

# 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: 160-11391-1

Client Project/Site: HDP

For:

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

Attn: Brian Miller



Authorized for release by:  
4/28/2015 1:41:03 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: 160-11391-1

**Job ID: 160-11391-1**

**Laboratory: TestAmerica St. Louis**

### Narrative

## CASE NARRATIVE

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

**Project: HDP**

**Report Number: 160-11391-1**

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 04/17/2015; 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 L10-14-01-B-E-S-00 (160-11391-1), L10-14-02-B-E-S-00 (160-11391-2), L10-14-03-B-E-S-00 (160-11391-3), L10-14-04-B-E-S-00 (160-11391-4), L10-14-05-B-E-S-00 (160-11391-5), L10-14-06-B-E-S-00 (160-11391-6), L10-14-07-B-E-S-00 (160-11391-7), L10-14-08-B-R-S-00 (160-11391-8), L10-14-09-B-E-S-00 (160-11391-9) and L10-14-06-B-E-Q-00 (160-11391-10) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 04/20/2015 and analyzed on 04/21/2015.

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

### PERCENT SOLIDS

Samples L10-14-01-B-E-S-00 (160-11391-1), L10-14-02-B-E-S-00 (160-11391-2), L10-14-03-B-E-S-00 (160-11391-3), L10-14-04-B-E-S-00 (160-11391-4), L10-14-05-B-E-S-00 (160-11391-5), L10-14-06-B-E-S-00 (160-11391-6), L10-14-07-B-E-S-00 (160-11391-7), L10-14-08-B-R-S-00 (160-11391-8), L10-14-09-B-E-S-00 (160-11391-9) and L10-14-06-B-E-Q-00 (160-11391-10) were

## Case Narrative

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

TestAmerica Job ID: 160-11391-1

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### Job ID: 160-11391-1 (Continued)

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

analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 04/18/2015.

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 L10-14-01-B-E-S-00 (160-11391-1), L10-14-02-B-E-S-00 (160-11391-2), L10-14-03-B-E-S-00 (160-11391-3), L10-14-04-B-E-S-00 (160-11391-4), L10-14-05-B-E-S-00 (160-11391-5), L10-14-06-B-E-S-00 (160-11391-6), L10-14-07-B-E-S-00 (160-11391-7), L10-14-08-B-R-S-00 (160-11391-8), L10-14-09-B-E-S-00 (160-11391-9) and L10-14-06-B-E-Q-00 (160-11391-10) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 04/17/2015, and prepared and analyzed on 04/21/2015.

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

**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: 04/17/2015</b>		<b>COC No: 041715-FSS1</b>	
Perma-Fix Environmental Services		Tel/Fax: (314) 810-3333		Lab Contact: Ivan Vanya		Carrier: Courier		____1____ of ____1____ COCs	
2800 Solway Road		<b>Analysis Turnaround Time</b>		<div style="display: flex; justify-content: space-between;"> <div> <b>Filtered Sample (Y/N)</b> Perform MS/MSD (Y/N) </div> <div> <b>Gamma Spec</b> Westinghouse Hematite Library </div> <div> <b>Alpha Spec</b> ICP/MS (Tc-99) </div> <div> <b>Gamma Spec</b> (With post-21 day ingrowth) </div> </div>		<div style="display: flex; justify-content: space-between;"> <div> <input checked="" type="checkbox"/> CALENDAR 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 </div> <div> <input type="checkbox"/> WORKING DAYS </div> </div>		<b>Sampler:</b> <b>For Lab Use Only:</b> Walk-in Client: _____ Lab Sampling: _____  <b>Job / SDG No.:</b> _____	
Knoxville, TN 37931									
(865) 690-0501 Phone									
(865) 539-9868 FAX									
Project Name: Hematite Decommissioning Project									
Site: Westinghouse Hematite, MO									
P O # 832953									
<b>Sample Identification</b>	<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type</b> (C=Comp, G=Grab)	<b>Matrix</b>	<b># of Cont.</b>				
L10-14-01-B-E-S-00	4/14/15	1615	G	Soil	1	N	X	X	X
L10-14-02-B-E-S-00	4/14/15	1620	G	Soil	1	N	X	X	X
L10-14-03-B-E-S-00	4/14/15	1630	G	Soil	1	N	X	X	X
L10-14-04-B-E-S-00	4/14/15	1635	G	Soil	1	N	X	X	X
L10-14-05-B-E-S-00	4/14/15	1645	G	Soil	1	N	X	X	X
L10-14-06-B-E-S-00	4/14/15	1650	G	Soil	1	N	X	X	X
L10-14-07-B-E-S-00	4/14/15	1700	G	Soil	1	N	X	X	X
L10-14-08-B-R-S-00	4/15/15	1125	C	Soil	1	N	X	X	X
L10-14-09-B-E-S-00	4/15/15	1130	G	Soil	1	N	X	X	X
L10-14-06-B-E-Q-00	4/14/15	1650	C	Soil	1	N	X	X	X
N / A									
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other None									
<b>Possible Hazard Identification:</b> 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.						<b>Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)</b>			
<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			
<b>Special Instructions/QC Requirements &amp; Comments:</b> Potential for Radiological Contamination									
Custody Seals Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____		Corr'd: _____		Therm ID No.:	
Relinquished by: <i>Perma-Fix</i>		Company: <i>Perma-Fix</i>		Date/Time: <i>4-17-15/0900</i>		Received by: <i>Sherry Vanya</i>		Company: <i>Crossroads</i>	
Relinquished by: <i>Sherry Vanya</i>		Company: <i>Crossroads</i>		Date/Time: <i>4-17-15/1020</i>		Received by: <i>Robert G. Davis</i>		Company: <i>TB Davis</i>	
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

