

# 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: 160-11834-2  
Client Project/Site: HDP

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

Attn: Brian Miller



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Authorized for release by:  
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[www.testamericainc.com](http://www.testamericainc.com)

*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.*

1

2

3

4

5

6

7

8

9

10

11



# Table of Contents

Cover Page . . . . .	1
Table of Contents . . . . .	2
Case Narrative . . . . .	3
Chain of Custody . . . . .	5
Receipt Checklists . . . . .	7
Definitions/Glossary . . . . .	8
Method Summary . . . . .	9
Sample Summary . . . . .	10
Client Sample Results . . . . .	11
QC Sample Results . . . . .	21
QC Association Summary . . . . .	23

# Case Narrative

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

TestAmerica Job ID: 160-11834-2

**Job ID: 160-11834-2**

**Laboratory: TestAmerica St. Louis**

**Narrative**

## CASE NARRATIVE

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

**Project: HDP**

**Report Number: 160-11834-2**

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 5/14/2015 10:40 AM; the samples arrived in good condition, properly preserved. The temperatures of the 2 coolers at receipt time were 20.0° C and 20.0° C.

### **RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)**

Samples L11-03-01-P-S-S-00 (160-11834-1), L11-03-02-P-R-S-00 (160-11834-2), L11-03-04-P-S-S-00 (160-11834-3), L11-03-05-P-R-S-00 (160-11834-4), L11-03-07-P-S-S-00 (160-11834-5), L11-03-08-P-R-S-00 (160-11834-6), L11-03-10-P-S-S-00 (160-11834-7), L11-03-11-P-R-S-00 (160-11834-8), L11-03-13-P-S-S-00 (160-11834-9), L11-03-14-P-R-S-00 (160-11834-10), L11-03-16-P-S-S-00 (160-11834-11), L11-03-17-P-R-S-00 (160-11834-12), L11-03-19-P-S-S-00 (160-11834-13), L11-03-20-P-R-S-00 (160-11834-14), L11-03-22-P-S-S-00 (160-11834-15), L11-03-23-P-R-S-00 (160-11834-16), L11-03-05-P-R-Q-00 (160-11834-17), L11-03-22-P-S-Q-00 (160-11834-18) and L11-03-25-P-S-B-00 (160-11834-19) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA\_01\_R. The samples were dried on 05/14/2015, prepared on 05/18/2015 and analyzed on 06/08/2015.

Insufficient sample was provided for the following sample to fit the marn soil geometry: L11-03-14-P-R-S-00 (160-11834-10). The sample

# Case Narrative

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

TestAmerica Job ID: 160-11834-2

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## Job ID: 160-11834-2 (Continued)

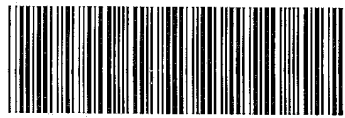
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### Laboratory: TestAmerica St. Louis (Continued)

was put into a tuna can geometry

The samples, analyzed by gamma spectroscopy resulted in a RER (replicate error ratio) outside of the acceptance criteria of 1 for protactinium-231. Both the sample and sample duplicates activity are less than the MDC. The data have been qualified and reported. L11-03-01-P-S-S-00 (160-11834-1), L11-03-02-P-R-S-00 (160-11834-2), L11-03-04-P-S-S-00 (160-11834-3), L11-03-05-P-R-S-00 (160-11834-4), L11-03-07-P-S-S-00 (160-11834-5), L11-03-08-P-R-S-00 (160-11834-6), L11-03-10-P-S-S-00 (160-11834-7), L11-03-11-P-R-S-00 (160-11834-8), L11-03-13-P-S-S-00 (160-11834-9), L11-03-14-P-R-S-00 (160-11834-10), L11-03-16-P-S-S-00 (160-11834-11), L11-03-17-P-R-S-00 (160-11834-12), L11-03-19-P-S-S-00 (160-11834-13), L11-03-20-P-R-S-00 (160-11834-14), L11-03-22-P-S-S-00 (160-11834-15), L11-03-23-P-R-S-00 (160-11834-16), L11-03-05-P-R-Q-00 (160-11834-17), L11-03-22-P-S-Q-00 (160-11834-18), L11-03-25-P-S-B-00 (160-11834-19), (LCS 160-191270/2-A), (MB 160-191270/1-A) and (160-11834-A-1-H DU)

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



# Chain of Custody Record

Earth City, MO 63045  
phone 314.298.8566 fax

Program:  DW  NPDES  RCRA  Other:

TestAmerica Laboratories, Inc.

