

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: 160-10553-2
Client Project/Site: HDP

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

Attn: Brian Miller

Elizabeth M. Hoerchler

Authorized for release by:
3/19/2015 11:30:57 AM
Elizabeth Hoerchler, Project Mgmt. Assistant
elizabeth.hoerchler@testamericainc.com

Designee for
Ivan Vania, Project Manager II
(314)298-8566
ivan.vania@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1

2

3

4

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6

7

8

9

10

11



Table of Contents

Cover Page	1
Table of Contents	2
Case Narrative	3
Chain of Custody	4
Receipt Checklists	5
Definitions/Glossary	6
Method Summary	7
Sample Summary	8
Client Sample Results	9
QC Sample Results	10
QC Association Summary	12

Case Narrative

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

TestAmerica Job ID: 160-10553-2

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Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Perma-Fix Environmental Services Inc.

Project: HDP

Report Number: 160-10553-2

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 02/19/2015; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 18.0° C.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)

Sample L10-03-13-B-E-B-00 (160-10553-1) was analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were dried on 02/19/2015, prepared on 02/23/2015 and analyzed on 03/16/2015.

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

Earth City, MO 63045
phone 314.298.8566 fax

Regulatory Program: DW NPDES RCRA Other:

TestAmerica Laboratories, Inc.

Client Contact		Project Manager: Brian Miller		Site Contact: Ellen Jakob		Date: 02/19/2015		COC No: 021915-FSS1							
Perma-Fix Environmental Services		Tel/Fax: (314) 810-3333		Lab Contact: Ivan Vanya		Carrier: Courier		Page 1 of 1							
2800 Solway Road		Analysis Turnaround Time		Filtered Sample (Y/N) Perform MS / MSD (Y/N) Gamma Spec (Westinghouse HDP Library) Alpha Spec ICP/MS (Tc-99) Gamma Spec (with ingrowth)				Sampler:							
Knoxville, TN 37931		<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						For Lab Use Only:							
(865) 690-0501 Phone								Walk-in Client:							
(865) 539-9868 FAX								Lab Sampling:							
Project Name: Hematite Decommissioning Project						Job / SDG No.:									
Site: Westinghouse Hematite, MO															
P O # 832953															
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 (with ingrowth)	Sample Specific Notes:		
L10-03-13-B-E-B-00		2/17/15	1420	G	Soil	1	N		X		X	X	Matt Cushman (~ 19 Kcpm)		
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.							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 Ansell</i>		Company: Perma-Fix		Date/Time: 2-19-15		Received by: <i>Bruce Harlan</i> 949		Company: Crossroads		Date/Time: 2/19/15 08:53					
Relinquished by: <i>Bruce Harlan</i>		Company: Crossroads		Date/Time: 2/19/15 1020		Received by: <i>John Clark</i>		Company: TA SR		Date/Time: 2-19-15 1020					
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:					



Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-10553-2

Login Number: 10553

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: 160-10553-2

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: 160-10553-2

Method	Method Description	Protocol	Laboratory
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	DOE	TAL SL

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: 160-10553-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10553-1	L10-03-13-B-E-B-00	Solid	02/17/15 14:20	02/19/15 10:20

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11

Client Sample Results

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

TestAmerica Job ID: 160-10553-2

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

Lab Sample ID: 160-10553-1

Date Collected: 02/17/15 14:20

Matrix: Solid

Date Received: 02/19/15 10:20

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	1.36		0.183	0.230		0.131	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Bismuth 212	1.42		0.495	0.516		0.514	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Bismuth 214	1.61		0.174	0.242		0.109	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Lead 212	1.21		0.101	0.186		0.102	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Lead 214	1.63		0.148	0.225		0.104	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Potassium 40	18.5		1.42	2.37		0.324	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Protactinium 231	0.545	U	0.437	0.441		1.54	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Radium 226	1.61		0.174	0.242	1.00	0.109	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Thorium 232	1.36		0.183	0.230		0.131	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Thorium 234	2.68		0.531	0.600		1.26	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Uranium 235	0.442		0.172	0.178		0.284	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Americium 241	0.00172	U	0.0955	0.0955		0.161	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Protactinium 234m	8.03		4.74	4.81		7.02	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Pb-210	1.78		0.872	0.896		1.08	pCi/g	02/23/15 15:07	03/16/15 13:30	1
Tl-208	0.458		0.0703	0.0849		0.0518	pCi/g	02/23/15 15:07	03/16/15 13:30	1