160-1391 Chain of Custody



## Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-11391-1

Login Number: 11391

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

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.	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?	N/A	
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: 160-11391-1

### Qualifiers

#### 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: 160-11391-1

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: 160-11391-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-11391-1	L10-14-01-B-E-S-00	Solid	04/14/15 16:15	04/17/15 10:20
160-11391-2	L10-14-02-B-E-S-00	Solid	04/14/15 16:20	04/17/15 10:20
160-11391-3	L10-14-03-B-E-S-00	Solid	04/14/15 16:30	04/17/15 10:20
160-11391-4	L10-14-04-B-E-S-00	Solid	04/14/15 16:35	04/17/15 10:20
160-11391-5	L10-14-05-B-E-S-00	Solid	04/14/15 16:45	04/17/15 10:20
160-11391-6	L10-14-06-B-E-S-00	Solid	04/14/15 16:50	04/17/15 10:20
160-11391-7	L10-14-07-B-E-S-00	Solid	04/14/15 17:00	04/17/15 10:20
160-11391-8	L10-14-08-B-R-S-00	Solid	04/15/15 11:25	04/17/15 10:20
160-11391-9	L10-14-09-B-E-S-00	Solid	04/15/15 11:30	04/17/15 10:20
160-11391-10	L10-14-06-B-E-Q-00	Solid	04/14/15 16:50	04/17/15 10:20

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

**Client Sample ID: L10-14-01-B-E-S-00**

**Lab Sample ID: 160-11391-1**

**Date Collected: 04/14/15 16:15**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

**Percent Solids: 82.6**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000066	0.000020	mg/Kg	☆	04/20/15 09:21	04/21/15 17:59	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	-0.0220	U	0.0581	0.0582	1.32	0.227	pCi/g	04/20/15 09:21	04/21/15 17:59	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					04/20/15 09:21	04/21/15 17:59	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	1.12		0.162	0.198		0.127	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Americium 241	-0.0281	U	0.0615	0.0615		0.102	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Bismuth 212	1.31		0.481	0.500		0.442	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Bismuth 214	0.751		0.0892	0.119		0.0560	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Lead 212	1.04		0.0741	0.153		0.0601	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Lead 214	0.817		0.0925	0.126		0.0750	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Potassium 40	18.3		1.21	2.23		0.231	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Protactinium 234m	0.353	U	2.85	2.85		5.19	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Protactinium 231	0.612	U	0.326	0.332		1.03	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Radium 226	0.751		0.0892	0.119		0.0560	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Thorium 234	1.11		0.479	0.492		0.752	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Uranium 235	0.0881	U	0.120	0.120		0.223	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Thorium 232	1.12		0.162	0.198		0.127	pCi/g	04/21/15 09:07	04/21/15 15:34	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.349		0.0490	0.0610		0.0365	pCi/g	04/21/15 09:07	04/21/15 15:34	1

