

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: 160-10521-1
Client Project/Site: HDP

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

Attn: Brian Miller



Authorized for release by:
2/24/2015 5:01:12 PM

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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: 160-10521-1

Job ID: 160-10521-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Perma-Fix Environmental Services Inc.

Project: HDP

Report Number: 160-10521-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 02/17/2015; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the coolers at receipt was 18.0 C.

TECHNETIUM-99 (ICPMS)

Samples L10-12-13-B-E-B-00 (160-10521-1) and L10-12-14-B-E-B-00 (160-10521-2) were analyzed for Technetium-99 (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 02/17/2015 and analyzed on 02/19/2015.

Preparation Batch 174849:

Radium-226 is reported in these samples at the client's request. Radium-226 is reported from the 609.31 keV line of bismuth-214. Because the samples have not had a 21-day ingrowth, the activity for radium-226 is an estimated value and may be biased low. This bias is caused by the disruption of secular equilibrium between radium-226 and bismuth-214 by the loss of radon-222 during sample preparation.

(160-10521-1 DU), (LCS 160-174849/2-A), (MB 160-174849/1-A), L10-12-13-B-E-B-00 (160-10521-1), L10-12-14-B-E-B-00 (160-10521-2)

Case Narrative

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

TestAmerica Job ID: 160-10521-1

Job ID: 160-10521-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

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

PERCENT SOLIDS

Samples L10-12-13-B-E-B-00 (160-10521-1) and L10-12-14-B-E-B-00 (160-10521-2) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 02/18/2015.

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

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples L10-12-13-B-E-B-00 (160-10521-1) and L10-12-14-B-E-B-00 (160-10521-2) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 02/17/2015, and prepared and analyzed on 02/19/2015.

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 Jakub		Date: 02/17/2015		COC No: 021715-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										
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										
Project Name: Hematite Decommissioning Project		<input checked="" type="checkbox"/> 1 week										
Site: Westinghouse Hematite, MO		<input type="checkbox"/> 2 days										
P O # 832953		<input type="checkbox"/> 1 day										
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 post-21 day ingrowth)	Sample Specific Notes:
L10-12-13-B-E-B-00	2/13/15	1530	G	Soil	1	N		X	X	X		Brian Miller, ~ 14 Kcpm
L10-12-14-B-E-B-00	2/13/15	1500	G	Soil	1	N		X	X	X		Brian Miller, ~ 16 Kcpm
N / A												
Preservation Used: 1=Ice, 2=HCl, 3=H2SO4, 4=HNO3, 5=NaOH, 6=Other, None						Sample Disposal (A fee may be assessed if samples are retained longer than 1						
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						
<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: <i>Perma-Fix</i>		Date/Time: <i>2/17/15</i>		Received by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: <i>2/17/15</i>		
Relinquished by: <i>[Signature]</i>		Company: <i>Crossroads</i>		Date/Time: <i>2/17/15</i>		Received by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: <i>2/17/15/1000</i>		
Relinquished by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: <i>10 50</i>		Received in Laboratory by: <i>[Signature]</i>		Company: <i>[Signature]</i>		Date/Time: _____		



Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-10521-1

Login Number: 10521

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.	N/A	
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?	False	
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: 160-10521-1

Qualifiers

Rad

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

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	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: 160-10521-1

Method	Method Description	Protocol	Laboratory
6020A	Metals (ICP/MS), Tc-99	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
6020A	Metals (ICP/MS), Tc-99 in Activity	SW846	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566



Sample Summary

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

TestAmerica Job ID: 160-10521-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10521-1	L10-12-13-B-E-B-00	Solid	02/13/15 15:30	02/17/15 10:00
160-10521-2	L10-12-14-B-E-B-00	Solid	02/13/15 15:00	02/17/15 10:00

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Client Sample Results

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

TestAmerica Job ID: 160-10521-1

Client Sample ID: L10-12-13-B-E-B-00

Lab Sample ID: 160-10521-1

Date Collected: 02/13/15 15:30

Matrix: Solid

Date Received: 02/17/15 10:00

Percent Solids: 69.5

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000076	0.000023	mg/Kg	☼	02/17/15 14:20	02/19/15 21:03	1

