

# 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: 160-10373-1

Client Project/Site: HDP

For:

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

Attn: Brian Miller



Authorized for release by:  
2/12/2015 12:07:53 PM

Ivan Vania, Project Manager II  
(314)298-8566

[ivan.vania@testamericainc.com](mailto:ivan.vania@testamericainc.com)

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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: 160-10373-1

**Job ID: 160-10373-1**

**Laboratory: TestAmerica St. Louis**

**Narrative**

### CASE NARRATIVE

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

**Project: HDP**

**Report Number: 160-10373-1**

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 02/05/2015; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 18.0 C.

#### **TECHNETIUM-99 (ICPMS)**

Samples L10-02-01-B-S-S-00 (160-10373-1), L10-02-02-B-R-S-00 (160-10373-2), L10-02-03-B-E-S-00 (160-10373-3), L10-02-04-B-S-S-00 (160-10373-4), L10-02-05-B-R-S-00 (160-10373-5), L10-02-06-B-E-S-00 (160-10373-6), L10-02-07-B-E-S-00 (160-10373-7), L10-02-08-B-E-S-00 (160-10373-8), L10-02-09-B-E-S-00 (160-10373-9), L10-02-10-B-E-S-00 (160-10373-10), L10-02-11-B-E-S-00 (160-10373-11), L10-02-12-B-E-S-00 (160-10373-12), L10-02-13-B-E-B-00 (160-10373-13) and L10-02-11-B-E-Q-00 (160-10373-14) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 02/05/2015 and analyzed on 02/09/2015.

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: 160-10373-1

### Job ID: 160-10373-1 (Continued)

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

Samples L10-02-01-B-S-S-00 (160-10373-1), L10-02-02-B-R-S-00 (160-10373-2), L10-02-03-B-E-S-00 (160-10373-3), L10-02-04-B-S-S-00 (160-10373-4), L10-02-05-B-R-S-00 (160-10373-5), L10-02-06-B-E-S-00 (160-10373-6), L10-02-07-B-E-S-00 (160-10373-7), L10-02-08-B-E-S-00 (160-10373-8), L10-02-09-B-E-S-00 (160-10373-9), L10-02-10-B-E-S-00 (160-10373-10), L10-02-11-B-E-S-00 (160-10373-11), L10-02-12-B-E-S-00 (160-10373-12), L10-02-13-B-E-B-00 (160-10373-13) and L10-02-11-B-E-Q-00 (160-10373-14) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 02/07/2015.

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 L10-02-01-B-S-S-00 (160-10373-1), L10-02-02-B-R-S-00 (160-10373-2), L10-02-03-B-E-S-00 (160-10373-3), L10-02-04-B-S-S-00 (160-10373-4), L10-02-05-B-R-S-00 (160-10373-5), L10-02-06-B-E-S-00 (160-10373-6), L10-02-07-B-E-S-00 (160-10373-7), L10-02-08-B-E-S-00 (160-10373-8), L10-02-09-B-E-S-00 (160-10373-9), L10-02-10-B-E-S-00 (160-10373-10), L10-02-11-B-E-S-00 (160-10373-11), L10-02-12-B-E-S-00 (160-10373-12), L10-02-13-B-E-B-00 (160-10373-13) and L10-02-11-B-E-Q-00 (160-10373-14) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 02/05/2015, and prepared and analyzed on 02/09/2015.

Preparation Batch 172851:

Radium-226 is reported in these samples at the client's request. Radium-226 is reported from the 609.31 keV line of bismuth-214. Because the samples have not had a 21-day ingrowth, the activity for radium-226 is an estimated value and may be biased low. This bias is caused by the disruption of secular equilibrium between radium-226 and bismuth-214 by the loss of radon-222 during sample preparation. (160-10373-1 DU), (LCS 160-172851/2-A), (MB 160-172851/1-A), L10-02-01-B-S-S-00 (160-10373-1), L10-02-02-B-R-S-00 (160-10373-2), L10-02-03-B-E-S-00 (160-10373-3), L10-02-04-B-S-S-00 (160-10373-4), L10-02-05-B-R-S-00 (160-10373-5), L10-02-06-B-E-S-00 (160-10373-6), L10-02-07-B-E-S-00 (160-10373-7), L10-02-08-B-E-S-00 (160-10373-8), L10-02-09-B-E-S-00 (160-10373-9), L10-02-10-B-E-S-00 (160-10373-10), L10-02-11-B-E-Q-00 (160-10373-14), L10-02-11-B-E-S-00 (160-10373-11), L10-02-12-B-E-S-00 (160-10373-12), L10-02-13-B-E-B-00 (160-10373-13)