**Client Sample ID: L10-14-02-B-E-S-00**

**Lab Sample ID: 160-11391-2**

**Date Collected: 04/14/15 16:20**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

**Percent Solids: 69.3**

## 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	☆	04/20/15 09:21	04/21/15 18:16	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	U	0.0828	0.0857	1.52	0.260	pCi/g	04/20/15 09:21	04/21/15 18:16	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	95		30 - 110					04/20/15 09:21	04/21/15 18:16	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

Client Sample ID: L10-14-02-B-E-S-00

Lab Sample ID: 160-11391-2

Date Collected: 04/14/15 16:20

Matrix: Solid

Date Received: 04/17/15 10:20

## 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	1.19		0.150	0.193		0.115	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Americium 241	-0.00327	U	0.340	0.340		0.0930	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Bismuth 212	1.68		0.622	0.646		0.522	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Bismuth 214	0.839		0.106	0.137		0.0709	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Lead 212	1.06		0.0829	0.160		0.0849	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Lead 214	0.870		0.0904	0.128		0.0870	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Potassium 40	16.1		1.17	2.02		0.348	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Protactinium 234m	1.48	U	3.21	3.21		5.50	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Protactinium 231	0.316	U	0.492	0.493		0.821	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Radium 226	0.839		0.106	0.137		0.0709	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Thorium 234	1.28		0.543	0.560		0.857	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Uranium 235	0.0227	U	0.130	0.130		0.277	pCi/g	04/21/15 09:07	04/21/15 15:37	1
Thorium 232	1.19		0.150	0.193		0.115	pCi/g	04/21/15 09:07	04/21/15 15:37	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.320		0.0483	0.0586		0.0396	pCi/g	04/21/15 09:07	04/21/15 15:37	1

Client Sample ID: L10-14-03-B-E-S-00

Lab Sample ID: 160-11391-3

Date Collected: 04/14/15 16:30

Matrix: Solid

Date Received: 04/17/15 10:20

Percent Solids: 78.5

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000065	0.000019	mg/Kg	☼	04/20/15 09:21	04/21/15 18:20	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	0.0839	U	0.0467	0.0473	1.30	0.222	pCi/g	04/20/15 09:21	04/21/15 18:20	1
<b>Carrier</b>										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	98		30 - 110					04/20/15 09:21	04/21/15 18:20	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	1.99		0.201	0.286		0.152	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Americium 241	0.0408	U	0.118	0.118		0.197	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Bismuth 212	2.04		0.922	0.946		0.899	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Bismuth 214	1.25		0.147	0.196		0.102	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Lead 212	2.00		0.125	0.287		0.0931	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Lead 214	1.44		0.142	0.206		0.109	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Potassium 40	28.9		1.82	3.47		0.458	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Protactinium 234m	-0.529	U	50.5	50.5		8.75	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Protactinium 231	-1.27	U	1.29	1.30		2.11	pCi/g	04/21/15 09:07	04/21/15 16:48	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

Client Sample ID: L10-14-03-B-E-S-00

Lab Sample ID: 160-11391-3

Date Collected: 04/14/15 16:30

Matrix: Solid

Date Received: 04/17/15 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
Radium 226	1.25		0.147	0.196		0.102	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Thorium 234	2.07		0.906	0.932		1.43	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Uranium 235	0.202	U	0.228	0.229		0.370	pCi/g	04/21/15 09:07	04/21/15 16:48	1
Thorium 232	1.99		0.201	0.286		0.152	pCi/g	04/21/15 09:07	04/21/15 16:48	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.609		0.0796	0.102		0.0585	pCi/g	04/21/15 09:07	04/21/15 16:48	1

