19	04/20/15 11:42	1

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

<i>Analyte</i>	<i>Result</i>	<i>Qualifier</i>	<i>Count</i>	<i>Total</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
			<i>Uncert.</i>	<i>Uncert.</i>						
			<i>(2σ+/-)</i>	<i>(2σ+/-)</i>						
Actinium 228	1.20		0.135	0.181		0.104	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Americium 241	0.000376	U	0.0624	0.0624		0.106	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Bismuth 212	1.63		0.364	0.400		0.289	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Bismuth 214	0.756		0.0976	0.125		0.0789	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Lead 212	1.18		0.0800	0.173		0.0788	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Lead 214	0.956		0.0971	0.139		0.0820	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Potassium 40	22.0		1.23	2.53		0.415	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Protactinium 234m	2.33	U	2.95	2.96		4.85	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Protactinium 231	0.233	U	0.533	0.534		0.899	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Radium 226	0.756		0.0976	0.125		0.0789	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Thorium 234	1.50		0.540	0.562		0.846	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Uranium 235	0.0889	U	0.150	0.151		0.247	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Thorium 232	1.20		0.135	0.181		0.104	pCi/g	04/16/15 10:07	04/16/15 19:50	1
<i>Other Detected</i>			<i>Count</i>	<i>Total</i>						
<i>Radionuclides</i>	<i>Result</i>	<i>Qualifier</i>	<i>Uncert.</i>	<i>Uncert.</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
			<i>(2σ+/-)</i>	<i>(2σ+/-)</i>						
Pb-210	1.89		0.699	0.734		0.833	pCi/g	04/16/15 10:07	04/16/15 19:50	1
Tl-208	0.417		0.0579	0.0720		0.0449	pCi/g	04/16/15 10:07	04/16/15 19:50	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-06-B-E-S-00

Lab Sample ID: 160-11319-6

Date Collected: 04/10/15 16:35

Matrix: Solid

Date Received: 04/14/15 10:20

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		0.000059	0.000018	mg/Kg	☼	04/16/15 11:19	04/20/15 11:46	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	0.0208	U	0.0196	0.0196	1.19	0.204	pCi/g	04/16/15 11:19	04/20/15 11:46	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	103		30 - 110					04/16/15 11:19	04/20/15 11:46	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	1.04		0.125	0.164		0.0906	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Americium 241	0.00481	U	0.0565	0.0565		0.0950	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Bismuth 212	1.26		0.329	0.354		0.295	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Bismuth 214	0.728		0.0875	0.116		0.0628	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Lead 212	1.09		0.0647	0.155		0.0464	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Lead 214	0.804		0.0721	0.110		0.0672	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Potassium 40	17.3		1.00	2.03		0.266	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Protactinium 234m	2.59	U	2.08	2.10		4.26	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Protactinium 231	0.381	U	0.224	0.227		0.980	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Radium 226	0.728		0.0875	0.116		0.0628	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Thorium 234	1.25		0.439	0.458		0.682	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Uranium 235	0.133	U	0.121	0.122		0.202	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Thorium 232	1.04		0.125	0.164		0.0906	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.11		0.442	0.461		0.616	pCi/g	04/16/15 10:07	04/16/15 19:51	1
Tl-208	0.325		0.0436	0.0551		0.0350	pCi/g	04/16/15 10:07	04/16/15 19:51	1

Client Sample ID: L10-13-07-B-R-S-00

Lab Sample ID: 160-11319-7

Date Collected: 04/10/15 15:10

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 86.6

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000021	J	0.000059	0.000018	mg/Kg	☼	04/16/15 11:19	04/20/15 11:50	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	0.358		0.0734	0.0804	1.18	0.202	pCi/g	04/16/15 11:19	04/20/15 11:50	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	98		30 - 110					04/16/15 11:19	04/20/15 11:50	1