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

**TestAmerica St. Louis**

13715 Rider Trail North

Earth City, MO 63045  
phone 314.298.8566 fax

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

THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

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

<b>Client Contact</b>		<b>Project Manager: Brian Miller</b>		<b>Site Contact: Ellen Jakub</b>		<b>Date: 02/05/2015</b>		<b>COC No: 020515-FSS1</b>						
Perma-Fix Environmental Services		Tel/Fax: (314) 810-3333		Lab Contact: Ivan Vanya		Carrier: Courier		Page 1 of 2						
2800 Solway Road		<b>Analysis Turnaround Time</b>		<input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS TAT if different from Below _____ <input type="checkbox"/> 2 weeks <input checked="" type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day		Perform MS / MSD (Y / N) Gamma Spec (Westinghouse HDP library) Alpha Spec ICP/MS (Tc-99) Gamma Spec (Ra-226: post-21 day ingrowth)		<b>For Lab Use Only:</b> Walk-in Client: Lab Sampling:  Job / SDG No.:						
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 (C=Comp, G=Grab)</b>	<b>Matrix</b>	<b># of Cont.</b>	<b>Filtered Sample (Y / N)</b>	<b>Perform MS / MSD (Y / N)</b>	<b>Gamma Spec (Westinghouse HDP library)</b>	<b>Alpha Spec</b>	<b>ICP/MS (Tc-99)</b>	<b>Gamma Spec (Ra-226: post-21 day ingrowth)</b>	<b>Field Sampler Name</b>		
L10-02-01-B-S-S-00	2/3/15	1525	G	Soil	1	N	X	X	X			Matt Cushman		
L10-02-02-B-R-S-00	2/3/15	1615	C	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-03-B-E-S-00	2/3/15	1620	G	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-04-B-S-S-00	2/3/15	1425	G	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-05-B-R-S-00	2/3/15	1515	C	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-06-B-E-S-00	2/3/15	1520	G	Soil	1	N	X	X	X			Matt Cushman		
L10-02-07-B-E-S-00	2/3/15	1125	G	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-08-B-E-S-00	2/3/15	1055	G	Soil	1	N	X	X	X			Matt Cushman		
L10-02-09-B-E-S-00	2/3/15	1100	G	Soil	1	N	X	X	X			Matt Cushman		
L10-02-10-B-E-S-00	2/3/15	1150	G	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-11-B-E-S-00	2/3/15	1135	G	Soil	1	N	X	X	X			Jahmai Williams		
L10-02-12-B-E-S-00	2/3/15	1415	G	Soil	1	N	X	X	X			Matt Cushman		
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. <input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown						<b>Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)</b> <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>Brian Miller</i>			Company: <i>Perma-Fix</i>			Date/Time: <i>2/5/15 0932</i>			Received by: <i>Ellen Jakub</i>			Company: <i>Per (TA)</i>		
Relinquished by: <i>Ivan Vanya</i>			Company: <i>Crossroads</i>			Date/Time: <i>2/5/15 11:00</i>			Received by: <i>Ellen Jakub</i>			Company: <i>Per (TA)</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

## Chain of Custody Record

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

**TestAmerica Laboratories, Inc.**

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other:[illegible]

## Hematite Decommissioning Project

Permafix (for Westinghouse) Non-Proprietary Class 3

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

Revision: 3



## Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-10373-1

Login Number: 10373

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
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 $<6\text{mm}$ (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: 160-10373-1

### 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: 160-10373-1

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: 160-10373-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10373-1	L10-02-01-B-S-S-00	Solid	02/03/15 15:25	02/05/15 11:00
160-10373-2	L10-02-02-B-R-S-00	Solid	02/03/15 16:15	02/05/15 11:00
160-10373-3	L10-02-03-B-E-S-00	Solid	02/03/15 16:20	02/05/15 11:00
160-10373-4	L10-02-04-B-S-S-00	Solid	02/03/15 14:25	02/05/15 11:00
160-10373-5	L10-02-05-B-R-S-00	Solid	02/03/15 15:15	02/05/15 11:00
160-10373-6	L10-02-06-B-E-S-00	Solid	02/03/15 15:20	02/05/15 11:00
160-10373-7	L10-02-07-B-E-S-00	Solid	02/03/15 11:25	02/05/15 11:00
160-10373-8	L10-02-08-B-E-S-00	Solid	02/03/15 10:55	02/05/15 11:00
160-10373-9	L10-02-09-B-E-S-00	Solid	02/03/15 11:00	02/05/15 11:00
160-10373-10	L10-02-10-B-E-S-00	Solid	02/03/15 11:50	02/05/15 11:00
160-10373-11	L10-02-11-B-E-S-00	Solid	02/03/15 11:35	02/05/15 11:00
160-10373-12	L10-02-12-B-E-S-00	Solid	02/03/15 14:15	02/05/15 11:00
160-10373-13	L10-02-13-B-E-B-00	Solid	02/03/15 10:45	02/05/15 11:00
160-10373-14	L10-02-11-B-E-Q-00	Solid	02/03/15 11:35	02/05/15 11:00

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

**Client Sample ID: L10-02-01-B-S-S-00**

**Lab Sample ID: 160-10373-1**

**Date Collected: 02/03/15 15:25**

**Matrix: Solid**

**Date Received: 02/05/15 11:00**

**Percent Solids: 78.7**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000026	J	0.000071	0.000021	mg/Kg	☆	02/05/15 13:55	02/09/15 12:37	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	0.443		0.0674	0.0787	1.42	0.243	pCi/g	02/05/15 13:55	02/09/15 12:37	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	90		30 - 110					02/05/15 13:55	02/09/15 12:37	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	1.11		0.160	0.196		0.0428	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Americium 241	0.0462	U	0.0529	0.0531		0.0780	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Bismuth 212	1.34		0.462	0.483		0.431	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Bismuth 214	0.797		0.108	0.136		0.0744	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Lead 212	0.942		0.0772	0.144		0.0609	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Lead 214	0.861		0.0826	0.122		0.0642	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Potassium 40	16.8		1.28	2.15		0.283	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Protactinium 234m	2.37	U	3.60	3.61		6.28	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Protactinium 231	0.424	U	0.326	0.329		0.920	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Radium 226	0.797		0.108	0.136		0.0744	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Thorium 234	1.27		0.582	0.597		0.917	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Uranium 235	0.176		0.110	0.111		0.161	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Thorium 232	1.11		0.160	0.196		0.0428	pCi/g	02/09/15 09:32	02/09/15 17:27	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.327		0.0487	0.0593		0.0335	pCi/g	02/09/15 09:32	02/09/15 17:27	1