Client Sample ID: L10-14-04-B-E-S-00

Lab Sample ID: 160-11391-4

Date Collected: 04/14/15 16:35

Matrix: Solid

Date Received: 04/17/15 10:20

Percent Solids: 79.4

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000063	0.000019	mg/Kg	☼	04/20/15 09:21	04/21/15 18:24	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	0.205	U	0.0181	0.0262	1.26	0.216	pCi/g	04/20/15 09:21	04/21/15 18:24	1
<b>Carrier</b>										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	100		30 - 110					04/20/15 09:21	04/21/15 18:24	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	1.90		0.253	0.319		0.205	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Americium 241	-0.00983	U	4.64	4.64		0.249	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Bismuth 212	2.51		0.759	0.803		0.614	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Bismuth 214	1.23		0.167	0.210		0.120	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Lead 212	1.67		0.139	0.256		0.138	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Lead 214	1.33		0.159	0.210		0.148	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Potassium 40	28.9		2.01	3.58		0.424	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Protactinium 234m	3.41	U	5.86	5.87		9.88	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Protactinium 231	0.634	U	0.343	0.350		2.24	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Radium 226	1.23		0.167	0.210		0.120	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Thorium 234	2.51		1.14	1.17		1.80	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Uranium 235	0.190	U	0.294	0.295		0.453	pCi/g	04/21/15 09:07	04/21/15 16:49	1
Thorium 232	1.90		0.253	0.319		0.205	pCi/g	04/21/15 09:07	04/21/15 16:49	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.495		0.0738	0.0900		0.0532	pCi/g	04/21/15 09:07	04/21/15 16:49	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

Client Sample ID: L10-14-05-B-E-S-00

Lab Sample ID: 160-11391-5

Date Collected: 04/14/15 16:45

Matrix: Solid

Date Received: 04/17/15 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		0.000059	0.000018	mg/Kg	☼	04/20/15 09:21	04/21/15 18:28	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	0.198	U	0.0347	0.0392	1.19	0.204	pCi/g	04/20/15 09:21	04/21/15 18:28	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	104		30 - 110					04/20/15 09:21	04/21/15 18:28	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	2.27		0.288	0.369		0.171	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Americium 241	-0.0587	U	0.437	0.437		0.266	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Bismuth 212	2.44		0.797	0.837		0.755	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Bismuth 214	1.38		0.166	0.220		0.159	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Lead 212	2.15		0.154	0.317		0.146	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Lead 214	1.77		0.167	0.249		0.132	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Potassium 40	38.0		2.17	4.45		0.673	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Protactinium 234m	5.49	U	6.00	6.02		9.75	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Protactinium 231	0.785	U	0.489	0.497		2.36	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Radium 226	1.38		0.166	0.220		0.159	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Thorium 234	2.40		1.27	1.29		2.05	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Uranium 235	0.400		0.285	0.288		0.364	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Thorium 232	2.27		0.288	0.369		0.171	pCi/g	04/21/15 09:07	04/21/15 16:50	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.663		0.0873	0.111		0.0673	pCi/g	04/21/15 09:07	04/21/15 16:50	1

Client Sample ID: L10-14-06-B-E-S-00

Lab Sample ID: 160-11391-6

Date Collected: 04/14/15 16:50

Matrix: Solid

Date Received: 04/17/15 10:20

Percent Solids: 76.5

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000071	0.000021	mg/Kg	☼	04/20/15 09:21	04/21/15 18:33	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	-0.0158	U	0.0536	0.0536	1.42	0.244	pCi/g	04/20/15 09:21	04/21/15 18:33	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	92		30 - 110					04/20/15 09:21	04/21/15 18:33	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

Client Sample ID: L10-14-06-B-E-S-00

Lab Sample ID: 160-11391-6

Date Collected: 04/14/15 16:50

Matrix: Solid

Date Received: 04/17/15 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	1.15		0.123	0.170		0.109	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Americium 241	-0.0161	U	0.0574	0.0575		0.0962	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Bismuth 212	1.40		0.461	0.483		0.400	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Bismuth 214	0.806		0.0911	0.124		0.0604	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Lead 212	1.20		0.0713	0.170		0.0505	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Lead 214	0.859		0.0819	0.121		0.0628	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Potassium 40	19.9		1.13	2.32		0.283	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Protactinium 234m	1.52	U	2.79	2.79		4.79	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Protactinium 231	-0.545	U	0.669	0.672		1.10	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Radium 226	0.806		0.0911	0.124		0.0604	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Thorium 234	0.931		0.291	0.307		0.765	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Uranium 235	0.199		0.117	0.119		0.164	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Thorium 232	1.15		0.123	0.170		0.109	pCi/g	04/21/15 09:07	04/21/15 16:47	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.52		0.540	0.569		0.708	pCi/g	04/21/15 09:07	04/21/15 16:47	1
Tl-208	0.333		0.0444	0.0562		0.0325	pCi/g	04/21/15 09:07	04/21/15 16:47	1

