

# 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: 160-11140-2  
Client Project/Site: HDP

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

Attn: Brian Miller

*Rhonda Ridenhower*

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Authorized for release by:  
4/30/2015 1:46:57 PM  
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### LINKS

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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: 160-11140-2

**Job ID: 160-11140-2**

**Laboratory: TestAmerica St. Louis**

**Narrative**

## CASE NARRATIVE

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

**Project: HDP**

**Report Number: 160-11140-2**

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 04/01/2015; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the coolers at receipt was 18.0 C.

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

Samples L11-04-01-P-S-S-00 (160-11140-1), L11-04-02-P-R-S-00 (160-11140-2), L11-04-04-P-S-S-00 (160-11140-3), L11-04-05-P-R-S-00 (160-11140-4), L11-04-07-P-S-S-00 (160-11140-5), L11-04-08-P-R-S-00 (160-11140-6), L11-04-10-P-S-S-00 (160-11140-7), L11-04-11-P-R-S-00 (160-11140-8), L11-04-13-P-S-S-00 (160-11140-9), L11-04-14-P-R-S-00 (160-11140-10), L11-04-16-P-S-S-00 (160-11140-11), L11-04-17-P-R-S-00 (160-11140-12), L11-04-19-P-S-S-00 (160-11140-13), L11-04-20-P-R-S-00 (160-11140-14), L11-04-22-P-S-S-00 (160-11140-15), L11-04-23-P-R-S-00 (160-11140-16), L11-04-08-P-R-Q-00 (160-11140-17), L11-04-13-P-S-Q-00 (160-11140-18) and L11-04-25-P-S-B-00 (160-11140-19) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA\_01\_R. The samples were dried on 04/01/2015, prepared on 04/03/2015 and analyzed on 04/24/2015.

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



# Chain of Custody Record

Program:  DW  NPDES  RCRA  Other:

TestAmerica Laboratories, Inc.

<b>Client Contact</b>		<b>Project Manager: Brian Miller</b>		<b>Site Contact: Ellen Jakub</b>		<b>Date: 04/01/2015</b>		<b>COC No: 040115-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>		Filtered Sample (Y/N) Perform MS / MSD (Y/N) Gamma Spec Westinghouse HDP Library Alpha Spec ICP/MS (Tc-99) Gamma Spec (Post-21 day ingrowth)				Sampler: For Lab Use Only: Walk-in Client: Lab Sampling:						
Knoxville, TN 37931		<input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS												
(865) 690-0501 Phone		TAT if different from Below _____												
(865) 539-9868 FAX		<input type="checkbox"/> 2 weeks <input checked="" type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day												
Project Name: Hematite Decommissioning Project		Site: Westinghouse Hematite, MO		P O # 832953		Job / SDG No.:		Sample Specific Notes:						
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 HDP Library	Alpha Spec	ICP/MS (Tc-99)	Gamma Spec (Post-21 day ingrowth)		
L11-04-01-P-S-S-00	3/27/15	1518	G	Soil	1	N		X		X	X			Matt Cushman
L11-04-02-P-R-S-00	3/27/15	1535	G	Soil	1	N		X		X	X			Jahmai Williams
L11-04-04-P-S-S-00	3/27/15	1600	G	Soil	1	N		X		X	X			Matt Cushman
L11-04-05-P-R-S-00	3/27/15	1620	G	Soil	1	N		X		X	X			Jahmai Williams
L11-04-07-P-S-S-00	3/30/15	1415	C	Soil	1	N		X		X	X			Jahmai Williams
L11-04-08-P-R-S-00	3/30/15	1425	G	Soil	1	N		X		X	X			Jahmai Williams
L11-04-10-P-S-S-00	3/30/15	1455	G	Soil	1	N		X		X	X			Jahmai Williams
L11-04-11-P-R-S-00	3/30/15	1510	C	Soil	1	N		X		X	X			Jahmai Williams
L11-04-13-P-S-S-00	3/30/15	1530	G	Soil	1	N		X		X	X			Matt Cushman
L11-04-14-P-R-S-00	3/30/15	1550	C	Soil	1	N		X		X	X			Matt Cushman
L11-04-16-P-S-S-00	3/30/15	1615	G	Soil	1	N		X		X	X			Matt Cushman
L11-04-17-P-R-S-00	3/30/15	1645	G	Soil	1	N		X		X	X			Jahmai Williams
Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other None														
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.						Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)								
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown						<input checked="" type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months								
Special Instructions/QC Requirements & Comments: Potential for Radiological Contamination														
Custody Seals Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____		Corr'd: _____		Therm ID No.:						
Relinquished by: <i>Brian Miller</i>		Company: Perma-Fix		Date/Time: 4/1/15 0945		Received by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: 4/1/15 0945				
Relinquished by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: 4/1/15 1044		Received by: <i>Old Clark</i>		Company: TA SR		Date/Time: 4-1-15 1044				
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:				