TestAmerica St. Louis



# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-07-B-R-S-00

Lab Sample ID: 160-11319-7

Date Collected: 04/10/15 15:10

Matrix: Solid

Date Received: 04/14/15 10:20

## 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	1.20		0.120	0.172		0.0980	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Americium 241	0.00470	U	0.0625	0.0625		0.105	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Bismuth 212	1.67		0.441	0.474		0.348	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Bismuth 214	0.858		0.0980	0.132		0.0660	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Lead 212	1.23		0.0749	0.176		0.0662	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Lead 214	0.938		0.0801	0.126		0.0614	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Potassium 40	17.8		1.06	2.11		0.347	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Protactinium 234m	3.22	U	2.66	2.68		4.30	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Protactinium 231	0.341	U	0.345	0.347		0.558	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Radium 226	0.858		0.0980	0.132		0.0660	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Thorium 234	1.15		0.492	0.506		0.777	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Uranium 235	0.141	U	0.153	0.153		0.236	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Thorium 232	1.20		0.120	0.172		0.0980	pCi/g	04/16/15 10:07	04/16/15 20:23	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.38		0.598	0.619		0.775	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Tl-208	0.406		0.0417	0.0593		0.0257	pCi/g	04/16/15 10:07	04/16/15 20:23	1

Client Sample ID: L10-13-08-B-E-S-00

Lab Sample ID: 160-11319-8

Date Collected: 04/10/15 15:15

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 82.5

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000036	J	0.000060	0.000018	mg/Kg	☼	04/16/15 11:19	04/20/15 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	0.622		0.0854	0.103	1.21	0.207	pCi/g	04/16/15 11:19	04/20/15 12:07	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	100		30 - 110					04/16/15 11:19	04/20/15 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	1.07		0.129	0.169		0.120	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Americium 241	-0.00502	U	0.0594	0.0594		0.100	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Bismuth 212	1.33		0.321	0.349		0.332	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Bismuth 214	0.797		0.0969	0.127		0.0675	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Lead 212	1.14		0.0727	0.164		0.0569	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Lead 214	0.872		0.0959	0.132		0.0730	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Potassium 40	17.8		1.12	2.14		0.205	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Protactinium 234m	3.35	U	1.52	1.55		5.09	pCi/g	04/16/15 10:07	04/16/15 20:20	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-08-B-E-S-00

Lab Sample ID: 160-11319-8

Date Collected: 04/10/15 15:15

Matrix: Solid

Date Received: 04/14/15 10:20

## 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
Protactinium 231	-0.690	U	0.678	0.682		1.10	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Radium 226	0.797		0.0969	0.127		0.0675	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Thorium 234	0.888		0.265	0.281		0.740	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Uranium 235	0.111	U	0.139	0.139		0.219	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Thorium 232	1.07		0.129	0.169		0.120	pCi/g	04/16/15 10:07	04/16/15 20:20	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	0.956		0.544	0.555		0.749	pCi/g	04/16/15 10:07	04/16/15 20:20	1
Tl-208	0.390		0.0514	0.0654		0.0375	pCi/g	04/16/15 10:07	04/16/15 20:20	1

Client Sample ID: L10-13-09-B-E-S-00

Lab Sample ID: 160-11319-9

Date Collected: 04/10/15 15:40

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 69.7

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000023	J	0.000071	0.000021	mg/Kg	☼	04/16/15 11:19	04/20/15 12:12	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	0.401		0.105	0.111	1.43	0.244	pCi/g	04/16/15 11:19	04/20/15 12:12	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	101		30 - 110					04/16/15 11:19	04/20/15 12:12	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	1.39		0.168	0.218		0.124	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Americium 241	-0.00102	U	0.0752	0.0752		0.104	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Bismuth 212	1.78		0.525	0.556		0.445	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Bismuth 214	0.852		0.102	0.135		0.0752	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Lead 212	1.20		0.0767	0.174		0.0739	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Lead 214	1.01		0.0770	0.131		0.0731	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Potassium 40	20.6		1.12	2.36		0.335	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Protactinium 234m	2.89	U	2.88	2.89		4.64	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Protactinium 231	0.740	U	0.238	0.251		1.12	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Radium 226	0.852		0.102	0.135		0.0752	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Thorium 234	1.09		0.490	0.503		0.782	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Uranium 235	0.110	U	0.153	0.153		0.239	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Thorium 232	1.39		0.168	0.218		0.124	pCi/g	04/16/15 10:07	04/16/15 20:23	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