<b>Client Contact</b> Perma-Fix Environmental Services 2800 Solway Road Knoxville, TN 37931 (865) 690-0501 Phone (865) 539-9868 FAX		<b>Project Manager: Brian Miller</b> Tel/Fax: (314) 810-3333		<b>Site Contact: Ellen Jakub</b>		<b>Date: 05/14/2015</b>		<b>COC No: 051415-FSS1</b> 1 of 2 COCs	
<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		<b>Lab Contact: Ivan Vanya</b>		<b>Carrier: Courier</b>		<b>Sampler:</b> For Lab Use Only: Walk-in Client: Lab Sampling:		<b>Job / SDG No.:</b>	
<b>Project Name: Hematite Decommissioning Project</b> <b>Site: Westinghouse Hematite, MO</b> <b>P O # 832953</b>		<b>Filtered Sample (Y/N)</b>		<b>Perform MS / MSD (Y/N)</b>		<b>Gamma Spec Westinghouse Hematite Library</b>		<b>Alpha Spec</b>	
<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>ICP/MS (Tc-99)</b>	<b>Gamma Spec (With post-21 day ingrowth)</b>	<b>Sample Specific Notes:</b>
L11-03-01-P-S-S-00		5/12/15	0835	G	Soil	1	N	X X X	Jahmai Williams
L11-03-02-P-R-S-00		5/12/15	0855	C	Soil	1	N	X X X	Jahmai Williams
L11-03-04-P-S-S-00		5/12/15	0935	G	Soil	1	N	X X X	Jahmai Williams
L11-03-05-P-R-S-00		5/12/15	1000	C	Soil	1	N	X X X	Jahmai Williams
L11-03-07-P-S-S-00		5/12/15	1040	G	Soil	1	N	X X X	Matt Cushman
L11-03-08-P-R-S-00		5/12/15	1100	C	Soil	1	N	X X X	Matt Cushman
L11-03-10-P-S-S-00		5/12/15	1450	G	Soil	1	N	X X X	Jahmai Williams
L11-03-11-P-R-S-00		5/12/15	1505	C	Soil	1	N	X X X	Jahmai Williams
L11-03-13-P-S-S-00		5/12/15	1535	G	Soil	1	N	X X X	Matt Cushman
L11-03-14-P-R-S-00		5/12/15	1550	C	Soil	1	N	X X X	Matt Cushman
L11-03-16-P-S-S-00		5/13/15	0845	G	Soil	1	N	X X X	Jahmai Williams
L11-03-17-P-R-S-00		5/13/15	0910	C	Soil	1	N	X X X	Jahmai Williams
<b>Preservation Used:</b> 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		<b>Custody Seals Intact:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Relinquished by:</b> <i>Brian Miller</i> Company: <i>Perma-Fix</i> Date/Time: <i>5-14-15/945</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>	
<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>		<b>Relinquished by:</b> <i>[Signature]</i> Company: <i>[Signature]</i> Date/Time: <i>5/14/15/1045</i>	



**TestAmerica St. Louis**

13745 Rider Trail North

**Chain of Custody Record**



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> Perma-Fix Environmental Services 2800 Solway Road Knoxville, TN 37931 (865) 690-0501 Phone (865) 539-9868 FAX Project Name: Hematite Decommissioning Project Site: Westinghouse Hematite, MO P O # 832953		<b>Project Manager: Brian Miller</b> Tel/Fax: (314) 810-3333		<b>Site Contact: Ellen Jakub</b> Lab Contact: Ivan Vanya		Date: 05/14/2015 Carrier: Courier		COC No: 051415-FSS1 2 of 2 COCs															
		<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						Sampler: For Lab Use Only: Walk-in Client: Lab Sampling:															
								Job / SDG No.:															
Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS /MSD (Y/N)	Gamma Spec Westinghouse Hematite Library	Alpha Spec	ICP/MS (Tc-99) Gamma Spec (With post-21 day ingrowth)	Sample Specific Notes:											
L11-03-19-P-S-S-00		5/13/15	0955	G	Soil	1	N	X	X	X		Matt Cushman											
L11-03-20-P-R-S-00		5/13/15	1010	C	Soil	1	N	X	X	X		Matt Cushman											
L11-03-22-P-S-S-00		5/13/15	1055	G	Soil	1	N	X	X	X		Matt Cushman											
L11-03-23-P-R-S-00		5/13/15	1115	C	Soil	1	N	X	X	X		Matt Cushman											
L11-03-05-P-R-Q-00		5/12/15	1000	C	Soil	1	N	X	X	X		Jahmai Williams											
L11-03-22-P-S-Q-00		5/13/15	1055	G	Soil	1	N	X	X	X		Matt Cushman											
L11-03-25-P-S-B-00		5/13/15	1135	G	Soil	1	N	X	X	X		Matt Cushman											
							N	/	A														
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other None																							
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. <input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown										Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month) <input checked="" type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months													
Special Instructions/QC Requirements & Comments: Potential for Radiological Contamination																							
Custody Seals Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:				Cooler Temp. (°C): Obs'd:				Corr'd:				Therm ID No.:									
Relinquished by: <i>[Signature]</i>		Company: Perma-Fix				Date/Time: 5-14-15/940				Received by: <i>[Signature]</i>				Company: <i>[Signature]</i>				Date/Time: 5/14/15 945					
Relinquished by: <i>[Signature]</i>		Company: <i>[Signature]</i>				Date/Time: 5/14/15/1040				Received by: <i>[Signature]</i>				Company: <i>[Signature]</i>				Date/Time: 5-14-15/1040					
Relinquished by:		Company:				Date/Time:				Received in Laboratory by:				Company:				Date/Time:					

Page 6 of 23

6/10/2015

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: 160-11834-2

**Login Number: 11834**

**List Number: 1**

**Creator: Clarke, Jill C**

**List Source: TestAmerica St. Louis**

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

# Definitions/Glossary

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

TestAmerica Job ID: 160-11834-2

## Qualifiers

### Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.
F	Duplicate RPD exceeds the control 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: 160-11834-2

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Method	Method Description	Protocol	Laboratory
GA-01-R	Gamma Spec: Radium 226 & other gamma emitters	DOE	TAL SL