**TestAmerica St. Louis**

13715 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		<b>Project Manager: Brian Miller</b> Tel/Fax: (314) 810-3333		<b>Site Contact: Ellen Jakub</b> Lab Contact: Ivan Vanya		<b>Date: 04/01/2015</b> Carrier: Courier		<b>COC No: 040115-FSS1</b> Page 2 of 2									
<b>Project Name: Hematite Decommissioning Project</b> Site: Westinghouse Hematite, MO P O # 832953		<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>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 (Post-21 day ingrowth)</b>		<b>Sampler:</b> <b>For Lab Use Only:</b> Walk-in Client: Lab Sampling: <b>Job / SDG No.:</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>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 (Post-21 day ingrowth)</b>	<b>Sample Specific Notes:</b>				
L11-04-19-P-S-S-00		3/31/15	1025	G	Soil	1	N		X		X	X	Jahmai Williams				
L11-04-20-P-R-S-00		3/31/15	1035	G	Soil	1	N		X		X	X	Jahmai Williams				
L11-04-22-P-S-S-00		3/31/15	1100	G	Soil	1	N		X		X	X	Jahmai Williams				
L11-04-23-P-R-S-00		3/31/15	1115	G	Soil	1	N		X		X	X	Jahmai Williams				
L11-04-08-P-R-Q-00		3/30/15	1425	G	Soil	1	N		X		X	X	Jahmai Williams				
L11-04-13-P-S-Q-00		3/30/15	1530	G	Soil	1	N		X		X	X	Matt Cushman				
L11-04-25-P-S-B-00		3/31/15	1135	G	Soil	1	N		X		X	X	Jahmai Williams				
													N / A				
<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>Custody Seal No.:</b>		<b>Cooler Temp. (°C):</b> Obs'd: _____ Corr'd: _____		<b>Therm ID No.:</b> _____											
Relinquished by: <i>Brian Miller</i>		Company: <i>Perma-Fix</i>		Date/Time: <i>4/1/15 0945</i>		Received by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: <i>4/1/15 0945</i>							
Relinquished by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: <i>4/1/15 1044</i>		Received by: <i>[Signature]</i>		Company: <i>TA SR</i>		Date/Time: <i>4.1.15 1044</i>							
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:							

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: 160-11140-2

**Login Number: 11140**

**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?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <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: 160-11140-2

### Qualifiers

#### Rad

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

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	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: 160-11140-2

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Method	Method Description	Protocol	Laboratory
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	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: 160-11140-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-11140-1	L11-04-01-P-S-S-00	Solid	03/27/15 15:18	04/01/15 10:44
160-11140-2	L11-04-02-P-R-S-00	Solid	03/27/15 15:35	04/01/15 10:44
160-11140-3	L11-04-04-P-S-S-00	Solid	03/27/15 16:00	04/01/15 10:44
160-11140-4	L11-04-05-P-R-S-00	Solid	03/27/15 16:20	04/01/15 10:44
160-11140-5	L11-04-07-P-S-S-00	Solid	03/30/15 14:15	04/01/15 10:44
160-11140-6	L11-04-08-P-R-S-00	Solid	03/30/15 14:25	04/01/15 10:44
160-11140-7	L11-04-10-P-S-S-00	Solid	03/30/15 14:55	04/01/15 10:44
160-11140-8	L11-04-11-P-R-S-00	Solid	03/30/15 15:10	04/01/15 10:44
160-11140-9	L11-04-13-P-S-S-00	Solid	03/30/15 15:30	04/01/15 10:44
160-11140-10	L11-04-14-P-R-S-00	Solid	03/30/15 15:50	04/01/15 10:44
160-11140-11	L11-04-16-P-S-S-00	Solid	03/30/15 16:15	04/01/15 10:44
160-11140-12	L11-04-17-P-R-S-00	Solid	03/30/15 16:45	04/01/15 10:44
160-11140-13	L11-04-19-P-S-S-00	Solid	03/31/15 10:25	04/01/15 10:44
160-11140-14	L11-04-20-P-R-S-00	Solid	03/31/15 10:35	04/01/15 10:44
160-11140-15	L11-04-22-P-S-S-00	Solid	03/31/15 11:00	04/01/15 10:44
160-11140-16	L11-04-23-P-R-S-00	Solid	03/31/15 11:15	04/01/15 10:44
160-11140-17	L11-04-08-P-R-Q-00	Solid	03/30/15 14:25	04/01/15 10:44
160-11140-18	L11-04-13-P-S-Q-00	Solid	03/30/15 15:30	04/01/15 10:44
160-11140-19	L11-04-25-P-S-B-00	Solid	03/31/15 11:35	04/01/15 10:44