**Client Sample ID: L10-13-09-B-E-S-00**

**Lab Sample ID: 160-11319-9**

**Date Collected: 04/10/15 15:40**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Pb-210	1.52		0.709	0.731		0.852	pCi/g	04/16/15 10:07	04/16/15 20:23	1
Tl-208	0.440		0.0535	0.0701		0.0389	pCi/g	04/16/15 10:07	04/16/15 20:23	1

**Client Sample ID: L10-13-10-B-R-S-00**

**Lab Sample ID: 160-11319-10**

**Date Collected: 04/10/15 16:45**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

**Percent Solids: 82.2**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000058	0.000017	mg/Kg	☼	04/16/15 11:19	04/20/15 12:16	1

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

		Count		Total						
Analyte	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Technetium 99	-0.0123	U	0.0416	0.0416	1.16	0.198	pCi/g	04/16/15 11:19	04/20/15 12:16	1
Carrier	%Yield	Qualifier	Limits							
Re	105		30 - 110							
								Prepared	Analyzed	Dil Fac
								04/16/15 11:19	04/20/15 12:16	1

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

		Count		Total						
Analyte	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.15		0.109	0.160		0.0840	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Americium 241	0.0301	U	0.0570	0.0571		0.0948	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Bismuth 212	1.16		0.381	0.400		0.367	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Bismuth 214	0.803		0.0832	0.118		0.0541	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Lead 212	1.12		0.0686	0.160		0.0545	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Lead 214	0.826		0.0803	0.118		0.0615	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Potassium 40	18.0		1.04	2.12		0.257	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Protactinium 234m	1.01	U	2.48	2.48		4.33	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Protactinium 231	-0.616	U	0.638	0.641		1.04	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Radium 226	0.803		0.0832	0.118		0.0541	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Thorium 234	1.29		0.464	0.483		0.724	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Uranium 235	0.134	U	0.113	0.113		0.197	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Thorium 232	1.15		0.109	0.160		0.0840	pCi/g	04/16/15 10:07	04/16/15 20:24	1
Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.346		0.0422	0.0554		0.0302	pCi/g	04/16/15 10:07	04/16/15 20:24	1

**Client Sample ID: L10-13-11-B-E-S-00**

**Lab Sample ID: 160-11319-11**

**Date Collected: 04/10/15 16:50**

**Matrix: Solid**

**Date Received: 04/14/15 10:20**

**Percent Solids: 77.8**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000062	0.000018	mg/Kg	☼	04/16/15 12:22	04/20/15 12:20	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-11-B-E-S-00

Lab Sample ID: 160-11319-11

Date Collected: 04/10/15 16:50

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 77.8

## 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	0.0900	U	0.0555	0.0561	1.23	0.211	pCi/g	04/16/15 12:22	04/20/15 12:20	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	105		30 - 110					04/16/15 12:22	04/20/15 12:20	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	1.24		0.120	0.174		0.0988	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Americium 241	0.0198	U	0.0566	0.0567		0.0947	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Bismuth 212	1.34		0.403	0.426		0.385	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Bismuth 214	0.754		0.0870	0.117		0.0566	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Lead 212	1.16		0.0735	0.167		0.0552	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Lead 214	0.883		0.0846	0.125		0.0735	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Potassium 40	17.2		1.12	2.09		0.211	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Protactinium 234m	1.22	U	2.78	2.78		5.59	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Protactinium 231	-0.749	U	0.724	0.729		1.18	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Radium 226	0.754		0.0870	0.117		0.0566	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Thorium 234	1.44		0.632	0.650		0.831	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Uranium 235	0.166	U	0.131	0.132		0.231	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Thorium 232	1.24		0.120	0.174		0.0988	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.366		0.0456	0.0594		0.0314	pCi/g	04/16/15 10:07	04/16/15 20:55	1