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**Protocol References:**

DOE = U.S. Department of Energy

**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: 160-11834-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-11834-1	L11-03-01-P-S-S-00	Solid	05/12/15 08:35	05/14/15 10:40
160-11834-2	L11-03-02-P-R-S-00	Solid	05/12/15 08:55	05/14/15 10:40
160-11834-3	L11-03-04-P-S-S-00	Solid	05/12/15 09:35	05/14/15 10:40
160-11834-4	L11-03-05-P-R-S-00	Solid	05/12/15 10:00	05/14/15 10:40
160-11834-5	L11-03-07-P-S-S-00	Solid	05/12/15 10:40	05/14/15 10:40
160-11834-6	L11-03-08-P-R-S-00	Solid	05/12/15 11:00	05/14/15 10:40
160-11834-7	L11-03-10-P-S-S-00	Solid	05/12/15 14:50	05/14/15 10:40
160-11834-8	L11-03-11-P-R-S-00	Solid	05/12/15 15:05	05/14/15 10:40
160-11834-9	L11-03-13-P-S-S-00	Solid	05/12/15 15:35	05/14/15 10:40
160-11834-10	L11-03-14-P-R-S-00	Solid	05/12/15 15:50	05/14/15 10:40
160-11834-11	L11-03-16-P-S-S-00	Solid	05/13/15 08:45	05/14/15 10:40
160-11834-12	L11-03-17-P-R-S-00	Solid	05/13/15 09:10	05/14/15 10:40
160-11834-13	L11-03-19-P-S-S-00	Solid	05/13/15 09:55	05/14/15 10:40
160-11834-14	L11-03-20-P-R-S-00	Solid	05/13/15 10:10	05/14/15 10:40
160-11834-15	L11-03-22-P-S-S-00	Solid	05/13/15 10:55	05/14/15 10:40
160-11834-16	L11-03-23-P-R-S-00	Solid	05/13/15 11:15	05/14/15 10:40
160-11834-17	L11-03-05-P-R-Q-00	Solid	05/12/15 10:00	05/14/15 10:40
160-11834-18	L11-03-22-P-S-Q-00	Solid	05/13/15 10:55	05/14/15 10:40
160-11834-19	L11-03-25-P-S-B-00	Solid	05/13/15 11:35	05/14/15 10:40

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-01-P-S-S-00**

**Lab Sample ID: 160-11834-1**

Date Collected: 05/12/15 08:35

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.915		0.104	0.140		0.0834	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Bismuth 212	1.10		0.349	0.368		0.318	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Bismuth 214	1.22		0.0800	0.150		0.0492	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Lead 212	0.960		0.0532	0.135		0.0434	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Lead 214	1.29		0.0656	0.150		0.0557	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Potassium 40	21.2		0.879	2.35		0.291	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Protactinium 231	0.593	U	0.205	0.215		0.654	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Radium 226	1.22		0.0800	0.150	1.00	0.0492	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Thorium 232	0.915		0.104	0.140		0.0834	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Thorium 234	1.13		0.360	0.379		0.569	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Uranium 235	0.102	U	0.102	0.103		0.163	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Americium 241	0.0142	U	0.0443	0.0443		0.0737	pCi/g	05/18/15 13:57	06/08/15 16:05	1
Protactinium 234m	5.52		2.04	2.11		3.83	pCi/g	05/18/15 13:57	06/08/15 16:05	1
<b>Other Detected Radionuclides</b>			<b>Count Uncert. (2σ+/-)</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.284		0.0375	0.0477		0.0308	pCi/g	05/18/15 13:57	06/08/15 16:05	1

**Client Sample ID: L11-03-02-P-R-S-00**

**Lab Sample ID: 160-11834-2**

Date Collected: 05/12/15 08:55

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	1.13		0.132	0.175		0.109	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Bismuth 212	1.72		0.419	0.455		0.337	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Bismuth 214	1.12		0.106	0.157		0.0725	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Lead 212	1.04		0.0922	0.163		0.0832	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Lead 214	1.26		0.0954	0.162		0.0752	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Potassium 40	20.1		1.14	2.35		0.425	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Protactinium 231	0.424	U	0.338	0.341		0.879	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Radium 226	1.12		0.106	0.157	1.00	0.0725	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Thorium 232	1.13		0.132	0.175		0.109	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Thorium 234	1.15		0.512	0.526		0.814	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Uranium 235	0.0984	U	0.148	0.148		0.241	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Americium 241	0.0232	U	0.0621	0.0622		0.104	pCi/g	05/18/15 13:57	06/08/15 17:07	1
Protactinium 234m	-0.00348	U	2.75	2.75		4.86	pCi/g	05/18/15 13:57	06/08/15 17:07	1
<b>Other Detected Radionuclides</b>			<b>Count Uncert. (2σ+/-)</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.358		0.0486	0.0611		0.0391	pCi/g	05/18/15 13:57	06/08/15 17:07	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-04-P-S-S-00**