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-01-P-S-S-00**

**Lab Sample ID: 160-11140-1**

Date Collected: 03/27/15 15:18

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.28		0.194	0.233		0.152	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Bismuth 212	1.63		0.442	0.472		0.362	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Bismuth 214	1.31		0.126	0.185		0.0836	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Lead 212	1.14		0.0809	0.169		0.0774	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Lead 214	1.25		0.101	0.165		0.0886	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Potassium 40	23.8		1.29	2.72		0.334	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Protactinium 231	0.757	U	0.550	0.557		0.871	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Radium 226	1.31		0.126	0.185	1.00	0.0836	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Thorium 232	1.28		0.194	0.233		0.152	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Thorium 234	1.08		0.319	0.338		0.925	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Uranium 235	0.122	U	0.153	0.153		0.267	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Americium 241	-0.0119	U	27.6	27.6		0.115	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Protactinium 234m	6.72		3.02	3.09		5.63	pCi/g	04/03/15 15:04	04/24/15 07:59	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.97		0.795	0.828		0.950	pCi/g	04/03/15 15:04	04/24/15 07:59	1
Tl-208	0.362		0.0559	0.0672		0.0462	pCi/g	04/03/15 15:04	04/24/15 07:59	1

**Client Sample ID: L11-04-02-P-R-S-00**

**Lab Sample ID: 160-11140-2**

Date Collected: 03/27/15 15:35

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.06		0.118	0.160		0.113	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Bismuth 212	1.36		0.393	0.417		0.350	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Bismuth 214	1.11		0.0967	0.151		0.0589	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Lead 212	1.10		0.0677	0.157		0.0551	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Lead 214	1.23		0.0983	0.161		0.0715	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Potassium 40	19.5		1.07	2.26		0.261	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Protactinium 231	0.584	U	0.237	0.246		1.01	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Radium 226	1.11		0.0967	0.151	1.00	0.0589	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Thorium 232	1.06		0.118	0.160		0.113	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Thorium 234	0.984		0.482	0.493		0.773	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Uranium 235	0.0878	U	0.147	0.147		0.214	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Americium 241	-0.0116	U	0.0597	0.0597		0.100	pCi/g	04/03/15 15:04	04/24/15 08:00	1
Protactinium 234m	-0.508	U	20.5	20.5		4.92	pCi/g	04/03/15 15:04	04/24/15 08:00	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.385		0.0456	0.0607		0.0323	pCi/g	04/03/15 15:04	04/24/15 08:00	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

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

**Lab Sample ID: 160-11140-3**

Date Collected: 03/27/15 16:00

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.09		0.123	0.166		0.0838	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Bismuth 212	1.46		0.467	0.491		0.400	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Bismuth 214	1.15		0.109	0.162		0.0745	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Lead 212	1.07		0.0742	0.158		0.0701	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Lead 214	1.27		0.107	0.170		0.0754	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Potassium 40	21.0		1.18	2.45		0.369	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Protactinium 231	-0.643	U	0.743	0.747		1.22	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Radium 226	1.15		0.109	0.162	1.00	0.0745	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Thorium 232	1.09		0.123	0.166		0.0838	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Thorium 234	1.70		0.705	0.727		0.881	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Uranium 235	0.163	U	0.149	0.150		0.252	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Americium 241	0.0144	U	0.0638	0.0638		0.107	pCi/g	04/03/15 15:04	04/24/15 08:41	1
Protactinium 234m	1.53	U	2.59	2.60		4.37	pCi/g	04/03/15 15:04	04/24/15 08:41	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.367		0.0434	0.0577		0.0315	pCi/g	04/03/15 15:04	04/24/15 08:41	1

**Client Sample ID: L11-04-05-P-R-S-00**

**Lab Sample ID: 160-11140-4**

Date Collected: 03/27/15 16:20

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.13		0.142	0.183		0.0868	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Bismuth 212	1.13		0.423	0.439		0.395	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Bismuth 214	1.20		0.125	0.176		0.0792	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Lead 212	0.949		0.0800	0.147		0.0817	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Lead 214	1.26		0.114	0.173		0.0914	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Potassium 40	19.3		1.29	2.35		0.261	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Protactinium 231	-0.643	U	0.777	0.781		1.28	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Radium 226	1.20		0.125	0.176	1.00	0.0792	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Thorium 232	1.13		0.142	0.183		0.0868	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Thorium 234	0.637	U	0.388	0.393		1.14	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Uranium 235	0.0471	U	0.154	0.154		0.259	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Americium 241	0.00703	U	0.0701	0.0701		0.118	pCi/g	04/03/15 15:04	04/24/15 08:39	1
Protactinium 234m	4.09	U	2.88	2.91		5.56	pCi/g	04/03/15 15:04	04/24/15 08:39	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.380		0.0507	0.0642		0.0350	pCi/g	04/03/15 15:04	04/24/15 08:39	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-07-P-S-S-00**

**Lab Sample ID: 160-11140-5**

Date Collected: 03/30/15 14:15

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.18		0.135	0.180		0.125	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Bismuth 212	1.29		0.479	0.497		0.473	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Bismuth 214	1.22		0.117	0.171		0.0812	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Lead 212	1.10		0.0778	0.163		0.0775	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Lead 214	1.42		0.108	0.183		0.0711	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Potassium 40	24.3		1.27	2.76		0.396	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Protactinium 231	0.584	U	0.386	0.391		1.12	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Radium 226	1.22		0.117	0.171	1.00	0.0812	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Thorium 232	1.18		0.135	0.180		0.125	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Thorium 234	1.25		0.571	0.586		0.913	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Uranium 235	0.173	U	0.155	0.156		0.254	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Americium 241	-0.0201	U	0.183	0.184		0.0932	pCi/g	04/03/15 15:04	04/24/15 08:40	1
Protactinium 234m	5.82		3.27	3.32		5.50	pCi/g	04/03/15 15:04	04/24/15 08:40	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>0.0477</i>	<i>0.0617</i>		<i>0.0383</i>	<i>pCi/g</i>	<i>04/03/15 15:04</i>	<i>04/24/15 08:40</i>	<i>1</i>