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

**Lab Sample ID: 160-10373-2**

**Date Collected: 02/03/15 16:15**

**Matrix: Solid**

**Date Received: 02/05/15 11:00**

**Percent Solids: 81.4**

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000067	0.000020	mg/Kg	☆	02/05/15 13:55	02/09/15 12:48	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	0.130	U	0.0944	0.0952	1.35	0.231	pCi/g	02/05/15 13:55	02/09/15 12:48	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					02/05/15 13:55	02/09/15 12:48	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

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

Lab Sample ID: 160-10373-2

Date Collected: 02/03/15 16:15

Matrix: Solid

Date Received: 02/05/15 11:00

## 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	1.08		0.186	0.216		0.139	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Americium 241	-0.0229	U	0.0764	0.0765		0.128	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Bismuth 212	1.61		0.479	0.507		0.362	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Bismuth 214	0.835		0.124	0.151		0.0927	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Lead 212	0.928		0.0947	0.153		0.0974	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Lead 214	0.837		0.102	0.134		0.100	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Potassium 40	18.4		1.51	2.42		0.392	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Protactinium 234m	2.00	U	4.13	4.13		7.10	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Protactinium 231	0.519	U	0.273	0.279		1.46	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Radium 226	0.835		0.124	0.151		0.0927	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Thorium 234	0.967	U	0.352	0.366		1.03	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Uranium 235	0.0621	U	0.176	0.176		0.278	pCi/g	02/09/15 09:32	02/09/15 17:28	1
Thorium 232	1.08		0.186	0.216		0.139	pCi/g	02/09/15 09:32	02/09/15 17:28	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.329		0.0779	0.0851		0.0657	pCi/g	02/09/15 09:32	02/09/15 17:28	1

Client Sample ID: L10-02-03-B-E-S-00

Lab Sample ID: 160-10373-3

Date Collected: 02/03/15 16:20

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 78.6

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000069	0.000021	mg/Kg	☼	02/05/15 13:55	02/09/15 13:00	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	0.0332	U	0.0507	0.0508	1.38	0.236	pCi/g	02/05/15 13:55	02/09/15 13:00	1
<b>Carrier</b>										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	93		30 - 110					02/05/15 13:55	02/09/15 13:00	1

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.15		0.212	0.242		0.165	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Americium 241	-0.000628	U	0.0781	0.0781		0.133	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Bismuth 212	1.22		0.499	0.515		0.448	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Bismuth 214	0.822		0.154	0.176		0.123	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Lead 212	0.919		0.103	0.157		0.118	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Lead 214	1.01		0.108	0.151		0.104	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Potassium 40	18.1		1.59	2.44		0.537	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Protactinium 234m	0.341	U	3.46	3.47		6.40	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Protactinium 231	0.446	U	0.293	0.297		1.60	pCi/g	02/09/15 09:32	02/09/15 18:01	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-03-B-E-S-00

Lab Sample ID: 160-10373-3

Date Collected: 02/03/15 16:20

Matrix: Solid

Date Received: 02/05/15 11:00

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.822		0.154	0.176		0.123	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Thorium 234	0.770	U	0.414	0.422		1.22	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Uranium 235	0.226	U	0.176	0.178		0.260	pCi/g	02/09/15 09:32	02/09/15 18:01	1
Thorium 232	1.15		0.212	0.242		0.165	pCi/g	02/09/15 09:32	02/09/15 18:01	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.411		0.0589	0.0727		0.0287	pCi/g	02/09/15 09:32	02/09/15 18:01	1

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

Lab Sample ID: 160-10373-4

Date Collected: 02/03/15 14:25

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 83.9

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000068	0.000020	mg/Kg	☼	02/05/15 13:55	02/09/15 13:04	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	0.303		0.0293	0.0405	1.35	0.232	pCi/g	02/05/15 13:55	02/09/15 13:04	1
<b>Carrier</b>										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					02/05/15 13:55	02/09/15 13:04	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.994		0.160	0.189		0.109	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Americium 241	0.0194	U	0.0662	0.0663		0.111	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Bismuth 212	0.748		0.418	0.425		0.613	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Bismuth 214	0.747		0.118	0.142		0.0968	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Lead 212	1.04		0.0837	0.158		0.0633	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Lead 214	0.957		0.0997	0.141		0.0847	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Potassium 40	18.3		1.39	2.33		0.308	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Protactinium 234m	8.46		3.41	3.52		2.72	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Protactinium 231	0.497	U	0.244	0.250		1.19	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Radium 226	0.747		0.118	0.142		0.0968	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Thorium 234	1.55		0.605	0.626		0.936	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Uranium 235	0.280		0.143	0.146		0.199	pCi/g	02/09/15 09:32	02/09/15 18:03	1
Thorium 232	0.994		0.160	0.189		0.109	pCi/g	02/09/15 09:32	02/09/15 18:03	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.313		0.0553	0.0641		0.0433	pCi/g	02/09/15 09:32	02/09/15 18:03	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-05-B-R-S-00