Client Sample ID: L10-13-12-B-E-S-00

Lab Sample ID: 160-11319-12

Date Collected: 04/10/15 15:50

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 71.3

## 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	☆	04/16/15 12:22	04/20/15 12:24	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	0.108	U	0.0587	0.0595	1.46	0.250	pCi/g	04/16/15 12:22	04/20/15 12:24	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	96		30 - 110					04/16/15 12:22	04/20/15 12:24	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	1.19		0.149	0.193		0.104	pCi/g	04/16/15 10:07	04/16/15 20:55	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-12-B-E-S-00

Lab Sample ID: 160-11319-12

Date Collected: 04/10/15 15:50

Matrix: Solid

Date Received: 04/14/15 10:20

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Americium 241	-0.00635	U	0.468	0.468		0.112	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Bismuth 212	1.97		0.519	0.558		0.393	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Bismuth 214	0.875		0.105	0.139		0.0670	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Lead 212	1.03		0.0843	0.158		0.0871	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Lead 214	0.843		0.0940	0.129		0.0838	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Potassium 40	15.8		1.21	2.02		0.394	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Protactinium 234m	0.551	U	3.02	3.02		5.38	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Protactinium 231	-0.607	U	0.800	0.802		1.32	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Radium 226	0.875		0.105	0.139		0.0670	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Thorium 234	0.526	U	0.288	0.293		0.838	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Uranium 235	0.305		0.185	0.188		0.204	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Thorium 232	1.19		0.149	0.193		0.104	pCi/g	04/16/15 10:07	04/16/15 20:55	1
Other Detected										
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.412		0.0567	0.0710		0.0427	pCi/g	04/16/15 10:07	04/16/15 20:55	1

Client Sample ID: L10-13-13-B-R-B-00

Lab Sample ID: 160-11319-13

Date Collected: 04/10/15 16:00

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 77.3

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.00017		0.000063	0.000019	mg/Kg	☆	04/16/15 12:22	04/20/15 12:29	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	2.83		0.215	0.337	1.26	0.215	pCi/g	04/16/15 12:22	04/20/15 12:29	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	104		30 - 110					04/16/15 12:22	04/20/15 12:29	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	1.28		0.130	0.183		0.0982	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Americium 241	0.0128	U	0.0715	0.0715		0.120	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Bismuth 212	1.14		0.367	0.385		0.372	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Bismuth 214	0.796		0.105	0.133		0.0824	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Lead 212	1.21		0.0785	0.175		0.0769	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Lead 214	0.912		0.0882	0.130		0.0652	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Potassium 40	19.8		1.12	2.29		0.377	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Protactinium 234m	6.80		3.42	3.49		5.09	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Protactinium 231	0.465	U	0.245	0.250		1.23	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Radium 226	0.796		0.105	0.133		0.0824	pCi/g	04/16/15 10:07	04/16/15 20:56	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11319-1

Client Sample ID: L10-13-13-B-R-B-00

Lab Sample ID: 160-11319-13

Date Collected: 04/10/15 16:00

Matrix: Solid

Date Received: 04/14/15 10:20

## 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
Thorium 234	3.97		0.636	0.760		0.907	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Uranium 235	1.08		0.172	0.204		0.232	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Thorium 232	1.28		0.130	0.183		0.0982	pCi/g	04/16/15 10:07	04/16/15 20:56	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.11		0.588	0.603		0.820	pCi/g	04/16/15 10:07	04/16/15 20:56	1
Tl-208	0.438		0.0507	0.0678		0.0361	pCi/g	04/16/15 10:07	04/16/15 20:56	1