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Technetium 99	0.375		0.166	0.169	1.53	0.261	pCi/g	02/17/15 14:20	02/19/15 21:03	1
<i>Carrier</i>	<i>%Yield</i>	<i>Qualifier</i>	<i>Limits</i>					<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Re	94		30 - 110					02/17/15 14:20	02/19/15 21:03	1

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.19		0.122	0.172		0.127	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Americium 241	0.00355	U	0.0669	0.0669		0.113	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Bismuth 212	1.85		0.435	0.475		0.306	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Bismuth 214	0.773		0.0950	0.124		0.0737	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Lead 212	1.26		0.0815	0.182		0.0625	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Lead 214	0.963		0.0854	0.132		0.0653	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Potassium 40	17.9		1.16	2.16		0.263	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Protactinium 234m	1.25	U	2.84	2.84		5.00	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Protactinium 231	0.632	U	0.349	0.356		1.14	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Radium 226	0.773		0.0950	0.124		0.0737	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Thorium 234	1.72		0.645	0.669		0.866	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Uranium 235	0.337		0.166	0.170		0.211	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Thorium 232	1.19		0.122	0.172		0.127	pCi/g	02/19/15 16:57	02/19/15 20:05	1
<i>Other Detected</i>			<i>Count</i>	<i>Total</i>						
<i>Radionuclides</i>	<i>Result</i>	<i>Qualifier</i>	<i>Uncert.</i>	<i>Uncert.</i>	<i>RL</i>	<i>MDC</i>	<i>Unit</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Tl-208	0.446		0.0499	0.0680		0.0303	pCi/g	02/19/15 16:57	02/19/15 20:05	1

Client Sample ID: L10-12-14-B-E-B-00

Lab Sample ID: 160-10521-2

Date Collected: 02/13/15 15:00

Matrix: Solid

Date Received: 02/17/15 10:00

Percent Solids: 71.9

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

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000075	0.000023	mg/Kg	☼	02/17/15 14:20	02/19/15 21:15	1

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Technetium 99	0.0237	U	0.0268	0.0269	1.50	0.257	pCi/g	02/17/15 14:20	02/19/15 21:15	1
<i>Carrier</i>	<i>%Yield</i>	<i>Qualifier</i>	<i>Limits</i>					<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
Re	92		30 - 110					02/17/15 14:20	02/19/15 21:15	1

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Client Sample Results

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

TestAmerica Job ID: 160-10521-1

Client Sample ID: L10-12-14-B-E-B-00

Lab Sample ID: 160-10521-2

Date Collected: 02/13/15 15:00

Matrix: Solid

Date Received: 02/17/15 10:00

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

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Actinium 228	1.31		0.128	0.185		0.104	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Americium 241	0.0453	U	0.0529	0.0531		0.0757	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Bismuth 212	1.81		0.428	0.467		0.365	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Bismuth 214	0.789		0.0895	0.121		0.0591	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Lead 212	1.28		0.105	0.196		0.0918	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Lead 214	0.834		0.0868	0.123		0.0663	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Potassium 40	16.3		1.07	1.99		0.322	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Protactinium 234m	1.69	U	2.78	2.79		4.73	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Protactinium 231	0.211	U	0.383	0.384		0.647	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Radium 226	0.789		0.0895	0.121		0.0591	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Thorium 234	1.07		0.546	0.558		0.875	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Uranium 235	0.113	U	0.145	0.146		0.254	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Thorium 232	1.31		0.128	0.185		0.104	pCi/g	02/19/15 16:57	02/19/15 20:05	1
Other Detected			Count	Total						
Radionuclides			Uncert.	Uncert.						
	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.435		0.0575	0.0731		0.0431	pCi/g	02/19/15 16:57	02/19/15 20:05	1

QC Sample Results

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

TestAmerica Job ID: 160-10521-1

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

Lab Sample ID: MB 160-174463/1-A
Matrix: Solid
Analysis Batch: 174922

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 174463

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Technetium 99	ND		0.000057	0.000017	mg/Kg		02/17/15 14:20	02/19/15 20:56	1