Client Sample ID: L10-14-07-B-E-S-00

Lab Sample ID: 160-11391-7

Date Collected: 04/14/15 17:00

Matrix: Solid

Date Received: 04/17/15 10:20

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		0.000066	0.000020	mg/Kg	☼	04/20/15 09:21	04/21/15 18:37	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	0.105	U	0.0743	0.0749	1.32	0.226	pCi/g	04/20/15 09:21	04/21/15 18:37	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	97		30 - 110					04/20/15 09:21	04/21/15 18:37	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	1.66		0.220	0.277		0.200	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Americium 241	0.0191	U	0.137	0.137		0.231	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Bismuth 212	2.11		0.638	0.674		0.530	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Bismuth 214	1.49		0.182	0.239		0.110	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Lead 212	1.55		0.135	0.242		0.145	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Lead 214	1.38		0.148	0.206		0.128	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Potassium 40	26.5		1.97	3.35		0.719	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Protactinium 234m	6.40	U	5.46	5.50		8.48	pCi/g	04/21/15 09:07	04/21/15 17:24	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

Client Sample ID: L10-14-07-B-E-S-00

Lab Sample ID: 160-11391-7

Date Collected: 04/14/15 17:00

Matrix: Solid

Date Received: 04/17/15 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	0.702	U	0.430	0.437		1.99	pCi/g	04/21/15 09:07	04/21/15 17:24	1
<b>Radium 226</b>	<b>1.49</b>		0.182	0.239		0.110	pCi/g	04/21/15 09:07	04/21/15 17:24	1
<b>Thorium 234</b>	<b>1.81</b>		0.575	0.606		1.75	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Uranium 235	0.185	U	0.299	0.300		0.446	pCi/g	04/21/15 09:07	04/21/15 17:24	1
<b>Thorium 232</b>	<b>1.66</b>		0.220	0.277		0.200	pCi/g	04/21/15 09:07	04/21/15 17:24	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	4.23		1.58	1.66		1.95	pCi/g	04/21/15 09:07	04/21/15 17:24	1
Tl-208	0.540		0.101	0.115		0.0846	pCi/g	04/21/15 09:07	04/21/15 17:24	1

Client Sample ID: L10-14-08-B-R-S-00

Lab Sample ID: 160-11391-8

Date Collected: 04/15/15 11:25

Matrix: Solid

Date Received: 04/17/15 10:20

Percent Solids: 85.5

## 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	☼	04/20/15 09:21	04/21/15 18:41	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	-0.0347	U	0.0115	0.0120	1.15	0.197	pCi/g	04/20/15 09:21	04/21/15 18:41	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	102		30 - 110					04/20/15 09:21	04/21/15 18:41	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>2.23</b>		0.282	0.362		0.185	pCi/g	04/21/15 09:07	04/21/15 17:25	1
Americium 241	-0.0215	U	1.31	1.31		0.254	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Bismuth 212</b>	<b>2.44</b>		0.682	0.728		0.588	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Bismuth 214</b>	<b>1.57</b>		0.192	0.253		0.136	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Lead 212</b>	<b>2.15</b>		0.152	0.317		0.143	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Lead 214</b>	<b>1.84</b>		0.178	0.262		0.147	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Potassium 40</b>	<b>35.2</b>		2.04	4.14		0.561	pCi/g	04/21/15 09:07	04/21/15 17:25	1
Protactinium 234m	2.57	U	5.26	5.26		8.96	pCi/g	04/21/15 09:07	04/21/15 17:25	1
Protactinium 231	0.637	U	0.379	0.386		2.52	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Radium 226</b>	<b>1.57</b>		0.192	0.253		0.136	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Thorium 234</b>	<b>2.47</b>		1.18	1.21		1.89	pCi/g	04/21/15 09:07	04/21/15 17:25	1
Uranium 235	0.200	U	0.264	0.265		0.453	pCi/g	04/21/15 09:07	04/21/15 17:25	1
<b>Thorium 232</b>	<b>2.23</b>		0.282	0.362		0.185	pCi/g	04/21/15 09:07	04/21/15 17:25	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

**Client Sample ID: L10-14-08-B-R-S-00**

**Lab Sample ID: 160-11391-8**

**Date Collected: 04/15/15 11:25**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.715		0.105	0.129		0.0771	pCi/g	04/21/15 09:07	04/21/15 17:25	1