Client Sample ID: L10-13-07-B-R-Q-00

Lab Sample ID: 160-11319-14

Date Collected: 04/10/15 15:10

Matrix: Solid

Date Received: 04/14/15 10:20

Percent Solids: 81.7

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000020	J	0.000062	0.000019	mg/Kg	☼	04/16/15 12:22	04/20/15 12:33	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	0.340		0.0489	0.0581	1.24	0.212	pCi/g	04/16/15 12:22	04/20/15 12:33	1
<b>Carrier</b>										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	99		30 - 110					04/16/15 12:22	04/20/15 12:33	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	1.24		0.115	0.171		0.106	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Americium 241	-0.00656	U	0.0570	0.0571		0.0960	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Bismuth 212	1.40		0.321	0.353		0.267	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Bismuth 214	0.780		0.0898	0.121		0.0631	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Lead 212	1.22		0.0712	0.174		0.0529	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Lead 214	0.891		0.0821	0.124		0.0620	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Potassium 40	16.6		1.01	1.97		0.277	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Protactinium 234m	3.30	U	2.44	2.46		4.55	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Protactinium 231	0.539	U	0.219	0.226		1.01	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Radium 226	0.780		0.0898	0.121		0.0631	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Thorium 234	1.13		0.457	0.472		0.720	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Uranium 235	0.136	U	0.124	0.124		0.155	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Thorium 232	1.24		0.115	0.171		0.106	pCi/g	04/16/15 10:07	04/16/15 20:57	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.55		0.596	0.623		0.750	pCi/g	04/16/15 10:07	04/16/15 20:57	1
Tl-208	0.359		0.0433	0.0571		0.0309	pCi/g	04/16/15 10:07	04/16/15 20:57	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11319-1

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

Lab Sample ID: MB 160-186047/1-A

Matrix: Solid

Analysis Batch: 186924

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 186047

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000047	0.000014	mg/Kg		04/16/15 11:19	04/20/15 10:38	1

Lab Sample ID: LCS 160-186047/2-A

Matrix: Solid

Analysis Batch: 186924

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 186047

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00123	0.00129		mg/Kg		105	80 - 120

Lab Sample ID: 160-11302-A-1-H MS

Matrix: Solid

Analysis Batch: 186924

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Prep Batch: 186047

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	ND		0.00180	0.00189		mg/Kg	☼	105	75 - 125

Lab Sample ID: 160-11302-A-1-I MSD

Matrix: Solid

Analysis Batch: 186924

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Prep Batch: 186047

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Technetium 99	ND		0.00180	0.00192		mg/Kg	☼	106	75 - 125	1	30

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

Lab Sample ID: MB 160-186047/1-A

Matrix: Solid

Analysis Batch: 186925

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 186047

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	-0.03545	U	0.0262	0.0264	0.937	0.160	pCi/g	04/16/15 11:19	04/20/15 10:38	1

Carrier	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	107		30 - 110	04/16/15 11:19	04/20/15 10:38	1

Lab Sample ID: LCS 160-186047/2-A

Matrix: Solid

Analysis Batch: 186925

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 186047

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	21.0	22.03		2.22	0.935	0.160	pCi/g	105	80 - 120

Carrier	LCS %Yield	LCS Qualifier	Limits
Re	107		30 - 110

TestAmerica St. Louis



# QC Sample Results

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

TestAmerica Job ID: 160-11319-1

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

Lab Sample ID: 160-11302-A-1-H MS

Matrix: Solid

Analysis Batch: 186925

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Prep Batch: 186047

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	0.133	U	30.8	32.44		3.28	1.49	0.255	pCi/g	105	75 - 125
Carrier	MS %Yield	MS Qualifier	Limits								
Re	98		30 - 110								

Lab Sample ID: 160-11302-A-1-I MSD

Matrix: Solid

Analysis Batch: 186925

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Prep Batch: 186047

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	0.133	U	30.9	32.81		3.21	1.41	0.241	pCi/g	106	75 - 125	0.06	1
Carrier	MSD %Yield	MSD Qualifier	Limits										
Re	104		30 - 110										