**Client Sample ID: L11-04-08-P-R-S-00**

**Lab Sample ID: 160-11140-6**

Date Collected: 03/30/15 14:25

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.07		0.149	0.184		0.170	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Bismuth 212	1.11		0.405	0.422		0.536	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Bismuth 214	1.35		0.142	0.200		0.0882	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Lead 212	1.02		0.0853	0.157		0.0885	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Lead 214	1.29		0.119	0.179		0.0924	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Potassium 40	18.9		1.36	2.37		0.397	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Protactinium 231	0.357	U	0.210	0.213		1.40	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Radium 226	1.35		0.142	0.200	1.00	0.0882	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Thorium 232	1.07		0.149	0.184		0.170	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Thorium 234	0.826	U	0.551	0.558		0.896	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Uranium 235	0.0653	U	0.147	0.147		0.278	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Americium 241	0.0223	U	0.0621	0.0621		0.104	pCi/g	04/03/15 15:04	04/24/15 09:12	1
Protactinium 234m	1.83	U	4.11	4.11		6.12	pCi/g	04/03/15 15:04	04/24/15 09:12	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>0.0674</i>	<i>0.0771</i>		<i>0.0521</i>	<i>pCi/g</i>	<i>04/03/15 15:04</i>	<i>04/24/15 09:12</i>	<i>1</i>

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-10-P-S-S-00**

**Lab Sample ID: 160-11140-7**

Date Collected: 03/30/15 14:55

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.17		0.163	0.202		0.108	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Bismuth 212	1.28		0.522	0.538		0.449	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Bismuth 214	1.04		0.0906	0.141		0.0800	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Lead 212	0.995		0.0704	0.147		0.0698	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Lead 214	1.23		0.0846	0.153		0.0724	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Potassium 40	20.5		1.10	2.37		0.285	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Protactinium 231	0.475	U	0.289	0.293		1.01	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Radium 226	1.04		0.0906	0.141	1.00	0.0800	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Thorium 232	1.17		0.163	0.202		0.108	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Thorium 234	0.755	U	0.281	0.292		0.857	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Uranium 235	0.113	U	0.142	0.142		0.197	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Americium 241	0.0224	U	0.0594	0.0595		0.0992	pCi/g	04/03/15 15:04	04/24/15 09:35	1
Protactinium 234m	2.82	U	2.80	2.81		4.51	pCi/g	04/03/15 15:04	04/24/15 09:35	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.364		0.0446	0.0584		0.0317	pCi/g	04/03/15 15:04	04/24/15 09:35	1

**Client Sample ID: L11-04-11-P-R-S-00**

**Lab Sample ID: 160-11140-8**

Date Collected: 03/30/15 15:10

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.21		0.156	0.199		0.160	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Bismuth 212	1.39		0.409	0.434		0.491	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Bismuth 214	1.27		0.136	0.189		0.0858	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Lead 212	1.06		0.0847	0.161		0.0826	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Lead 214	1.32		0.114	0.179		0.0886	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Potassium 40	19.5		1.38	2.43		0.422	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Protactinium 231	0.486	U	0.283	0.288		1.31	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Radium 226	1.27		0.136	0.189	1.00	0.0858	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Thorium 232	1.21		0.156	0.199		0.160	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Thorium 234	0.849	U	0.321	0.333		0.963	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Uranium 235	0.000773	U	0.171	0.171		0.290	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Americium 241	-0.0129	U	0.163	0.163		0.121	pCi/g	04/03/15 15:04	04/24/15 09:44	1
Protactinium 234m	2.70	U	4.23	4.24		6.67	pCi/g	04/03/15 15:04	04/24/15 09:44	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.359		0.0646	0.0746		0.0536	pCi/g	04/03/15 15:04	04/24/15 09:44	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-13-P-S-S-00**

**Lab Sample ID: 160-11140-9**

Date Collected: 03/30/15 15:30

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.22		0.119	0.171		0.109	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Bismuth 212	1.22		0.357	0.378		0.358	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Bismuth 214	1.24		0.106	0.166		0.0747	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Lead 212	1.08		0.0703	0.157		0.0700	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Lead 214	1.44		0.102	0.181		0.0674	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Potassium 40	22.2		1.12	2.50		0.355	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Protactinium 231	0.595	U	0.285	0.293		1.10	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Radium 226	1.24		0.106	0.166	1.00	0.0747	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Thorium 232	1.22		0.119	0.171		0.109	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Thorium 234	0.909		0.259	0.276		0.750	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Uranium 235	0.126	U	0.153	0.153		0.252	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Americium 241	0.00936	U	0.0594	0.0595		0.0999	pCi/g	04/03/15 15:04	04/24/15 09:45	1
Protactinium 234m	0.265	U	2.81	2.81		4.91	pCi/g	04/03/15 15:04	04/24/15 09:45	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.380		0.0453	0.0598		0.0365	pCi/g	04/03/15 15:04	04/24/15 09:45	1