**Lab Sample ID: 160-11834-3**

Date Collected: 05/12/15 09:35

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.14		0.175	0.210		0.138	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Bismuth 212	1.15		0.431	0.447		0.444	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Bismuth 214	1.15		0.129	0.176		0.0852	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Lead 212	1.00		0.0931	0.160		0.0834	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Lead 214	1.30		0.105	0.171		0.0897	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Potassium 40	20.0		1.41	2.48		0.288	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Protactinium 231	0.385	U	0.303	0.306		1.26	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Radium 226	1.15		0.129	0.176	1.00	0.0852	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Thorium 232	1.14		0.175	0.210		0.138	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Thorium 234	1.30		0.582	0.598		0.915	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Uranium 235	0.164	U	0.162	0.162		0.264	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Americium 241	-0.00456	U	0.0548	0.0548		0.0933	pCi/g	05/18/15 13:57	06/08/15 17:08	1
Protactinium 234m	0.302	U	3.68	3.68		6.62	pCi/g	05/18/15 13:57	06/08/15 17:08	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.326		0.0532	0.0631		0.0408	pCi/g	05/18/15 13:57	06/08/15 17:08	1

**Client Sample ID: L11-03-05-P-R-S-00**

**Lab Sample ID: 160-11834-4**

Date Collected: 05/12/15 10:00

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.18		0.104	0.159		0.123	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Bismuth 212	1.34		0.397	0.421		0.367	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Bismuth 214	1.22		0.107	0.166		0.0667	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Lead 212	1.25		0.0780	0.180		0.0580	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Lead 214	1.29		0.0872	0.160		0.0681	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Potassium 40	18.4		1.06	2.16		0.269	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Protactinium 231	0.508	U	0.253	0.259		1.15	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Radium 226	1.22		0.107	0.166	1.00	0.0667	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Thorium 232	1.18		0.104	0.159		0.123	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Thorium 234	1.49		0.532	0.554		0.834	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Uranium 235	0.0427	U	0.138	0.139		0.221	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Americium 241	-0.0142	U	0.0582	0.0582		0.0975	pCi/g	05/18/15 13:57	06/08/15 17:09	1
Protactinium 234m	6.27		2.38	2.47		4.76	pCi/g	05/18/15 13:57	06/08/15 17:09	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.344		0.0432	0.0561		0.0340	pCi/g	05/18/15 13:57	06/08/15 17:09	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-07-P-S-S-00**

**Lab Sample ID: 160-11834-5**

Date Collected: 05/12/15 10:40

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.11		0.148	0.186		0.109	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Bismuth 212	1.53		0.495	0.520		0.458	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Bismuth 214	1.07		0.107	0.154		0.0590	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Lead 212	0.894		0.0877	0.145		0.0826	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Lead 214	1.14		0.102	0.156		0.0870	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Potassium 40	20.3		1.28	2.44		0.420	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Protactinium 231	0.527	U	0.294	0.300		1.36	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Radium 226	1.07		0.107	0.154	1.00	0.0590	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Thorium 232	1.11		0.148	0.186		0.109	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Thorium 234	0.933	U	0.320	0.335		0.953	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Uranium 235	0.221	U	0.165	0.166		0.234	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Americium 241	0.00107	U	0.0693	0.0693		0.117	pCi/g	05/18/15 13:57	06/08/15 18:17	1
Protactinium 234m	3.87	U	3.35	3.37		5.34	pCi/g	05/18/15 13:57	06/08/15 18:17	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.325		0.0468	0.0577		0.0365	pCi/g	05/18/15 13:57	06/08/15 18:17	1

**Client Sample ID: L11-03-08-P-R-S-00**

**Lab Sample ID: 160-11834-6**

Date Collected: 05/12/15 11:00

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.988		0.127	0.162		0.0988	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Bismuth 212	0.981		0.469	0.480		0.471	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Bismuth 214	1.11		0.110	0.160		0.0702	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Lead 212	1.03		0.0792	0.155		0.0685	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Lead 214	1.15		0.101	0.157		0.0740	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Potassium 40	18.2		1.13	2.18		0.202	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Protactinium 231	0.313	U	0.245	0.247		1.14	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Radium 226	1.11		0.110	0.160	1.00	0.0702	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Thorium 232	0.988		0.127	0.162		0.0988	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Thorium 234	1.29		0.663	0.677		0.857	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Uranium 235	0.0610	U	0.108	0.109		0.227	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Americium 241	0.00405	U	0.0558	0.0558		0.0941	pCi/g	05/18/15 13:57	06/08/15 18:18	1
Protactinium 234m	4.17	U	2.86	2.89		4.92	pCi/g	05/18/15 13:57	06/08/15 18:18	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.354		0.0504	0.0624		0.0375	pCi/g	05/18/15 13:57	06/08/15 18:18	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-10-P-S-S-00**

**Lab Sample ID: 160-11834-7**

Date Collected: 05/12/15 14:50

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.24		0.149	0.195		0.108	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Bismuth 212	1.48		0.420	0.448		0.359	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Bismuth 214	1.09		0.107	0.156		0.0699	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Lead 212	1.10		0.0880	0.168		0.0727	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Lead 214	1.11		0.0925	0.148		0.0721	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Potassium 40	20.0		1.20	2.37		0.363	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Protactinium 231	0.730	U	0.282	0.293		1.16	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Radium 226	1.09		0.107	0.156	1.00	0.0699	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Thorium 232	1.24		0.149	0.195		0.108	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Thorium 234	1.42		0.520	0.540		0.812	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Uranium 235	0.0809	U	0.156	0.156		0.244	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Americium 241	0.00883	U	0.0614	0.0614		0.103	pCi/g	05/18/15 13:57	06/08/15 18:19	1
Protactinium 234m	0.481	U	2.67	2.67		4.71	pCi/g	05/18/15 13:57	06/08/15 18:19	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.360		0.0441	0.0578		0.0324	pCi/g	05/18/15 13:57	06/08/15 18:19	1