Lab Sample ID: LCS 160-174463/2-A
Matrix: Solid
Analysis Batch: 174922

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174463

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	0.00123	0.00113		mg/Kg		92	80 - 120

Lab Sample ID: 160-10521-1 MS
Matrix: Solid
Analysis Batch: 174922

Client Sample ID: L10-12-13-B-E-B-00
Prep Type: Total/NA
Prep Batch: 174463

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Technetium 99	ND		0.00178	0.00171		mg/Kg	☼	96	75 - 125

Lab Sample ID: 160-10521-1 MSD
Matrix: Solid
Analysis Batch: 174922

Client Sample ID: L10-12-13-B-E-B-00
Prep Type: Total/NA
Prep Batch: 174463

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Technetium 99	ND		0.00176	0.00166		mg/Kg	☼	95	75 - 125	3	30

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

Lab Sample ID: MB 160-174463/1-A
Matrix: Solid
Analysis Batch: 174923

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 174463

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Technetium 99	0.01117	U	0.00686	0.00694	1.15	0.196	pCi/g	02/17/15 14:20	02/19/15 20:56	1

Carrier	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Re	87		30 - 110	02/17/15 14:20	02/19/15 20:56	1

Lab Sample ID: LCS 160-174463/2-A
Matrix: Solid
Analysis Batch: 174923

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174463

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	21.0	19.27		1.82	1.10	0.188	pCi/g	92	80 - 120

Carrier	LCS %Yield	LCS Qualifier	Limits
Re	91		30 - 110

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-10521-1

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

Lab Sample ID: 160-10521-1 MS

Matrix: Solid

Analysis Batch: 174923

Client Sample ID: L10-12-13-B-E-B-00

Prep Type: Total/NA

Prep Batch: 174463

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Technetium 99	0.375		30.4	29.20		2.81	1.53	0.262	pCi/g	95	75 - 125
Carrier	%Yield	MS Qualifier	Limits								
Re	94		30 - 110								

Lab Sample ID: 160-10521-1 MSD

Matrix: Solid

Analysis Batch: 174923

Client Sample ID: L10-12-13-B-E-B-00

Prep Type: Total/NA

Prep Batch: 174463

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Technetium 99	0.375		30.1	28.44		2.64	1.53	0.261	pCi/g	93	75 - 125	0.14	1
Carrier	%Yield	MSD Qualifier	Limits										
Re	94		30 - 110										

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

Lab Sample ID: MB 160-174849/1-A

Matrix: Solid

Analysis Batch: 174816

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 174849

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium 228	0.006571	U	0.0159	0.0159		0.0322	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Americium 241	0.004707	U	0.00995	0.00996		0.0174	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Bismuth 212	0.0000	U	0.0390	0.0390		0.208	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Bismuth 214	-0.004837	U	0.0367	0.0367		0.0438	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Lead 212	-0.01069	U	0.671	0.671		0.0261	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Lead 214	0.01304	U	0.0178	0.0178		0.0295	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Potassium 40	-0.06756	U	2.70	2.70		0.213	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Protactinium 234m	0.3176	U	0.880	0.880		2.89	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Protactinium 231	0.07982	U	0.174	0.174		0.305	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Radium 226	-0.004837	U	0.0367	0.0367		0.0438	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Thorium 234	0.1050	U	0.129	0.129		0.218	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Uranium 235	-0.004137	U	0.0362	0.0362		0.0660	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Thorium 232	0.006571	U	0.0159	0.0159		0.0322	pCi/g	02/19/15 16:57	02/19/15 20:03	1
Other Detected Radionuclides	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Other Detected Radionuclide	None						pCi/g	02/19/15 16:57	02/19/15 20:03	1

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-10521-1

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

Lab Sample ID: LCS 160-174849/2-A
Matrix: Solid
Analysis Batch: 174819

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174849

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium 241	101	100.3		10.4		0.527	pCi/g	99	87 - 116
Cesium 137	35.0	34.33		3.59	0.200	0.163	pCi/g	98	87 - 120
Cobalt 60	36.7	35.47		3.58		0.109	pCi/g	97	87 - 115