**Client Sample ID: L11-04-14-P-R-S-00**

**Lab Sample ID: 160-11140-10**

Date Collected: 03/30/15 15:50

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.06		0.119	0.161		0.112	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Bismuth 212	1.21		0.365	0.386		0.352	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Bismuth 214	1.18		0.106	0.162		0.0657	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Lead 212	1.15		0.0719	0.165		0.0567	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Lead 214	1.25		0.0942	0.161		0.0863	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Potassium 40	19.0		1.10	2.23		0.267	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Protactinium 231	-0.448	U	0.632	0.634		1.05	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Radium 226	1.18		0.106	0.162	1.00	0.0657	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Thorium 232	1.06		0.119	0.161		0.112	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Thorium 234	1.10		0.478	0.492		0.758	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Uranium 235	0.0522	U	0.140	0.140		0.225	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Americium 241	0.0281	U	0.0548	0.0549		0.0912	pCi/g	04/03/15 15:04	04/24/15 09:47	1
Protactinium 234m	-0.574	U	16.5	16.5		4.50	pCi/g	04/03/15 15:04	04/24/15 09:47	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.325		0.0455	0.0566		0.0366	pCi/g	04/03/15 15:04	04/24/15 09:47	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-16-P-S-S-00**

**Lab Sample ID: 160-11140-11**

Date Collected: 03/30/15 16:15

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	1.17		0.131	0.177		0.0956	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Bismuth 212	1.51		0.453	0.479		0.392	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Bismuth 214	1.17		0.136	0.182		0.0867	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Lead 212	1.01		0.0828	0.155		0.0795	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Lead 214	1.11		0.108	0.158		0.0835	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Potassium 40	15.1		1.20	1.96		0.243	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Protactinium 231	0.295	U	0.256	0.258		1.34	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Radium 226	1.17		0.136	0.182	1.00	0.0867	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Thorium 232	1.17		0.131	0.177		0.0956	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Thorium 234	0.929		0.542	0.550		0.873	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Uranium 235	0.0560	U	0.153	0.153		0.253	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Americium 241	0.00607	U	0.0671	0.0671		0.113	pCi/g	04/03/15 15:04	04/24/15 09:50	1
Protactinium 234m	0.000	U	1.04	1.04		7.25	pCi/g	04/03/15 15:04	04/24/15 09:50	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
<i>Tl-208</i>	0.364		0.0590	0.0701		0.0464	pCi/g	04/03/15 15:04	04/24/15 09:50	1

**Client Sample ID: L11-04-17-P-R-S-00**

**Lab Sample ID: 160-11140-12**

Date Collected: 03/30/15 16:45

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Actinium 228	1.04		0.112	0.155		0.104	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Bismuth 212	1.58		0.402	0.434		0.330	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Bismuth 214	1.12		0.0918	0.148		0.0536	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Lead 212	0.975		0.0650	0.142		0.0620	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Lead 214	1.16		0.0942	0.153		0.0663	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Potassium 40	17.1		1.04	2.03		0.445	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Protactinium 231	0.351	U	0.191	0.195		0.941	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Radium 226	1.12		0.0918	0.148	1.00	0.0536	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Thorium 232	1.04		0.112	0.155		0.104	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Thorium 234	0.645	U	0.246	0.255		0.730	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Uranium 235	0.0557	U	0.138	0.138		0.230	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Americium 241	0.0271	U	0.0524	0.0525		0.0871	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Protactinium 234m	1.12	U	2.45	2.46		4.18	pCi/g	04/03/15 15:04	04/24/15 10:18	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
<i>Tl-208</i>	0.339		0.0369	0.0510		0.0245	pCi/g	04/03/15 15:04	04/24/15 10:18	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-19-P-S-S-00**

**Lab Sample ID: 160-11140-13**

Date Collected: 03/31/15 10:25

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.11		0.136	0.177		0.132	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Bismuth 212	1.42		0.475	0.497		0.460	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Bismuth 214	1.18		0.117	0.169		0.0703	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Lead 212	1.08		0.0741	0.158		0.0556	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Lead 214	1.32		0.0973	0.168		0.0929	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Potassium 40	19.6		1.26	2.36		0.314	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Protactinium 231	0.463	U	0.217	0.223		1.32	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Radium 226	1.18		0.117	0.169	1.00	0.0703	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Thorium 232	1.11		0.136	0.177		0.132	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Thorium 234	1.30		0.496	0.514		0.771	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Uranium 235	0.0592	U	0.157	0.157		0.247	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Americium 241	0.0173	U	0.0605	0.0605		0.101	pCi/g	04/03/15 15:04	04/24/15 10:18	1
Protactinium 234m	0.0976	U	0.449	0.449		6.21	pCi/g	04/03/15 15:04	04/24/15 10:18	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.401		0.0535	0.0678		0.0398	pCi/g	04/03/15 15:04	04/24/15 10:18	1