**Client Sample ID: L11-03-11-P-R-S-00**

**Lab Sample ID: 160-11834-8**

Date Collected: 05/12/15 15:05

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.23		0.134	0.182		0.125	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Bismuth 212	1.96		0.509	0.547		0.417	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Bismuth 214	1.39		0.129	0.193		0.0895	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Lead 212	1.14		0.0982	0.177		0.0884	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Lead 214	1.49		0.0973	0.184		0.0839	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Potassium 40	20.2		1.14	2.33		0.278	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Protactinium 231	0.398	U	0.261	0.264		1.22	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Radium 226	1.39		0.129	0.193	1.00	0.0895	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Thorium 232	1.23		0.134	0.182		0.125	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Thorium 234	1.41		0.736	0.751		0.914	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Uranium 235	0.0706	U	0.159	0.159		0.265	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Americium 241	-0.0270	U	0.129	0.129		0.113	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Protactinium 234m	5.08	U	2.63	2.68		5.44	pCi/g	05/18/15 13:57	06/08/15 18:20	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Pb-210	1.91		0.625	0.664		0.784	pCi/g	05/18/15 13:57	06/08/15 18:20	1
Tl-208	0.432		0.0526	0.0689		0.0355	pCi/g	05/18/15 13:57	06/08/15 18:20	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-13-P-S-S-00**

**Lab Sample ID: 160-11834-9**

Date Collected: 05/12/15 15:35

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.21		0.125	0.176		0.106	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Bismuth 212	1.09		0.342	0.360		0.451	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Bismuth 214	1.14		0.111	0.163		0.0754	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Lead 212	1.02		0.0961	0.164		0.0881	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Lead 214	1.20		0.106	0.164		0.0773	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Potassium 40	20.5		1.15	2.39		0.302	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Protactinium 231	0.0998	U	0.457	0.457		0.785	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Radium 226	1.14		0.111	0.163	1.00	0.0754	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Thorium 232	1.21		0.125	0.176		0.106	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Thorium 234	1.75		0.717	0.740		0.897	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Uranium 235	0.204	U	0.148	0.149		0.225	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Americium 241	0.00526	U	0.0639	0.0639		0.108	pCi/g	05/18/15 13:57	06/08/15 19:33	1
Protactinium 234m	3.47	U	1.85	1.89		5.90	pCi/g	05/18/15 13:57	06/08/15 19:33	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.306		0.0547	0.0632		0.0462	pCi/g	05/18/15 13:57	06/08/15 19:33	1

**Client Sample ID: L11-03-14-P-R-S-00**

**Lab Sample ID: 160-11834-10**

Date Collected: 05/12/15 15:50

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.31		0.191	0.233		0.138	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Bismuth 212	1.79		0.798	0.820		0.742	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Bismuth 214	1.42		0.196	0.245		0.130	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Lead 212	1.31		0.119	0.207		0.108	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Lead 214	1.42		0.157	0.215		0.120	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Potassium 40	17.3		1.67	2.43		0.748	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Protactinium 231	0.282	U	0.259	0.260		2.24	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Radium 226	1.42		0.196	0.245	1.00	0.130	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Thorium 232	1.31		0.191	0.233		0.138	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Thorium 234	0.823	U	0.543	0.550		1.80	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Uranium 235	0.131	U	0.307	0.307		0.472	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Americium 241	0.131	U	0.160	0.160		0.197	pCi/g	05/18/15 13:57	06/08/15 14:12	1
Protactinium 234m	1.99	U	4.92	4.92		10.1	pCi/g	05/18/15 13:57	06/08/15 14:12	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.417		0.0721	0.0841		0.0580	pCi/g	05/18/15 13:57	06/08/15 14:12	1



# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-16-P-S-S-00**

**Lab Sample ID: 160-11834-11**

Date Collected: 05/13/15 08:45

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.17		0.136	0.181		0.119	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Bismuth 212	0.986		0.340	0.355		0.436	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Bismuth 214	1.17		0.114	0.167		0.0683	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Lead 212	1.03		0.0946	0.163		0.0839	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Lead 214	1.15		0.122	0.171		0.0949	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Potassium 40	19.4		1.26	2.35		0.380	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Protactinium 231	0.420	U	0.250	0.254		1.20	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Radium 226	1.17		0.114	0.167	1.00	0.0683	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Thorium 232	1.17		0.136	0.181		0.119	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Thorium 234	1.22		0.502	0.518		0.786	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Uranium 235	0.0638	U	0.119	0.119		0.229	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Americium 241	0.000598	U	0.0531	0.0531		0.0901	pCi/g	05/18/15 13:57	06/08/15 19:34	1
Protactinium 234m	0.319	U	3.07	3.07		5.46	pCi/g	05/18/15 13:57	06/08/15 19:34	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.362		0.0468	0.0600		0.0325	pCi/g	05/18/15 13:57	06/08/15 19:34	1