**Client Sample ID: L10-14-09-B-E-S-00**

**Lab Sample ID: 160-11391-9**

**Date Collected: 04/15/15 11:30**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

**Percent Solids: 82.6**

**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	☼	04/20/15 09:21	04/21/15 18:45	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	-0.0104	U	0.0409	0.0409	1.19	0.203	pCi/g	04/20/15 09:21	04/21/15 18:45	1
Carrier	%Yield	Qualifier	Limits						Prepared	Analyzed
Re	102		30 - 110						04/20/15 09:21	04/21/15 18:45

**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	1.86		0.224	0.293		0.192	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Americium 241	0.0120	U	0.128	0.128		0.217	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Bismuth 212	1.59		0.658	0.679		0.680	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Bismuth 214	1.31		0.164	0.213		0.112	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Lead 212	1.75		0.131	0.262		0.104	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Lead 214	1.52		0.155	0.221		0.126	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Potassium 40	30.4		2.05	3.73		0.400	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Protactinium 234m	0.225	U	4.93	4.93		9.11	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Protactinium 231	-1.08	U	1.25	1.25		2.05	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Radium 226	1.31		0.164	0.213		0.112	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Thorium 234	1.86		0.552	0.585		1.66	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Uranium 235	0.316	U	0.228	0.230		0.365	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Thorium 232	1.86		0.224	0.293		0.192	pCi/g	04/21/15 09:07	04/21/15 17:28	1
Other Detected		Count		Total						
Radionuclides	Result	Qualifier	Uncert.	Uncert.	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			(2σ+/-)	(2σ+/-)						
Tl-208	0.555		0.0808	0.0992		0.0582	pCi/g	04/21/15 09:07	04/21/15 17:28	1

**Client Sample ID: L10-14-06-B-E-Q-00**

**Lab Sample ID: 160-11391-10**

**Date Collected: 04/14/15 16:50**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

**Percent Solids: 76.6**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000071	0.000021	mg/Kg	☼	04/20/15 09:21	04/21/15 18:50	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11391-1

**Client Sample ID: L10-14-06-B-E-Q-00**

**Lab Sample ID: 160-11391-10**

**Date Collected: 04/14/15 16:50**

**Matrix: Solid**

**Date Received: 04/17/15 10:20**

**Percent Solids: 76.6**

## 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	-0.0329	U	0.0718	0.0719	1.42	0.243	pCi/g	04/20/15 09:21	04/21/15 18:50	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	92		30 - 110					04/20/15 09:21	04/21/15 18:50	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	1.09		0.141	0.180		0.131	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Americium 241	0.0403	U	0.0579	0.0581		0.0958	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Bismuth 212	1.27		0.462	0.481		0.448	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Bismuth 214	0.719		0.0882	0.116		0.0773	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Lead 212	1.15		0.0779	0.168		0.0634	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Lead 214	0.843		0.0859	0.123		0.0884	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Potassium 40	18.6		1.21	2.25		0.229	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Protactinium 234m	-0.848	U	6.05	6.05		3.79	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Protactinium 231	-0.633	U	0.772	0.775		1.27	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Radium 226	0.719		0.0882	0.116		0.0773	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Thorium 234	1.17		0.301	0.325		0.825	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Uranium 235	0.106	U	0.142	0.142		0.238	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Thorium 232	1.09		0.141	0.180		0.131	pCi/g	04/21/15 09:07	04/21/15 19:01	1
Other Detected			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radionuclides	Result	Qualifier								
Tl-208	0.358		0.0479	0.0607		0.0366	pCi/g	04/21/15 09:07	04/21/15 19:01	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11391-1

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

Lab Sample ID: MB 160-186878/1-A

Matrix: Solid

Analysis Batch: 187237

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 186878

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000052	0.000016	mg/Kg		04/20/15 09:21	04/21/15 17:20	1

Lab Sample ID: LCS 160-186878/2-A

Matrix: Solid

Analysis Batch: 187237

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 186878

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00123	0.00128		mg/Kg		104	80 - 120

Lab Sample ID: 160-11299-A-1-F MS

Matrix: Solid

Analysis Batch: 187237

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Prep Batch: 186878

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	ND		0.00158	0.00173		mg/Kg	☼	109	75 - 125