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

Lab Sample ID: MB 160-186027/1-A

Matrix: Solid

Analysis Batch: 186063

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 186027

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	-0.0005527	U	0.0287	0.0287		0.0563	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Americium 241	-0.008998	U	0.524	0.524		0.0271	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Bismuth 212	-0.04523	U	0.141	0.141		0.250	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Bismuth 214	-0.006634	U	0.0423	0.0423		0.0384	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Lead 212	0.003571	U	0.0114	0.0114		0.0225	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Lead 214	0.004759	U	0.0149	0.0149		0.0275	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Potassium 40	-0.05883	U	0.240	0.240		0.309	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Protactinium 234m	0.0000	U	0.359	0.359		3.03	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Protactinium 231	0.01870	U	0.0331	0.0332		0.371	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Radium 226	-0.006634	U	0.0423	0.0423		0.0384	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Thorium 234	0.05060	U	0.0713	0.0715		0.256	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Uranium 235	0.02410	U	0.0354	0.0355		0.0616	pCi/g	04/16/15 10:07	04/16/15 17:35	1
Thorium 232	-0.0005527	U	0.0287	0.0287		0.0563	pCi/g	04/16/15 10:07	04/16/15 17:35	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	04/16/15 10:07	04/16/15 17:35	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11319-1

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

Lab Sample ID: LCS 160-186027/2-A

Matrix: Solid

Analysis Batch: 186062

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 186027

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	93.34		9.72		0.584	pCi/g	93	87 - 116
Cesium 137	34.8	31.61		3.32	0.200	0.204	pCi/g	91	87 - 120
Cobalt 60	36.0	33.02		3.34		0.137	pCi/g	92	87 - 115

Lab Sample ID: 160-11319-1 DU

Matrix: Solid

Analysis Batch: 186063

Client Sample ID: L10-13-01-B-E-S-00

Prep Type: Total/NA

Prep Batch: 186027

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.10		1.222		0.190		0.0996	pCi/g	0.33	1
Americium 241	0.00282	U	-0.00774	U	0.513		0.110	pCi/g	0.02	1
Bismuth 212	1.09		1.499		0.407		0.348	pCi/g	0.53	1
Bismuth 214	0.854		0.9472		0.134		0.0596	pCi/g	0.36	1
Lead 212	1.13		1.167		0.169		0.0696	pCi/g	0.12	1
Lead 214	0.925		1.110		0.143		0.0699	pCi/g	0.70	1
Potassium 40	19.4		22.32		2.53		0.344	pCi/g	0.60	1
Protactinium 234m	0.986	U	2.646	U	2.69		4.59	pCi/g	0.32	1
Protactinium 231	0.537	U	0.6063	U	0.512		0.815	pCi/g	0.08	1
Radium 226	0.854		0.9472		0.134		0.0596	pCi/g	0.36	1
Thorium 234	1.31		2.043		0.758		0.866	pCi/g	0.58	1
Uranium 235	0.341		0.1461	U	0.148		0.247	pCi/g	0.66	1
Thorium 232	1.10		1.222		0.190		0.0996	pCi/g	0.33	1
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Pb-210	1.44		1.294		0.761		0.903	pCi/g	0.10	1
Tl-208	0.362		0.3825		0.0610		0.0342	pCi/g	0.17	1

TestAmerica St. Louis

# QC Association Summary

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

TestAmerica Job ID: 160-11319-1

## Metals

### Prep Batch: 186047

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11302-A-1-H MS	Matrix Spike	Total/NA	Solid	None	
160-11302-A-1-I MSD	Matrix Spike Duplicate	Total/NA	Solid	None	
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	None	
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	None	
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	None	
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	None	
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	None	
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	None	
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	None	
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	None	
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	None	
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	None	
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	None	
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	None	
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	None	
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	None	
LCS 160-186047/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-186047/1-A	Method Blank	Total/NA	Solid	None	