**Client Sample ID: L11-03-17-P-R-S-00**

**Lab Sample ID: 160-11834-12**

Date Collected: 05/13/15 09:10

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.52		0.185	0.240		0.141	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Bismuth 212	1.71		0.463	0.495		0.408	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Bismuth 214	1.61		0.122	0.206		0.0773	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Lead 212	1.33		0.106	0.203		0.0953	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Lead 214	1.89		0.113	0.227		0.0830	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Potassium 40	19.5		1.10	2.25		0.393	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Protactinium 231	0.559	U	0.238	0.246		1.35	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Radium 226	1.61		0.122	0.206	1.00	0.0773	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Thorium 232	1.52		0.185	0.240		0.141	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Thorium 234	0.859		0.282	0.296		0.831	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Uranium 235	0.0562	U	0.161	0.161		0.269	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Americium 241	0.0156	U	0.0672	0.0672		0.113	pCi/g	05/18/15 13:57	06/08/15 19:35	1
Protactinium 234m	8.18		4.27	4.34		3.77	pCi/g	05/18/15 13:57	06/08/15 19:35	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
TI-208	0.493		0.0547	0.0746		0.0381	pCi/g	05/18/15 13:57	06/08/15 19:35	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-19-P-S-S-00**

**Lab Sample ID: 160-11834-13**

Date Collected: 05/13/15 09:55

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.19		0.139	0.184		0.0973	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Bismuth 212	1.48		0.433	0.459		0.374	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Bismuth 214	1.15		0.105	0.159		0.0598	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Lead 212	1.01		0.0803	0.154		0.0698	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Lead 214	1.21		0.0884	0.153		0.0731	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Potassium 40	17.5		1.14	2.12		0.418	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Protactinium 231	-0.592	U	0.671	0.675		1.10	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Radium 226	1.15		0.105	0.159	1.00	0.0598	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Thorium 232	1.19		0.139	0.184		0.0973	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Thorium 234	1.01		0.315	0.333		0.826	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Uranium 235	0.147	U	0.139	0.140		0.230	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Americium 241	-0.000385	U	0.0606	0.0606		0.102	pCi/g	05/18/15 13:57	06/08/15 19:36	1
Protactinium 234m	0.486	U	2.61	2.61		4.60	pCi/g	05/18/15 13:57	06/08/15 19:36	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0479</i>	<i>0.0580</i>		<i>0.0373</i>	<i>pCi/g</i>	<i>05/18/15 13:57</i>	<i>06/08/15 19:36</i>	<i>1</i>

**Client Sample ID: L11-03-20-P-R-S-00**

**Lab Sample ID: 160-11834-14**

Date Collected: 05/13/15 10:10

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.928		0.117	0.150		0.0937	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Bismuth 212	1.07		0.318	0.336		0.283	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Bismuth 214	0.896		0.0854	0.126		0.0586	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Lead 212	0.828		0.0688	0.127		0.0624	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Lead 214	1.04		0.0841	0.137		0.0610	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Potassium 40	16.7		0.965	1.96		0.345	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Protactinium 231	-0.385	U	0.551	0.553		0.912	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Radium 226	0.896		0.0854	0.126	1.00	0.0586	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Thorium 232	0.928		0.117	0.150		0.0937	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Thorium 234	0.742		0.247	0.259		0.710	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Uranium 235	0.0476	U	0.129	0.129		0.219	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Americium 241	0.0416	U	0.0412	0.0414		0.0674	pCi/g	05/18/15 13:57	06/08/15 20:41	1
Protactinium 234m	0.176	U	1.37	1.37		5.00	pCi/g	05/18/15 13:57	06/08/15 20:41	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0376</i>	<i>0.0479</i>		<i>0.0290</i>	<i>pCi/g</i>	<i>05/18/15 13:57</i>	<i>06/08/15 20:41</i>	<i>1</i>

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-22-P-S-S-00**

**Lab Sample ID: 160-11834-15**

Date Collected: 05/13/15 10:55

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.21		0.139	0.186		0.0951	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Bismuth 212	1.33		0.420	0.442		0.399	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Bismuth 214	0.999		0.108	0.150		0.0694	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Lead 212	1.01		0.0863	0.157		0.0761	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Lead 214	1.27		0.112	0.173		0.0794	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Potassium 40	19.7		1.32	2.41		0.411	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Protactinium 231	0.310	U	0.243	0.246		1.14	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Radium 226	0.999		0.108	0.150	1.00	0.0694	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Thorium 232	1.21		0.139	0.186		0.0951	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Thorium 234	1.29		0.526	0.543		0.822	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Uranium 235	0.190	U	0.138	0.139		0.261	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Americium 241	0.00353	U	0.0628	0.0628		0.106	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Protactinium 234m	2.98	U	3.45	3.47		5.64	pCi/g	05/18/15 13:57	06/08/15 20:43	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0494</i>	<i>0.0617</i>		<i>0.0363</i>	<i>pCi/g</i>	<i>05/18/15 13:57</i>	<i>06/08/15 20:43</i>	<i>1</i>