Lab Sample ID: 160-11299-A-1-G MSD

Matrix: Solid

Analysis Batch: 187237

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Prep Batch: 186878

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Technetium 99	ND		0.00158	0.00167		mg/Kg	☼	105	75 - 125	3	30

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

Lab Sample ID: MB 160-186878/1-A

Matrix: Solid

Analysis Batch: 187238

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 186878

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	-0.03956	U	0.0704	0.0705	1.04	0.177	pCi/g	04/20/15 09:21	04/21/15 17:20	1

Carrier	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	97		30 - 110	04/20/15 09:21	04/21/15 17:20	1

Lab Sample ID: LCS 160-186878/2-A

Matrix: Solid

Analysis Batch: 187238

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 186878

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	21.1	22.00		2.04	1.03	0.176	pCi/g	104	80 - 120

Carrier	LCS %Yield	LCS Qualifier	Limits
Re	97		30 - 110

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11391-1

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

Lab Sample ID: 160-11299-A-1-F MS

Matrix: Solid

Analysis Batch: 187238

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Prep Batch: 186878

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	0.255		27.1	29.56		2.78	1.31	0.224	pCi/g	108	75 - 125
Carrier	MS %Yield	MS Qualifier	Limits								
Re	98		30 - 110								

Lab Sample ID: 160-11299-A-1-G MSD

Matrix: Solid

Analysis Batch: 187238

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Prep Batch: 186878

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	0.255		27.1	28.57		2.65	1.31	0.225	pCi/g	104	75 - 125	0.18	1
Carrier	MSD %Yield	MSD Qualifier	Limits										
Re	98		30 - 110										

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

Lab Sample ID: MB 160-187142/1-A

Matrix: Solid

Analysis Batch: 186954

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 187142

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.01029	U	0.0356	0.0356		0.0644	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Americium 241	-0.009462	U	0.378	0.378		0.0284	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Bismuth 212	-0.009171	U	0.0895	0.0895		0.173	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Bismuth 214	-0.009173	U	0.0766	0.0766		0.0430	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Lead 212	-0.008477	U	0.103	0.103		0.0251	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Lead 214	0.01070	U	0.0171	0.0171		0.0288	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Potassium 40	-0.1739	U	6.96	6.96		0.267	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Protactinium 234m	0.0000	U	0.359	0.359		0.935	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Protactinium 231	0.008553	U	0.0138	0.0138		0.390	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Radium 226	-0.009173	U	0.0766	0.0766		0.0430	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Thorium 234	-0.04546	U	0.239	0.239		0.290	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Uranium 235	0.01843	U	0.0394	0.0394		0.0621	pCi/g	04/21/15 09:07	04/21/15 15:38	1
Thorium 232	0.01029	U	0.0356	0.0356		0.0644	pCi/g	04/21/15 09:07	04/21/15 15:38	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	04/21/15 09:07	04/21/15 15:38	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11391-1

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

Lab Sample ID: LCS 160-187142/2-A

Matrix: Solid

Analysis Batch: 186956

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 187142

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	101.3		10.5		0.487	pCi/g	100	87 - 116
Cesium 137	34.8	34.13		3.57	0.200	0.166	pCi/g	98	87 - 120
Cobalt 60	35.9	34.01		3.43		0.106	pCi/g	95	87 - 115