QC Sample Results

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

TestAmerica Job ID: 160-10553-2

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

Lab Sample ID: MB 160-175826/1-A
Matrix: Solid
Analysis Batch: 179434

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 175826

Analyte	MB	MB	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert.	Uncert.						
Actinium 228	0.01161	U	0.0180	0.0180		0.0545	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Bismuth 212	0.0000	U	0.0958	0.0958		0.257	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Bismuth 214	0.006926	U	0.00801	0.00805		0.0383	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Lead 212	0.01227	U	0.0120	0.0121		0.0196	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Lead 214	-0.01397	U	0.559	0.559		0.0366	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Potassium 40	-0.07816	U	3.13	3.13		0.328	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Protactinium 231	0.05209	U	0.154	0.154		0.275	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Radium 226	0.006926	U	0.00801	0.00805	1.00	0.0383	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Thorium 232	0.01161	U	0.0180	0.0180		0.0545	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Thorium 234	-0.05951	U	0.301	0.301		0.261	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Uranium 235	0.01312	U	0.0347	0.0347		0.0604	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Americium 241	0.004197	U	0.0131	0.0131		0.0229	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Protactinium 234m	0.0000	U	0.341	0.341		0.888	pCi/g	02/23/15 15:07	03/16/15 13:28	1
Count Total										
Other Detected	MB	MB	Uncert.	Uncert.						
Radionuclides	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected	None						pCi/g	02/23/15 15:07	03/16/15 13:28	1
Radionuclide										

Lab Sample ID: LCS 160-175826/2-A
Matrix: Solid
Analysis Batch: 179436

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 175826

Analyte	Spike Added	LCS Result	LCS Qual	Total	RL	MDC	Unit	%Rec	%Rec.
				Uncert. (2σ+/-)					Limits
Americium 241	101	102.9		10.7		0.479	pCi/g	102	87 - 116
Cesium 137	34.9	35.32		3.70		0.170	pCi/g	101	87 - 120
Cobalt 60	36.4	36.35		3.67		0.109	pCi/g	100	87 - 115

Lab Sample ID: 160-10553-1 DU
Matrix: Solid
Analysis Batch: 179436

Client Sample ID: L10-03-13-B-E-B-00
Prep Type: Total/NA
Prep Batch: 175826

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total	RL	MDC	Unit	RER	RER
					Uncert. (2σ+/-)					Limit
Actinium 228	1.36		1.373		0.238		0.157	pCi/g	0.02	1
Bismuth 212	1.42		1.391		0.463		0.559	pCi/g	0.03	1
Bismuth 214	1.61		1.608		0.222		0.0912	pCi/g	0.01	1
Lead 212	1.21		1.403		0.204		0.0731	pCi/g	0.51	1
Lead 214	1.63		1.815		0.226		0.100	pCi/g	0.41	1
Potassium 40	18.5		20.45		2.50		0.268	pCi/g	0.40	1
Protactinium 231	0.545	U	-0.7694	U	0.957		1.57	pCi/g	0.94	1
Radium 226	1.61		1.608		0.222	1.00	0.0912	pCi/g	0.01	1
Thorium 232	1.36		1.373		0.238		0.157	pCi/g	0.02	1
Thorium 234	2.68		4.046		0.820		0.975	pCi/g	0.97	1
Uranium 235	0.442		0.6269		0.244		0.273	pCi/g	0.44	1
Americium 241	0.00172	U	0.08658	U	0.0721		0.116	pCi/g	0.51	1

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-10553-2

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

Lab Sample ID: 160-10553-1 DU

Matrix: Solid

Analysis Batch: 179436

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

Prep Type: Total/NA

Prep Batch: 175826

Analyte	Sample Result	Sample Qual	DU		Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
			Result	Qual						
Protactinium 234m	8.03		8.868		3.57		3.00	pCi/g	0.1	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>1.78</i>		<i>1.880</i>		<i>0.866</i>		<i>1.05</i>	<i>pCi/g</i>	<i>0.05</i>	<i>1</i>
<i>Tl-208</i>	<i>0.458</i>		<i>0.4205</i>		<i>0.0764</i>		<i>0.0492</i>	<i>pCi/g</i>	<i>0.24</i>	<i>1</i>

QC Association Summary

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

TestAmerica Job ID: 160-10553-2

Rad

Leach Batch: 174830

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10553-1	L10-03-13-B-E-B-00	Total/NA	Solid	Dry and Grind	
160-10553-1 DU	L10-03-13-B-E-B-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 175826

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10553-1	L10-03-13-B-E-B-00	Total/NA	Solid	Fill_Geo-21	174830
160-10553-1 DU	L10-03-13-B-E-B-00	Total/NA	Solid	Fill_Geo-21	174830
LCS 160-175826/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-175826/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	