Lab Sample ID: 160-10373-5

Date Collected: 02/03/15 15:15

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 85.9

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000070	0.000021	mg/Kg	☼	02/05/15 13:55	02/09/15 13:08	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	0.0185	U	0.0904	0.0904	1.40	0.240	pCi/g	02/05/15 13:55	02/09/15 13:08	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	83		30 - 110					02/05/15 13:55	02/09/15 13:08	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	1.11		0.158	0.194		0.154	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Americium 241	-0.0146	U	0.0614	0.0614		0.103	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Bismuth 212	1.98		0.673	0.703		0.559	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Bismuth 214	0.838		0.104	0.136		0.0709	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Lead 212	1.05		0.0898	0.163		0.0876	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Lead 214	0.835		0.107	0.138		0.0819	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Potassium 40	17.0		1.35	2.20		0.439	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Protactinium 234m	3.00	U	3.13	3.14		6.64	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Protactinium 231	-0.701	U	0.895	0.899		1.48	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Radium 226	0.838		0.104	0.136		0.0709	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Thorium 234	1.24		0.631	0.644		1.01	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Uranium 235	0.0938	U	0.139	0.139		0.276	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Thorium 232	1.11		0.158	0.194		0.154	pCi/g	02/09/15 09:32	02/09/15 18:05	1
Other Detected			Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.394		0.0588	0.0716		0.0405	pCi/g	02/09/15 09:32	02/09/15 18:05	1

Client Sample ID: L10-02-06-B-E-S-00

Lab Sample ID: 160-10373-6

Date Collected: 02/03/15 15:20

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 83.0

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000067	0.000020	mg/Kg	☼	02/05/15 13:55	02/09/15 13:12	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	0.0413	U	0.0323	0.0325	1.33	0.228	pCi/g	02/05/15 13:55	02/09/15 13:12	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					02/05/15 13:55	02/09/15 13:12	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-06-B-E-S-00

Lab Sample ID: 160-10373-6

Date Collected: 02/03/15 15:20

Matrix: Solid

Date Received: 02/05/15 11:00

## 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	1.38		0.220	0.261		0.121	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Americium 241	0.00946	U	0.0517	0.0517		0.0880	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Bismuth 212	1.30		0.425	0.446		0.363	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Bismuth 214	0.945		0.134	0.166		0.0889	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Lead 212	1.06		0.128	0.187		0.120	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Lead 214	1.04		0.116	0.158		0.0998	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Potassium 40	19.6		1.54	2.53		0.327	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Protactinium 234m	-0.110	U	4.79	4.79		8.61	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Protactinium 231	0.260	U	0.207	0.209		1.43	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Radium 226	0.945		0.134	0.166		0.0889	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Thorium 234	0.709	U	0.435	0.441		1.28	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Uranium 235	0.150	U	0.166	0.167		0.279	pCi/g	02/09/15 09:32	02/09/15 18:47	1
Thorium 232	1.38		0.220	0.261		0.121	pCi/g	02/09/15 09:32	02/09/15 18:47	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.405		0.0744	0.0854		0.0555	pCi/g	02/09/15 09:32	02/09/15 18:47	1

Client Sample ID: L10-02-07-B-E-S-00

Lab Sample ID: 160-10373-7

Date Collected: 02/03/15 11:25

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 73.1

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000075	0.000022	mg/Kg	☼	02/05/15 13:55	02/09/15 13:15	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	0.0420	U	0.129	0.129	1.49	0.256	pCi/g	02/05/15 13:55	02/09/15 13:15	1
<b>Carrier</b>										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					02/05/15 13:55	02/09/15 13:15	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	1.24		0.138	0.187		0.0842	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Americium 241	-0.0208	U	0.0679	0.0679		0.114	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Bismuth 212	1.43		0.514	0.535		0.444	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Bismuth 214	0.823		0.121	0.148		0.0943	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Lead 212	1.07		0.0808	0.160		0.0795	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Lead 214	1.04		0.0936	0.143		0.0678	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Potassium 40	18.5		1.18	2.23		0.389	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Protactinium 234m	1.85	U	2.91	2.91		4.93	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Protactinium 231	0.420	U	0.217	0.222		1.19	pCi/g	02/09/15 09:32	02/09/15 18:48	1

TestAmerica St. Louis



# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-07-B-E-S-00

Lab Sample ID: 160-10373-7

Date Collected: 02/03/15 11:25

Matrix: Solid

Date Received: 02/05/15 11:00

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.823		0.121	0.148		0.0943	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Thorium 234	1.04		0.379	0.394		0.949	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Uranium 235	0.135	U	0.131	0.131		0.207	pCi/g	02/09/15 09:32	02/09/15 18:48	1
Thorium 232	1.24		0.138	0.187		0.0842	pCi/g	02/09/15 09:32	02/09/15 18:48	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.396		0.0485	0.0636		0.0323	pCi/g	02/09/15 09:32	02/09/15 18:48	1