**Client Sample ID: L11-03-23-P-R-S-00**

**Lab Sample ID: 160-11834-16**

Date Collected: 05/13/15 11:15

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.31		0.135	0.189		0.110	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Bismuth 212	1.63		0.445	0.476		0.384	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Bismuth 214	1.23		0.102	0.163		0.0609	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Lead 212	1.15		0.0829	0.170		0.0720	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Lead 214	1.40		0.106	0.180		0.0760	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Potassium 40	21.5		1.12	2.44		0.333	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Protactinium 231	-0.685	U	0.707	0.711		1.16	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Radium 226	1.23		0.102	0.163	1.00	0.0609	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Thorium 232	1.31		0.135	0.189		0.110	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Thorium 234	0.802	U	0.280	0.293		0.846	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Uranium 235	0.0471	U	0.154	0.154		0.238	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Americium 241	-0.0161	U	0.148	0.148		0.0915	pCi/g	05/18/15 13:57	06/08/15 20:43	1
Protactinium 234m	1.31	U	2.51	2.51		4.97	pCi/g	05/18/15 13:57	06/08/15 20:43	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
<i>Tl-208</i>			<i>0.0471</i>	<i>0.0601</i>		<i>0.0364</i>	<i>pCi/g</i>	<i>05/18/15 13:57</i>	<i>06/08/15 20:43</i>	<i>1</i>

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-05-P-R-Q-00**

**Lab Sample ID: 160-11834-17**

Date Collected: 05/12/15 10:00

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.27		0.127	0.182		0.106	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Bismuth 212	1.37		0.444	0.466		0.403	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Bismuth 214	1.24		0.106	0.167		0.0674	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Lead 212	1.18		0.0770	0.171		0.0607	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Lead 214	1.44		0.0964	0.178		0.0768	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Potassium 40	15.7		0.982	1.88		0.304	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Protactinium 231	0.746	U	0.330	0.340		1.04	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Radium 226	1.24		0.106	0.167	1.00	0.0674	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Thorium 232	1.27		0.127	0.182		0.106	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Thorium 234	1.55		0.511	0.536		0.794	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Uranium 235	0.105	U	0.127	0.128		0.226	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Americium 241	-0.0118	U	0.0610	0.0610		0.102	pCi/g	05/18/15 13:57	06/08/15 20:42	1
Protactinium 234m	0.555	U	2.71	2.71		4.73	pCi/g	05/18/15 13:57	06/08/15 20:42	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.412		0.0439	0.0613		0.0298	pCi/g	05/18/15 13:57	06/08/15 20:42	1

**Client Sample ID: L11-03-22-P-S-Q-00**

**Lab Sample ID: 160-11834-18**

Date Collected: 05/13/15 10:55

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.21		0.142	0.187		0.0978	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Bismuth 212	1.37		0.388	0.412		0.374	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Bismuth 214	1.28		0.118	0.177		0.0762	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Lead 212	1.13		0.103	0.179		0.0938	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Lead 214	1.44		0.117	0.191		0.0841	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Potassium 40	22.0		1.20	2.52		0.284	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Protactinium 231	0.483	U	0.275	0.280		1.23	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Radium 226	1.28		0.118	0.177	1.00	0.0762	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Thorium 232	1.21		0.142	0.187		0.0978	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Thorium 234	1.07		0.305	0.325		0.887	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Uranium 235	0.213	U	0.174	0.175		0.223	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Americium 241	-0.0217	U	0.162	0.162		0.117	pCi/g	05/18/15 13:57	06/08/15 21:53	1
Protactinium 234m	3.45	U	2.90	2.92		4.56	pCi/g	05/18/15 13:57	06/08/15 21:53	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.371		0.0496	0.0625		0.0371	pCi/g	05/18/15 13:57	06/08/15 21:53	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11834-2

**Client Sample ID: L11-03-25-P-S-B-00**

**Lab Sample ID: 160-11834-19**

Date Collected: 05/13/15 11:35

Matrix: Solid

Date Received: 05/14/15 10:40

**Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	1.35		0.180	0.227		0.107	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Bismuth 212	1.37		0.361	0.388		0.289	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Bismuth 214	1.27		0.126	0.182		0.0822	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Lead 212	1.21		0.0860	0.179		0.0630	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Lead 214	1.29		0.100	0.168		0.0838	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Potassium 40	19.9		1.23	2.38		0.250	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Protactinium 231	0.353	U	0.205	0.209		1.33	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Radium 226	1.27		0.126	0.182	1.00	0.0822	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Thorium 232	1.35		0.180	0.227		0.107	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Thorium 234	1.92		0.616	0.648		0.950	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Uranium 235	0.0655	U	0.170	0.170		0.259	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Americium 241	0.0183	U	0.0671	0.0671		0.112	pCi/g	05/18/15 13:57	06/08/15 21:54	1
Protactinium 234m	1.52	U	3.25	3.25		5.54	pCi/g	05/18/15 13:57	06/08/15 21:54	1
<b>Other Detected Radionuclides</b>			<b>Count</b>	<b>Total</b>						
	<b>Result</b>	<b>Qualifier</b>	<b>Uncert.</b>	<b>Uncert.</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Tl-208	0.393		0.0584	0.0712		0.0455	pCi/g	05/18/15 13:57	06/08/15 21:54	1

# QC Sample Results

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

TestAmerica Job ID: 160-11834-2

## Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters

**Lab Sample ID: MB 160-191270/1-A**  
**Matrix: Solid**  
**Analysis Batch: 193961**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 191270**