### Analysis Batch: 186924

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11302-A-1-H MS	Matrix Spike	Total/NA	Solid	6020A	186047
160-11302-A-1-I MSD	Matrix Spike Duplicate	Total/NA	Solid	6020A	186047
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	6020A	186047
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	6020A	186047
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	6020A	186047
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	6020A	186047
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	6020A	186047
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	6020A	186047
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	6020A	186047
LCS 160-186047/2-A	Lab Control Sample	Total/NA	Solid	6020A	186047
MB 160-186047/1-A	Method Blank	Total/NA	Solid	6020A	186047

## General Chemistry

### Analysis Batch: 185699

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-1 DU	L10-13-01-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	Moisture	
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	Moisture	

TestAmerica St. Louis

# QC Association Summary

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

TestAmerica Job ID: 160-11319-1

## General Chemistry (Continued)

### Analysis Batch: 185699 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	Moisture	
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	Moisture	
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	Moisture	
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	Moisture	
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	Moisture	

## Rad

### Leach Batch: 185650

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-1 DU	L10-13-01-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	Dry and Grind	
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 186027

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-1 DU	L10-13-01-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	Fill_Geo-0	185650
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	Fill_Geo-0	185650
LCS 160-186027/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-186027/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

TestAmerica St. Louis

## QC Association Summary

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

TestAmerica Job ID: 160-11319-1

### Rad (Continued)

Prep Batch: 186047

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11302-A-1-H MS	Matrix Spike	Total/NA	Solid	None	
160-11302-A-1-I MSD	Matrix Spike Duplicate	Total/NA	Solid	None	
160-11319-1	L10-13-01-B-E-S-00	Total/NA	Solid	None	
160-11319-2	L10-13-02-B-R-S-00	Total/NA	Solid	None	
160-11319-3	L10-13-03-B-E-S-00	Total/NA	Solid	None	
160-11319-4	L10-13-04-B-E-S-00	Total/NA	Solid	None	
160-11319-5	L10-13-05-B-R-S-00	Total/NA	Solid	None	
160-11319-6	L10-13-06-B-E-S-00	Total/NA	Solid	None	
160-11319-7	L10-13-07-B-R-S-00	Total/NA	Solid	None	
160-11319-8	L10-13-08-B-E-S-00	Total/NA	Solid	None	
160-11319-9	L10-13-09-B-E-S-00	Total/NA	Solid	None	
160-11319-10	L10-13-10-B-R-S-00	Total/NA	Solid	None	
160-11319-11	L10-13-11-B-E-S-00	Total/NA	Solid	None	
160-11319-12	L10-13-12-B-E-S-00	Total/NA	Solid	None	
160-11319-13	L10-13-13-B-R-B-00	Total/NA	Solid	None	
160-11319-14	L10-13-07-B-R-Q-00	Total/NA	Solid	None	
LCS 160-186047/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-186047/1-A	Method Blank	Total/NA	Solid	None	

## Tracer/Carrier Summary

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

TestAmerica Job ID: 160-11319-1

### 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)	
160-11302-A-1-H MS	Matrix Spike	98	
160-11302-A-1-I MSD	Matrix Spike Duplicate	104	
160-11319-1	L10-13-01-B-E-S-00	105	
160-11319-2	L10-13-02-B-R-S-00	105	
160-11319-3	L10-13-03-B-E-S-00	100	
160-11319-4	L10-13-04-B-E-S-00	106	
160-11319-5	L10-13-05-B-R-S-00	100	
160-11319-6	L10-13-06-B-E-S-00	103	
160-11319-7	L10-13-07-B-R-S-00	98	
160-11319-8	L10-13-08-B-E-S-00	100	
160-11319-9	L10-13-09-B-E-S-00	101	
160-11319-10	L10-13-10-B-R-S-00	105	
160-11319-11	L10-13-11-B-E-S-00	105	
160-11319-12	L10-13-12-B-E-S-00	96	
160-11319-13	L10-13-13-B-R-B-00	104	
160-11319-14	L10-13-07-B-R-Q-00	99	
LCS 160-186047/2-A	Lab Control Sample	107	
MB 160-186047/1-A	Method Blank	107	

#### Tracer/Carrier Legend

Re = Re