Client Sample ID: L10-02-08-B-E-S-00

Lab Sample ID: 160-10373-8

Date Collected: 02/03/15 10:55

Matrix: Solid

Date Received: 02/05/15 11:00

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		0.000070	0.000021	mg/Kg	☼	02/05/15 13:55	02/09/15 13:19	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	-0.00764	U	0.0588	0.0588	1.40	0.239	pCi/g	02/05/15 13:55	02/09/15 13:19	1
<b>Carrier</b>										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	89		30 - 110					02/05/15 13:55	02/09/15 13:19	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		0.160	0.195		0.123	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Americium 241	0.0131	U	0.0581	0.0581		0.0979	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Bismuth 212	1.15		0.348	0.368		0.301	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Bismuth 214	0.832		0.102	0.134		0.0694	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Lead 212	1.11		0.0805	0.165		0.0625	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Lead 214	0.931		0.0999	0.139		0.0781	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Potassium 40	18.2		1.31	2.28		0.391	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Protactinium 234m	0.696	U	3.54	3.54		6.25	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Protactinium 231	-0.574	U	0.744	0.746		1.23	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Radium 226	0.832		0.102	0.134		0.0694	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Thorium 234	1.14		0.688	0.698		0.944	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Uranium 235	0.136	U	0.142	0.142		0.232	pCi/g	02/09/15 09:32	02/09/15 18:49	1
Thorium 232	1.10		0.160	0.195		0.123	pCi/g	02/09/15 09:32	02/09/15 18:49	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.249		0.0554	0.0611		0.0743	pCi/g	02/09/15 09:32	02/09/15 18:49	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-09-B-E-S-00

Lab Sample ID: 160-10373-9

Date Collected: 02/03/15 11:00

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 80.0

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000051	J	0.000069	0.000021	mg/Kg	☼	02/05/15 13:55	02/09/15 13:23	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	0.871		0.0874	0.119	1.38	0.237	pCi/g	02/05/15 13:55	02/09/15 13:23	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	91		30 - 110					02/05/15 13:55	02/09/15 13:23	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.886		0.120	0.150		0.0734	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Americium 241	0.00855	U	0.0524	0.0524		0.0888	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Bismuth 212	0.432	U	0.372	0.374		0.587	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Bismuth 214	0.737		0.110	0.134		0.0825	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Lead 212	0.737		0.0728	0.120		0.0719	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Lead 214	0.811		0.0865	0.121		0.0665	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Potassium 40	12.4		1.10	1.68		0.305	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Protactinium 234m	-0.0172	U	2.93	2.93		5.41	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Protactinium 231	0.294	U	0.226	0.229		1.16	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Radium 226	0.737		0.110	0.134		0.0825	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Thorium 234	0.695	U	0.292	0.301		0.845	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Uranium 235	0.130	U	0.124	0.125		0.227	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Thorium 232	0.886		0.120	0.150		0.0734	pCi/g	02/09/15 09:32	02/09/15 18:50	1
Other Detected			Count Uncert.	Total Uncert.						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.239		0.0480	0.0540		0.0404	pCi/g	02/09/15 09:32	02/09/15 18:50	1

Client Sample ID: L10-02-10-B-E-S-00

Lab Sample ID: 160-10373-10

Date Collected: 02/03/15 11:50

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 70.8

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000085	0.000025	mg/Kg	☼	02/05/15 13:55	02/09/15 13:27	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	0.353		0.114	0.119	1.70	0.290	pCi/g	02/05/15 13:55	02/09/15 13:27	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	83		30 - 110					02/05/15 13:55	02/09/15 13:27	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-10-B-E-S-00

Lab Sample ID: 160-10373-10

Date Collected: 02/03/15 11:50

Matrix: Solid

Date Received: 02/05/15 11:00

## 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	1.09		0.133	0.173		0.106	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Americium 241	-0.00719	U	0.0543	0.0543		0.0918	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Bismuth 212	1.06		0.395	0.410		0.399	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Bismuth 214	0.668		0.0872	0.111		0.0627	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Lead 212	1.00		0.0722	0.148		0.0557	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Lead 214	0.753		0.0777	0.110		0.0658	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Potassium 40	17.1		1.12	2.08		0.259	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Protactinium 234m	3.72	U	1.99	2.03		5.04	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Protactinium 231	0.438	U	0.263	0.267		1.14	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Radium 226	0.668		0.0872	0.111		0.0627	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Thorium 234	1.33		0.514	0.533		0.805	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Uranium 235	0.124	U	0.139	0.139		0.226	pCi/g	02/09/15 09:32	02/09/15 18:51	1
Thorium 232	1.09		0.133	0.173		0.106	pCi/g	02/09/15 09:32	02/09/15 18:51	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Tl-208	0.326		0.0517	0.0618		0.0380	pCi/g	02/09/15 09:32	02/09/15 18:51	1

Client Sample ID: L10-02-11-B-E-S-00

Lab Sample ID: 160-10373-11

Date Collected: 02/03/15 11:35

Matrix: Solid

Date Received: 02/05/15 11:00

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		0.000073	0.000022	mg/Kg	☼	02/05/15 13:55	02/09/15 13:31	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	0.274		0.0285	0.0381	1.45	0.249	pCi/g	02/05/15 13:55	02/09/15 13:31	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	88		30 - 110					02/05/15 13:55	02/09/15 13:31	1

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.859		0.158	0.181		0.0999	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Americium 241	0.0144	U	0.0559	0.0559		0.0941	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Bismuth 212	1.13		0.415	0.431		0.326	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Bismuth 214	0.624		0.104	0.122		0.0736	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Lead 212	0.628		0.0753	0.111		0.0886	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Lead 214	0.732		0.0955	0.122		0.0910	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Potassium 40	12.8		1.12	1.73		0.267	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Protactinium 234m	-0.397	U	3.76	3.76		6.71	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Protactinium 231	0.182	U	0.149	0.150		1.24	pCi/g	02/09/15 09:32	02/09/15 19:22	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-11-B-E-S-00