**Client Sample ID: L11-04-20-P-R-S-00**

**Lab Sample ID: 160-11140-14**

Date Collected: 03/31/15 10:35

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.19		0.178	0.216		0.106	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Bismuth 212	1.02		0.430	0.443		0.608	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Bismuth 214	1.19		0.142	0.188		0.0950	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Lead 212	0.964		0.0807	0.149		0.0796	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Lead 214	1.16		0.113	0.165		0.107	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Potassium 40	18.1		1.36	2.30		0.533	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Protactinium 231	0.593	U	0.316	0.323		1.34	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Radium 226	1.19		0.142	0.188	1.00	0.0950	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Thorium 232	1.19		0.178	0.216		0.106	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Thorium 234	1.17		0.727	0.737		0.947	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Uranium 235	0.127	U	0.177	0.178		0.281	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Americium 241	-0.0352	U	0.0976	0.0976		0.123	pCi/g	04/03/15 15:04	04/24/15 10:24	1
Protactinium 234m	0.937	U	3.67	3.67		6.42	pCi/g	04/03/15 15:04	04/24/15 10:24	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.392		0.0687	0.0798		0.0552	pCi/g	04/03/15 15:04	04/24/15 10:24	1

TestAmerica St. Louis



# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-22-P-S-S-00**

**Lab Sample ID: 160-11140-15**

Date Collected: 03/31/15 11:00

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.31		0.154	0.202		0.110	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Bismuth 212	1.31		0.367	0.391		0.353	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Bismuth 214	1.32		0.129	0.188		0.0902	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Lead 212	1.24		0.0818	0.181		0.0778	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Lead 214	1.50		0.112	0.193		0.0748	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Potassium 40	24.2		1.29	2.76		0.413	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Protactinium 231	0.419	U	0.251	0.256		1.36	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Radium 226	1.32		0.129	0.188	1.00	0.0902	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Thorium 232	1.31		0.154	0.202		0.110	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Thorium 234	1.25		0.316	0.342		0.920	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Uranium 235	-0.00401	U	0.164	0.164		0.277	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Americium 241	-0.0346	U	0.127	0.128		0.110	pCi/g	04/03/15 15:04	04/24/15 10:26	1
Protactinium 234m	8.22		3.54	3.63		4.69	pCi/g	04/03/15 15:04	04/24/15 10:26	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.431		0.0554	0.0709		0.0435	pCi/g	04/03/15 15:04	04/24/15 10:26	1

**Client Sample ID: L11-04-23-P-R-S-00**

**Lab Sample ID: 160-11140-16**

Date Collected: 03/31/15 11:15

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.11		0.131	0.173		0.109	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Bismuth 212	1.34		0.479	0.498		0.443	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Bismuth 214	1.18		0.0979	0.157		0.0606	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Lead 212	1.08		0.0635	0.153		0.0479	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Lead 214	1.25		0.0874	0.157		0.0594	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Potassium 40	18.3		0.998	2.12		0.241	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Protactinium 231	-0.497	U	0.629	0.631		1.04	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Radium 226	1.18		0.0979	0.157	1.00	0.0606	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Thorium 232	1.11		0.131	0.173		0.109	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Thorium 234	1.04		0.431	0.445		0.682	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Uranium 235	0.0764	U	0.0953	0.0956		0.228	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Americium 241	-0.00168	U	0.0580	0.0580		0.0976	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Protactinium 234m	6.29		2.34	2.42		4.22	pCi/g	04/03/15 15:04	04/24/15 10:28	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
<b>Radionuclides</b>			<b>Uncert.</b>	<b>Uncert.</b>						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.59		0.511	0.544		0.663	pCi/g	04/03/15 15:04	04/24/15 10:28	1
Tl-208	0.376		0.0413	0.0568		0.0282	pCi/g	04/03/15 15:04	04/24/15 10:28	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-08-P-R-Q-00**

**Lab Sample ID: 160-11140-17**

Date Collected: 03/30/15 14:25

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.27		0.154	0.201		0.118	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Bismuth 212	1.04		0.478	0.490		0.528	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Bismuth 214	1.15		0.120	0.169		0.0980	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Lead 212	1.14		0.0874	0.171		0.0834	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Lead 214	1.35		0.114	0.181		0.100	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Potassium 40	18.7		1.37	2.36		0.398	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Protactinium 231	0.424	U	0.323	0.326		1.40	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Radium 226	1.15		0.120	0.169	1.00	0.0980	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Thorium 232	1.27		0.154	0.201		0.118	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Thorium 234	0.981		0.322	0.338		0.929	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Uranium 235	0.203		0.137	0.138		0.193	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Americium 241	0.0508	U	0.0585	0.0587		0.0962	pCi/g	04/03/15 15:04	04/24/15 10:33	1
Protactinium 234m	0.144	U	3.32	3.32		6.01	pCi/g	04/03/15 15:04	04/24/15 10:33	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.379		0.0659	0.0768		0.0488	pCi/g	04/03/15 15:04	04/24/15 10:33	1