Lab Sample ID: 160-10521-1 DU
Matrix: Solid
Analysis Batch: 174816

Client Sample ID: L10-12-13-B-E-B-00
Prep Type: Total/NA
Prep Batch: 174849

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium 228	1.19		1.302		0.213		0.142	pCi/g	0.29	1
Americium 241	0.00355	U	-0.01732	U	0.0621		0.104	pCi/g	0.16	1
Bismuth 212	1.85		1.933		0.583		0.446	pCi/g	0.08	1
Bismuth 214	0.773		0.9379		0.150		0.0778	pCi/g	0.60	1
Lead 212	1.26		1.297		0.190		0.0697	pCi/g	0.10	1
Lead 214	0.963		0.8962		0.132		0.0764	pCi/g	0.26	1
Potassium 40	17.9		16.32		2.09		0.278	pCi/g	0.37	1
Protactinium 234m	1.25	U	1.858	U	3.81		6.50	pCi/g	0.09	1
Protactinium 231	0.632	U	0.2665	U	0.236		1.36	pCi/g	0.62	1
Radium 226	0.773		0.9379		0.150		0.0778	pCi/g	0.60	1
Thorium 234	1.72		2.073		0.651		0.923	pCi/g	0.27	1
Uranium 235	0.337		0.1763	U	0.140		0.258	pCi/g	0.52	1
Thorium 232	1.19		1.302		0.213		0.142	pCi/g	0.29	1
Other Detected Radionuclides	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tl-208	0.446		0.4407		0.0761		0.0453	pCi/g	0.03	1

QC Association Summary

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

TestAmerica Job ID: 160-10521-1

Metals

Prep Batch: 174463

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-1 MS	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-1 MSD	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	None	
LCS 160-174463/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-174463/1-A	Method Blank	Total/NA	Solid	None	

Analysis Batch: 174922

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	6020A	174463
160-10521-1 MS	L10-12-13-B-E-B-00	Total/NA	Solid	6020A	174463
160-10521-1 MSD	L10-12-13-B-E-B-00	Total/NA	Solid	6020A	174463
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	6020A	174463
LCS 160-174463/2-A	Lab Control Sample	Total/NA	Solid	6020A	174463
MB 160-174463/1-A	Method Blank	Total/NA	Solid	6020A	174463

General Chemistry

Analysis Batch: 174524

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	Moisture	
160-10521-1 DU	L10-12-13-B-E-B-00	Total/NA	Solid	Moisture	
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	Moisture	

Rad

Prep Batch: 174463

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-1 MS	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-1 MSD	L10-12-13-B-E-B-00	Total/NA	Solid	None	
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	None	
LCS 160-174463/2-A	Lab Control Sample	Total/NA	Solid	None	
MB 160-174463/1-A	Method Blank	Total/NA	Solid	None	

Leach Batch: 174481

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	Dry and Grind	
160-10521-1 DU	L10-12-13-B-E-B-00	Total/NA	Solid	Dry and Grind	
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	Dry and Grind	

Prep Batch: 174849

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10521-1	L10-12-13-B-E-B-00	Total/NA	Solid	Fill_Geo-0	174481
160-10521-1 DU	L10-12-13-B-E-B-00	Total/NA	Solid	Fill_Geo-0	174481
160-10521-2	L10-12-14-B-E-B-00	Total/NA	Solid	Fill_Geo-0	174481
LCS 160-174849/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-174849/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

TestAmerica St. Louis

Tracer/Carrier Summary

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

TestAmerica Job ID: 160-10521-1

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

Matrix: Solid

Prep Type: Total/NA

Percent Yield (Acceptance Limits)

Lab Sample ID	Client Sample ID	Re (30-110)
160-10521-1	L10-12-13-B-E-B-00	94
160-10521-1 MS	L10-12-13-B-E-B-00	94
160-10521-1 MSD	L10-12-13-B-E-B-00	94
160-10521-2	L10-12-14-B-E-B-00	92
LCS 160-174463/2-A	Lab Control Sample	91
MB 160-174463/1-A	Method Blank	87

Tracer/Carrier Legend

Re = Re