Lab Sample ID: 160-10373-11

Date Collected: 02/03/15 11:35

Matrix: Solid

Date Received: 02/05/15 11:00

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium 226	0.624		0.104	0.122		0.0736	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Thorium 234	0.631	U	0.274	0.282		0.789	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Uranium 235	0.0212	U	0.0799	0.0800		0.218	pCi/g	02/09/15 09:32	02/09/15 19:22	1
Thorium 232	0.859		0.158	0.181		0.0999	pCi/g	02/09/15 09:32	02/09/15 19:22	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.263		0.0475	0.0548		0.0341	pCi/g	02/09/15 09:32	02/09/15 19:22	1

Client Sample ID: L10-02-12-B-E-S-00

Lab Sample ID: 160-10373-12

Date Collected: 02/03/15 14:15

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 91.5

## 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	☼	02/05/15 13:55	02/09/15 13:35	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	0.301		0.0814	0.0860	1.25	0.214	pCi/g	02/05/15 13:55	02/09/15 13:35	1
<b>Carrier</b>										
Re	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	88		30 - 110					02/05/15 13:55	02/09/15 13:35	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.347		0.0608	0.0704		0.0388	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Americium 241	-0.0142	U	0.0425	0.0425		0.0712	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Bismuth 212	0.579		0.164	0.174		0.130	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Bismuth 214	0.506		0.0635	0.0825		0.0445	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Lead 212	0.288		0.0349	0.0510		0.0375	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Lead 214	0.582		0.0514	0.0793		0.0375	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Potassium 40	4.80		0.473	0.682		0.165	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Protactinium 234m	1.98	U	1.78	1.79		2.85	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Protactinium 231	0.165	U	0.212	0.213		0.506	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Radium 226	0.506		0.0635	0.0825		0.0445	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Thorium 234	1.77		0.371	0.415		0.529	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Uranium 235	0.232		0.0799	0.0833		0.111	pCi/g	02/09/15 09:32	02/09/15 19:23	1
Thorium 232	0.347		0.0608	0.0704		0.0388	pCi/g	02/09/15 09:32	02/09/15 19:23	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.110		0.0249	0.0274		0.0207	pCi/g	02/09/15 09:32	02/09/15 19:23	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-13-B-E-B-00

Lab Sample ID: 160-10373-13

Date Collected: 02/03/15 10:45

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 72.4

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000084	0.000025	mg/Kg	☼	02/05/15 13:55	02/09/15 13:46	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	0.265	U	0.000932	0.0244	1.68	0.287	pCi/g	02/05/15 13:55	02/09/15 13:46	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	83		30 - 110					02/05/15 13:55	02/09/15 13:46	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	1.07		0.158	0.192		0.0430	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Americium 241	-0.00132	U	0.0618	0.0618		0.105	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Bismuth 212	1.48		0.484	0.508		0.424	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Bismuth 214	0.835		0.123	0.151		0.0940	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Lead 212	1.09		0.0845	0.164		0.0693	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Lead 214	0.915		0.0966	0.136		0.0780	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Potassium 40	18.9		1.38	2.38		0.394	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Protactinium 234m	2.28	U	3.12	3.13		5.18	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Protactinium 231	0.517	U	0.237	0.244		1.30	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Radium 226	0.835		0.123	0.151		0.0940	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Thorium 234	2.65		0.677	0.731		0.833	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Uranium 235	0.364		0.167	0.171		0.217	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Thorium 232	1.07		0.158	0.192		0.0430	pCi/g	02/09/15 09:32	02/09/15 19:24	1
Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.340		0.0509	0.0619		0.0377	pCi/g	02/09/15 09:32	02/09/15 19:24	1

Client Sample ID: L10-02-11-B-E-Q-00

Lab Sample ID: 160-10373-14

Date Collected: 02/03/15 11:35

Matrix: Solid

Date Received: 02/05/15 11:00

Percent Solids: 85.5

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	0.000026	J	0.000071	0.000021	mg/Kg	☼	02/05/15 13:55	02/09/15 13:50	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	0.453		0.206	0.210	1.42	0.243	pCi/g	02/05/15 13:55	02/09/15 13:50	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Re	82		30 - 110					02/05/15 13:55	02/09/15 13:50	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-10373-1

Client Sample ID: L10-02-11-B-E-Q-00

Lab Sample ID: 160-10373-14

Date Collected: 02/03/15 11:35

Matrix: Solid

Date Received: 02/05/15 11:00

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.853		0.136	0.161		0.0398	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Americium 241	-0.00652	U	0.0568	0.0568		0.0961	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Bismuth 212	0.645		0.290	0.298		0.296	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Bismuth 214	0.637		0.0944	0.115		0.0661	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Lead 212	0.587		0.0653	0.100		0.0690	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Lead 214	0.676		0.0784	0.105		0.0706	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Potassium 40	11.6		1.03	1.57		0.287	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Protactinium 234m	1.41	U	2.91	2.91		5.00	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Protactinium 231	0.0596	U	0.121	0.121		0.961	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Radium 226	0.637		0.0944	0.115		0.0661	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Thorium 234	1.12		0.689	0.699		0.841	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Uranium 235	0.0652	U	0.133	0.133		0.222	pCi/g	02/09/15 09:32	02/09/15 19:25	1
Thorium 232	0.853		0.136	0.161		0.0398	pCi/g	02/09/15 09:32	02/09/15 19:25	1
<b>Other Detected</b>										
Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.200		0.0424	0.0471		0.0333	pCi/g	02/09/15 09:32	02/09/15 19:25	1