**Client Sample ID: L11-04-13-P-S-Q-00**

**Lab Sample ID: 160-11140-18**

Date Collected: 03/30/15 15:30

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.17		0.153	0.194		0.0957	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Bismuth 212	1.40		0.440	0.463		0.386	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Bismuth 214	1.10		0.110	0.159		0.0767	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Lead 212	1.12		0.0748	0.163		0.0677	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Lead 214	1.28		0.101	0.167		0.0737	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Potassium 40	19.7		1.12	2.31		0.303	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Protactinium 231	0.420	U	0.216	0.220		1.16	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Radium 226	1.10		0.110	0.159	1.00	0.0767	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Thorium 232	1.17		0.153	0.194		0.0957	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Thorium 234	1.19		0.530	0.545		0.840	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Uranium 235	0.0952	U	0.137	0.138		0.253	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Americium 241	-0.0107	U	0.0624	0.0624		0.105	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Protactinium 234m	2.48	U	2.76	2.77		4.49	pCi/g	04/03/15 15:04	04/24/15 11:34	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.402		0.0494	0.0647		0.0358	pCi/g	04/03/15 15:04	04/24/15 11:34	1

TestAmerica St. Louis

# Client Sample Results

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

TestAmerica Job ID: 160-11140-2

**Client Sample ID: L11-04-25-P-S-B-00**

**Lab Sample ID: 160-11140-19**

Date Collected: 03/31/15 11:35

Matrix: Solid

Date Received: 04/01/15 10:44

**Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)**

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	0.998		0.143	0.176		0.120	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Bismuth 212	1.30		0.421	0.442		0.375	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Bismuth 214	0.986		0.102	0.145		0.0607	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Lead 212	0.997		0.0742	0.149		0.0640	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Lead 214	1.06		0.0946	0.145		0.0760	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Potassium 40	15.4		1.11	1.93		0.231	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Protactinium 231	0.694	U	0.322	0.331		1.03	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Radium 226	0.986		0.102	0.145	1.00	0.0607	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Thorium 232	0.998		0.143	0.176		0.120	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Thorium 234	0.834		0.268	0.282		0.765	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Uranium 235	0.122	U	0.136	0.137		0.232	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Americium 241	0.00592	U	0.0571	0.0571		0.0964	pCi/g	04/03/15 15:04	04/24/15 11:34	1
Protactinium 234m	-0.371	U	32.6	32.6		5.44	pCi/g	04/03/15 15:04	04/24/15 11:34	1
<b>Other Detected</b>			<b>Count</b>	<b>Total</b>						
			<b>Uncert.</b>	<b>Uncert.</b>						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.365		0.0477	0.0609		0.0316	pCi/g	04/03/15 15:04	04/24/15 11:34	1

# QC Sample Results

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

TestAmerica Job ID: 160-11140-2

## Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

**Lab Sample ID: MB 160-183539/1-A**  
**Matrix: Solid**  
**Analysis Batch: 187824**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 183539**

Analyte	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert.	Uncert.						
Actinium 228	0.001772	U	0.00906	0.00906		0.0575	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Bismuth 212	0.03803	U	0.0886	0.0887		0.158	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Bismuth 214	-0.0007460	U	0.0222	0.0222		0.0412	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Lead 212	0.01495	U	0.0124	0.0126		0.0195	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Lead 214	-0.001622	U	0.0226	0.0226		0.0337	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Potassium 40	-0.09646	U	3.86	3.86		0.337	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Protactinium 231	0.006507	U	0.140	0.140		0.265	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Radium 226	-0.0007460	U	0.0222	0.0222	1.00	0.0412	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Thorium 232	0.001772	U	0.00906	0.00906		0.0575	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Thorium 234	0.005179	U	0.0371	0.0371		0.260	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Uranium 235	-0.001649	U	0.0548	0.0548		0.0638	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Americium 241	0.008971	U	0.0134	0.0134		0.0224	pCi/g	04/03/15 15:04	04/24/15 07:57	1
Protactinium 234m	0.0000	U	0.902	0.902		2.12	pCi/g	04/03/15 15:04	04/24/15 07:57	1
<b>Count Total</b>										
<b>Other Detected</b>	<b>MB MB</b>		<b>Uncert.</b>	<b>Uncert.</b>						
<b>Radionuclides</b>	<b>Result</b>	<b>Qualifier</b>	<b>(2σ+/-)</b>	<b>(2σ+/-)</b>	<b>RL</b>	<b>MDC</b>	<b>Unit</b>	<b>Prepared</b>	<b>Analyzed</b>	<b>Dil Fac</b>
Other Detected	None						pCi/g	04/03/15 15:04	04/24/15 07:57	1
Radionuclide										

**Lab Sample ID: LCS 160-183539/2-A**  
**Matrix: Solid**  
**Analysis Batch: 187829**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 183539**