Analyte	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	0.009329	U	0.0160	0.0161		0.0410	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Bismuth 212	0.008935	U	0.0651	0.0651		0.123	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Bismuth 214	-0.007741	U	0.0435	0.0435		0.0269	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Lead 212	-0.0000390	U	0.00883	0.00883		0.0172	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Lead 214	0.003670	U	0.00961	0.00962		0.0187	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Potassium 40	-0.06540	U	2.62	2.62		0.139	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Protactinium 231	-0.003886	U	0.115	0.115		0.212	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Radium 226	-0.007741	U	0.0435	0.0435	1.00	0.0269	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Thorium 232	0.009329	U	0.0160	0.0161		0.0410	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Thorium 234	0.001963	U	0.104	0.104		0.182	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Uranium 235	-0.01822	U	0.0337	0.0337		0.0567	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Americium 241	0.005637	U	0.00876	0.00878		0.0147	pCi/g	05/18/15 13:57	06/08/15 16:03	1
Protactinium 234m	0.2496	U	0.784	0.784		1.37	pCi/g	05/18/15 13:57	06/08/15 16:03	1
<b>Other Detected Radionuclides</b>	<b>MB Result</b>	<b>MB Qualifier</b>	<b>Count Uncert. (2σ+/-)</b>	<b>Total Uncert. (2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Other Detected Radionuclide	None						pCi/g	05/18/15 13:57	06/08/15 16:03	1

**Lab Sample ID: LCS 160-191270/2-A**  
**Matrix: Solid**  
**Analysis Batch: 193962**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 191270**

Analyte	Spike Added	LCS Result	LCS Qual	Total	RL	MDC	Unit	%Rec	%Rec Limits
				Uncert. (2σ+/-)					
Americium 241	101	104.3		10.9		0.400	pCi/g	103	87 - 116
Cesium 137	34.7	37.41		3.86		0.133	pCi/g	108	87 - 120
Cobalt 60	35.3	36.98		3.66		0.0947	pCi/g	105	87 - 115

**Lab Sample ID: 160-11834-1 DU**  
**Matrix: Solid**  
**Analysis Batch: 193962**

**Client Sample ID: L11-03-01-P-S-S-00**  
**Prep Type: Total/NA**  
**Prep Batch: 191270**

Analyte	Sample Sample		DU	DU	Total	RL	MDC	Unit	RER	RER Limit
	Result	Qual	Result	Qual	Uncert. (2σ+/-)					
Actinium 228	0.915		1.025		0.152		0.106	pCi/g	0.38	1
Bismuth 212	1.10		1.200		0.302		0.279	pCi/g	0.15	1
Bismuth 214	1.22		1.288		0.154		0.0522	pCi/g	0.23	1
Lead 212	0.960		1.006		0.143		0.0538	pCi/g	0.17	1
Lead 214	1.29		1.464		0.175		0.0604	pCi/g	0.53	1
Potassium 40	21.2		25.85		2.76		0.260	pCi/g	0.90	1
Protactinium 231	0.593	U	-0.5989	U F	0.561		0.911	pCi/g	1.54	1
Radium 226	1.22		1.288		0.154	1.00	0.0522	pCi/g	0.23	1
Thorium 232	0.915		1.025		0.152		0.106	pCi/g	0.38	1
Thorium 234	1.13		0.9099		0.270		0.671	pCi/g	0.34	1
Uranium 235	0.102	U	0.09880	U	0.120		0.187	pCi/g	0.01	1
Americium 241	0.0142	U	0.01283	U	0.0471		0.0786	pCi/g	0.02	1

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# QC Sample Results

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

TestAmerica Job ID: 160-11834-2

## Method: GA-01-R - Gamma Spec: Radium 226 & other gamma emitters (Continued)

Lab Sample ID: 160-11834-1 DU  
Matrix: Solid  
Analysis Batch: 193962

Client Sample ID: L11-03-01-P-S-S-00  
Prep Type: Total/NA  
Prep Batch: 191270

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Protactinium 234m	5.52		1.840	U	2.34		3.85	pCi/g	0.83	1

Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.284		0.3365		0.0499		0.0288	pCi/g	0.54	1



# QC Association Summary

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

TestAmerica Job ID: 160-11834-2

## Rad

### Leach Batch: 190775

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11834-1	L11-03-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-1 DU	L11-03-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-2	L11-03-02-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-3	L11-03-04-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-4	L11-03-05-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-5	L11-03-07-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-6	L11-03-08-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-7	L11-03-10-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-8	L11-03-11-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-9	L11-03-13-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-10	L11-03-14-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-11	L11-03-16-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-12	L11-03-17-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-13	L11-03-19-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-14	L11-03-20-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-15	L11-03-22-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11834-16	L11-03-23-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11834-17	L11-03-05-P-R-Q-00	Total/NA	Solid	Dry and Grind	
160-11834-18	L11-03-22-P-S-Q-00	Total/NA	Solid	Dry and Grind	
160-11834-19	L11-03-25-P-S-B-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 191270

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11834-1	L11-03-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-1 DU	L11-03-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-2	L11-03-02-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-3	L11-03-04-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-4	L11-03-05-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-5	L11-03-07-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-6	L11-03-08-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-7	L11-03-10-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-8	L11-03-11-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-9	L11-03-13-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-10	L11-03-14-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-11	L11-03-16-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-12	L11-03-17-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-13	L11-03-19-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-14	L11-03-20-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-15	L11-03-22-P-S-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-16	L11-03-23-P-R-S-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-17	L11-03-05-P-R-Q-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-18	L11-03-22-P-S-Q-00	Total/NA	Solid	Fill_Geo-21	190775
160-11834-19	L11-03-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	190775
LCS 160-191270/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-191270/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	

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