# QC Sample Results

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

TestAmerica Job ID: 160-10373-1

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

Lab Sample ID: MB 160-172337/1-A  
Matrix: Solid  
Analysis Batch: 173058

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000053	0.000016	mg/Kg		02/05/15 13:55	02/09/15 12:29	1

Lab Sample ID: LCS 160-172337/2-A  
Matrix: Solid  
Analysis Batch: 173058

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00122	0.00123		mg/Kg		101	80 - 120

Lab Sample ID: 160-10373-1 MS  
Matrix: Solid  
Analysis Batch: 173058

Client Sample ID: L10-02-01-B-S-S-00  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.000026	J	0.00156	0.00161		mg/Kg	☼	101	75 - 125

Lab Sample ID: 160-10373-1 MSD  
Matrix: Solid  
Analysis Batch: 173058

Client Sample ID: L10-02-01-B-S-S-00  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Technetium 99	0.000026	J	0.00156	0.00164		mg/Kg	☼	103	75 - 125	2	30

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

Lab Sample ID: MB 160-172337/1-A  
Matrix: Solid  
Analysis Batch: 173059

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	-0.003780	U	0.0358	0.0358	1.05	0.180	pCi/g	02/05/15 13:55	02/09/15 12:29	1

Carrier	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	95		30 - 110	02/05/15 13:55	02/09/15 12:29	1

Lab Sample ID: LCS 160-172337/2-A  
Matrix: Solid  
Analysis Batch: 173059

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 172337

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	21.0	21.10		2.02	1.04	0.178	pCi/g	101	80 - 120

Carrier	LCS %Yield	LCS Qualifier	Limits
Re	96		30 - 110

TestAmerica St. Louis



# QC Sample Results

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

TestAmerica Job ID: 160-10373-1

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

Lab Sample ID: 160-10373-1 MS

Matrix: Solid

Analysis Batch: 173059

Client Sample ID: L10-02-01-B-S-S-00

Prep Type: Total/NA

Prep Batch: 172337

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	0.443		26.7	27.56		2.55	1.44	0.247	pCi/g	101	75 - 125
Carrier	MS %Yield	MS Qualifier	Limits								
Re	88		30 - 110								

Lab Sample ID: 160-10373-1 MSD

Matrix: Solid

Analysis Batch: 173059

Client Sample ID: L10-02-01-B-S-S-00

Prep Type: Total/NA

Prep Batch: 172337

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	0.443		26.7	28.13		2.73	1.40	0.240	pCi/g	103	75 - 125	0.11	1
Carrier	MSD %Yield	MSD Qualifier	Limits										
Re	91		30 - 110										

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

Lab Sample ID: MB 160-172851/1-A

Matrix: Solid

Analysis Batch: 172858

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 172851

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.01390	U	0.0281	0.0281		0.0708	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Americium 241	-0.0001567	U	0.0131	0.0131		0.0244	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Bismuth 212	0.0000	U	0.0352	0.0352		0.276	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Bismuth 214	-0.006701	U	0.268	0.268		0.0411	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Lead 212	-0.004551	U	0.0414	0.0414		0.0262	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Lead 214	0.004048	U	0.0135	0.0135		0.0254	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Potassium 40	-0.07330	U	2.93	2.93		0.258	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Protactinium 234m	-0.2037	U	1.15	1.15		2.35	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Protactinium 231	-0.03869	U	0.225	0.225		0.416	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Radium 226	-0.006701	U	0.268	0.268		0.0411	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Thorium 234	-0.1662	U	6.65	6.65		0.343	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Uranium 235	0.01336	U	0.0252	0.0252		0.0538	pCi/g	02/09/15 09:32	02/09/15 17:25	1
Thorium 232	0.01390	U	0.0281	0.0281		0.0708	pCi/g	02/09/15 09:32	02/09/15 17:25	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	02/09/15 09:32	02/09/15 17:25	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-10373-1

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

Lab Sample ID: LCS 160-172851/2-A

Matrix: Solid

Analysis Batch: 172864

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 172851

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	98.71		10.3		0.504	pCi/g	98	87 - 116
Cesium 137	35.0	34.22		3.58	0.200	0.165	pCi/g	98	87 - 120
Cobalt 60	36.8	35.26		3.55		0.126	pCi/g	96	87 - 115