Lab Sample ID: 160-11391-1 DU

Matrix: Solid

Analysis Batch: 186985

Client Sample ID: L10-14-01-B-E-S-00

Prep Type: Total/NA

Prep Batch: 187142

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.12		1.146		0.186		0.121	pCi/g	0.07	1
Americium 241	-0.0281	U	-0.02123	U	0.0990		0.102	pCi/g	0.04	1
Bismuth 212	1.31		0.5721		0.341		0.492	pCi/g	0.88	1
Bismuth 214	0.751		0.8161		0.145		0.0834	pCi/g	0.25	1
Lead 212	1.04		0.9257		0.146		0.0853	pCi/g	0.37	1
Lead 214	0.817		0.8191		0.122		0.0765	pCi/g	0.01	1
Potassium 40	18.3		18.01		2.26		0.284	pCi/g	0.07	1
Protactinium 234m	0.353	U	1.710	U	3.24		5.52	pCi/g	0.22	1
Protactinium 231	0.612	U	0.5741	U	0.307		1.25	pCi/g	0.06	1
Radium 226	0.751		0.8161		0.145		0.0834	pCi/g	0.25	1
Thorium 234	1.11		0.9060	U	0.360		1.12	pCi/g	0.23	1
Uranium 235	0.0881	U	0.01806	U	0.165		0.280	pCi/g	0.25	1
Thorium 232	1.12		1.146		0.186		0.121	pCi/g	0.07	1
<b>Total</b>										
<b>Other Detected Radionuclides</b>	<b>Sample Result</b>	<b>Sample Qual</b>	<b>DU Result</b>	<b>DU Qual</b>	<b>Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>RER</b>	<b>RER Limit</b>
Tl-208	0.349		0.3812		0.0700		0.0443	pCi/g	0.24	1

TestAmerica St. Louis

# QC Association Summary

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

TestAmerica Job ID: 160-11391-1

## Metals

### Prep Batch: 186878

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11299-A-1-F MS	Matrix Spike	Total/NA	Solid	None	
160-11299-A-1-G MSD	Matrix Spike Duplicate	Total/NA	Solid	None	
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	None	
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	None	
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	None	
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	None	
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	None	
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	None	
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	None	
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	None	
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	None	
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	None	
LCS 160-186878/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-186878/1-A	Method Blank	Total/NA	Solid	None	

### Analysis Batch: 187237

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11299-A-1-F MS	Matrix Spike	Total/NA	Solid	6020A	186878
160-11299-A-1-G MSD	Matrix Spike Duplicate	Total/NA	Solid	6020A	186878
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	6020A	186878
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	6020A	186878
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	6020A	186878
LCS 160-186878/2-A	Lab Control Sample	Total/NA	Solid	6020A	186878
MB 160-186878/1-A	Method Blank	Total/NA	Solid	6020A	186878

## General Chemistry

### Analysis Batch: 186629

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-1 DU	L10-14-01-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	Moisture	
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	Moisture	
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	Moisture	

TestAmerica St. Louis

# QC Association Summary

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

TestAmerica Job ID: 160-11391-1

## Rad

### Leach Batch: 186422

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-1 DU	L10-14-01-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 186878

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11299-A-1-F MS	Matrix Spike	Total/NA	Solid	None	
160-11299-A-1-G MSD	Matrix Spike Duplicate	Total/NA	Solid	None	
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	None	
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	None	
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	None	
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	None	
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	None	
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	None	
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	None	
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	None	
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	None	
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	None	
LCS 160-186878/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-186878/1-A	Method Blank	Total/NA	Solid	None	

### Prep Batch: 187142

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11391-1	L10-14-01-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-1 DU	L10-14-01-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-2	L10-14-02-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-3	L10-14-03-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-4	L10-14-04-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-5	L10-14-05-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-6	L10-14-06-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-7	L10-14-07-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-8	L10-14-08-B-R-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-9	L10-14-09-B-E-S-00	Total/NA	Solid	Fill_Geo-0	186422
160-11391-10	L10-14-06-B-E-Q-00	Total/NA	Solid	Fill_Geo-0	186422
LCS 160-187142/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-187142/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

TestAmerica St. Louis

## Tracer/Carrier Summary

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

TestAmerica Job ID: 160-11391-1

### 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)	
160-11299-A-1-F MS	Matrix Spike	98	
160-11299-A-1-G MSD	Matrix Spike Duplicate	98	
160-11391-1	L10-14-01-B-E-S-00	91	
160-11391-2	L10-14-02-B-E-S-00	95	
160-11391-3	L10-14-03-B-E-S-00	98	
160-11391-4	L10-14-04-B-E-S-00	100	
160-11391-5	L10-14-05-B-E-S-00	104	
160-11391-6	L10-14-06-B-E-S-00	92	
160-11391-7	L10-14-07-B-E-S-00	97	
160-11391-8	L10-14-08-B-R-S-00	102	
160-11391-9	L10-14-09-B-E-S-00	102	
160-11391-10	L10-14-06-B-E-Q-00	92	
LCS 160-186878/2-A	Lab Control Sample	97	
MB 160-186878/1-A	Method Blank	97	
<b>Tracer/Carrier Legend</b>			
Re = Re			