Analyte	Spike Added	LCS Result	LCS Qual	Total	RL	MDC	Unit	%Rec	%Rec.
				Uncert. (2σ+/-)					Limits
Americium 241	101	94.85		9.88		0.583	pCi/g	94	87 - 116
Cesium 137	34.8	32.75		3.44		0.191	pCi/g	94	87 - 120
Cobalt 60	35.9	33.93		3.43		0.125	pCi/g	95	87 - 115

**Lab Sample ID: 160-11140-1 DU**  
**Matrix: Solid**  
**Analysis Batch: 187830**

**Client Sample ID: L11-04-01-P-S-S-00**  
**Prep Type: Total/NA**  
**Prep Batch: 183539**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total	RL	MDC	Unit	RER	RER
					Uncert. (2σ+/-)					Limit
Actinium 228	1.28		1.030		0.151		0.102	pCi/g	0.65	1
Bismuth 212	1.63		1.045		0.369		0.351	pCi/g	0.69	1
Bismuth 214	1.31		1.091		0.155		0.0682	pCi/g	0.66	1
Lead 212	1.14		1.030		0.152		0.0590	pCi/g	0.34	1
Lead 214	1.25		1.235		0.165		0.0719	pCi/g	0.03	1
Potassium 40	23.8		19.22		2.29		0.240	pCi/g	0.91	1
Protactinium 231	0.757	U	0.2712	U	0.169		1.16	pCi/g	0.67	1
Radium 226	1.31		1.091		0.155	1.00	0.0682	pCi/g	0.66	1
Thorium 232	1.28		1.030		0.151		0.102	pCi/g	0.65	1
Thorium 234	1.08		0.9635		0.312		0.862	pCi/g	0.18	1
Uranium 235	0.122	U	0.2230		0.150		0.222	pCi/g	0.33	1
Americium 241	-0.0119	U	0.004481	U	0.0637		0.107	pCi/g	0	1

TestAmerica St. Louis

# QC Sample Results

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

TestAmerica Job ID: 160-11140-2

## Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS) (Continued)

**Lab Sample ID: 160-11140-1 DU**

**Matrix: Solid**

**Analysis Batch: 187830**

**Client Sample ID: L11-04-01-P-S-S-00**

**Prep Type: Total/NA**

**Prep Batch: 183539**

Analyte	Sample Result	Sample Qual	DU		Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
			Result	Qual						
Protactinium 234m	6.72		0.3282	U	3.23		5.79	pCi/g	1.01	1
<i>Total</i>										
<i>Other Detected Radionuclides</i>	<i>Sample Result</i>	<i>Sample Qual</i>	<i>DU</i>		<i>Total Uncert. (2σ+/-)</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>RER</i>	<i>RER Limit</i>
<i>Pb-210</i>	<i>1.97</i>		<i>2.159</i>		<i>0.719</i>		<i>0.831</i>	<i>pCi/g</i>	<i>0.12</i>	<i>1</i>
<i>Tl-208</i>	<i>0.362</i>		<i>0.3526</i>		<i>0.0658</i>		<i>0.0412</i>	<i>pCi/g</i>	<i>0.07</i>	<i>1</i>

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# QC Association Summary

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

TestAmerica Job ID: 160-11140-2

## Rad

### Leach Batch: 182711

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11140-1	L11-04-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-1 DU	L11-04-01-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-2	L11-04-02-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-3	L11-04-04-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-4	L11-04-05-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-5	L11-04-07-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-6	L11-04-08-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-7	L11-04-10-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-8	L11-04-11-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-9	L11-04-13-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-10	L11-04-14-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-11	L11-04-16-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-12	L11-04-17-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-13	L11-04-19-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-14	L11-04-20-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-15	L11-04-22-P-S-S-00	Total/NA	Solid	Dry and Grind	
160-11140-16	L11-04-23-P-R-S-00	Total/NA	Solid	Dry and Grind	
160-11140-17	L11-04-08-P-R-Q-00	Total/NA	Solid	Dry and Grind	
160-11140-18	L11-04-13-P-S-Q-00	Total/NA	Solid	Dry and Grind	
160-11140-19	L11-04-25-P-S-B-00	Total/NA	Solid	Dry and Grind	

### Prep Batch: 183539

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-11140-1	L11-04-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-1 DU	L11-04-01-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-2	L11-04-02-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-3	L11-04-04-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-4	L11-04-05-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-5	L11-04-07-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-6	L11-04-08-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-7	L11-04-10-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-8	L11-04-11-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-9	L11-04-13-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-10	L11-04-14-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-11	L11-04-16-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-12	L11-04-17-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-13	L11-04-19-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-14	L11-04-20-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-15	L11-04-22-P-S-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-16	L11-04-23-P-R-S-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-17	L11-04-08-P-R-Q-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-18	L11-04-13-P-S-Q-00	Total/NA	Solid	Fill_Geo-21	182711
160-11140-19	L11-04-25-P-S-B-00	Total/NA	Solid	Fill_Geo-21	182711
LCS 160-183539/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-183539/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	