Lab Sample ID: 160-10373-1 DU

Matrix: Solid

Analysis Batch: 172864

Client Sample ID: L10-02-01-B-S-S-00

Prep Type: Total/NA

Prep Batch: 172851

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.11		1.042		0.185		0.119	pCi/g	0.17	1
Americium 241	0.0462	U	0.02218	U	0.0600		0.100	pCi/g	0.21	1
Bismuth 212	1.34		1.459		0.433		0.335	pCi/g	0.14	1
Bismuth 214	0.797		0.7382		0.126		0.0761	pCi/g	0.23	1
Lead 212	0.942		0.9411		0.143		0.0751	pCi/g	0	1
Lead 214	0.861		0.9239		0.138		0.0704	pCi/g	0.24	1
Potassium 40	16.8		17.81		2.20		0.522	pCi/g	0.23	1
Protactinium 234m	2.37	U	-0.3092	U	12.4		7.01	pCi/g	0.17	1
Protactinium 231	0.424	U	-0.4354	U	0.660		1.09	pCi/g	0.87	1
Radium 226	0.797		0.7382		0.126		0.0761	pCi/g	0.23	1
Thorium 234	1.27		1.318		0.570		0.872	pCi/g	0.04	1
Uranium 235	0.176		0.1681	U	0.155		0.246	pCi/g	0.03	1
Thorium 232	1.11		1.042		0.185		0.119	pCi/g	0.17	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	0.327		0.2847		0.0510		0.0323	pCi/g	0.38	1

TestAmerica St. Louis

# QC Association Summary

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

TestAmerica Job ID: 160-10373-1

## Metals

### Prep Batch: 172337

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-1 MS	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-1 MSD	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	None	
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	None	
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	None	
160-10373-5	L10-02-05-B-R-S-00	Total/NA	Solid	None	
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	None	
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	None	
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	None	
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	None	
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	None	
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	None	
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	None	
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	None	
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	None	
LCS 160-172337/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-172337/1-A	Method Blank	Total/NA	Solid	None	

### Analysis Batch: 173058

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	6020A	172337
160-10373-1 MS	L10-02-01-B-S-S-00	Total/NA	Solid	6020A	172337
160-10373-1 MSD	L10-02-01-B-S-S-00	Total/NA	Solid	6020A	172337
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	6020A	172337
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	6020A	172337
160-10373-5	L10-02-05-B-R-S-00	Total/NA	Solid	6020A	172337
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	6020A	172337
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	6020A	172337
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	6020A	172337
LCS 160-172337/2-A	Lab Control Sample	Total/NA	Solid	6020A	172337
MB 160-172337/1-A	Method Blank	Total/NA	Solid	6020A	172337

## General Chemistry

### Analysis Batch: 172737

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	Moisture	
160-10373-1 DU	L10-02-01-B-S-S-00	Total/NA	Solid	Moisture	
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	Moisture	
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	Moisture	
160-10373-5	L10-02-05-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: 160-10373-1

## General Chemistry (Continued)

### Analysis Batch: 172737 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	Moisture	
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	Moisture	
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	Moisture	

## Rad

### Leach Batch: 172318

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	Dry and Grind	
160-10373-1 DU	L10-02-01-B-S-S-00	Total/NA	Solid	Dry and Grind	
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	Dry and Grind	
160-10373-5	L10-02-05-B-R-S-00	Total/NA	Solid	Dry and Grind	
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	Dry and Grind	
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	Dry and Grind	
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 172337

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-1 MS	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-1 MSD	L10-02-01-B-S-S-00	Total/NA	Solid	None	
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	None	
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	None	
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	None	
160-10373-5	L10-02-05-B-R-S-00	Total/NA	Solid	None	
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	None	
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	None	
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	None	
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	None	
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	None	
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	None	
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	None	
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	None	
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	None	
LCS 160-172337/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-172337/1-A	Method Blank	Total/NA	Solid	None	

TestAmerica St. Louis

## QC Association Summary

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

TestAmerica Job ID: 160-10373-1

### Rad (Continued)

Prep Batch: 172851

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10373-1	L10-02-01-B-S-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-1 DU	L10-02-01-B-S-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-2	L10-02-02-B-R-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-3	L10-02-03-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-4	L10-02-04-B-S-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-5	L10-02-05-B-R-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-6	L10-02-06-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-7	L10-02-07-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-8	L10-02-08-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-9	L10-02-09-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-10	L10-02-10-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-11	L10-02-11-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-12	L10-02-12-B-E-S-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-13	L10-02-13-B-E-B-00	Total/NA	Solid	Fill_Geo-0	172318
160-10373-14	L10-02-11-B-E-Q-00	Total/NA	Solid	Fill_Geo-0	172318
LCS 160-172851/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-172851/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

## Tracer/Carrier Summary

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

TestAmerica Job ID: 160-10373-1

**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)	
160-10373-1	L10-02-01-B-S-S-00	90	
160-10373-1 MS	L10-02-01-B-S-S-00	88	
160-10373-1 MSD	L10-02-01-B-S-S-00	91	
160-10373-2	L10-02-02-B-R-S-00	91	
160-10373-3	L10-02-03-B-E-S-00	93	
160-10373-4	L10-02-04-B-S-S-00	89	
160-10373-5	L10-02-05-B-R-S-00	83	
160-10373-6	L10-02-06-B-E-S-00	91	
160-10373-7	L10-02-07-B-E-S-00	91	
160-10373-8	L10-02-08-B-E-S-00	89	
160-10373-9	L10-02-09-B-E-S-00	91	
160-10373-10	L10-02-10-B-E-S-00	83	
160-10373-11	L10-02-11-B-E-S-00	88	
160-10373-12	L10-02-12-B-E-S-00	88	
160-10373-13	L10-02-13-B-E-B-00	83	
160-10373-14	L10-02-11-B-E-Q-00	82	
LCS 160-172337/2-A	Lab Control Sample	96	
MB 160-172337/1-A	Method Blank	95	

### Tracer/Carrier Legend

Re = Re