

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: 160-10296-2
Client Project/Site: HDP

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

Attn: Brian Miller



Authorized for release by:
2/26/2015 4:32:02 PM

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.

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Case Narrative

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

TestAmerica Job ID: 160-10296-2

Job ID: 160-10296-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Perma-Fix Environmental Services Inc.

Project: HDP

Report Number: 160-10296-2

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 01/28/2015; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the coolers at receipt was 20.0 C.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)


Samples L10-03-10-B-E-B-00 (160-10296-1), L10-03-11-B-E-B-00 (160-10296-2) and L10-03-12-B-E-B-00 (160-10296-3) were analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 01/28/2015, prepared on 01/30/2015 and analyzed on 02/24/2015.

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 Perma-Fix Environmental Services 2800 Solway Road Knoxville, TN 37931 (865) 690-0501 PHONE (865) 539-9868 FAX | | Project Manager: Brian Miller Tel/Fax: (314) 810-3333 | | Site Contact: Ellen Jakub Lab Contact: Ivan Vania | | Date: 1/28/15 Carrier: Courier | | COC No: 012815-FSS1 Page 1 of 1 | | | | |
|--|-------------|---|------------------------------|---|------------|--|------------------------|---|------------|--------------------------|---|------------------------------|
| Analysis Turnaround Time <input checked="" type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS TAT if different from Below _____ <input type="checkbox"/> 2 weeks <input checked="" type="checkbox"/> 1 week <input type="checkbox"/> 2 days <input type="checkbox"/> 1 day | | | | | | | | Sampler: For Lab Use Only: Walk-in Client: Lab Sampling: Job / SDG No.: | | | | |
| Project Name: Hematite Decommissioning Project 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 (Ra-226, Th-232, U-235, U-238) | Alpha Spec | ICP/MS (Tc-99) | Gamma Spec (Ra-226: post-21 day ingrowth) | Sample Specific Notes: |
| L10-03-10-B-E-B-00 | 1/27/15 | 10:40 | G | Soil | 1 | N | X | X | X | | | LSA 10-03 (bias); (~8K ncpm) |
| L10-03-11-B-E-B-00 | 1/27/15 | 10:45 | G | Soil | 1 | N | X | X | X | | | LSA 10-03 (bias); (~5K ncpm) |
| L10-03-12-B-E-B-00 | 1/27/15 | 10:50 | G | Soil | 1 | N | X | X | X | | | LSA 10-03 (bias); (~5K ncpm) |
| N / A | | | | | | | | | | | | |
|  160-10296 Chain of Custody | | | | | | | | | | | | |
| Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other None | | | | | | | | | | | | |
| Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. <input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown | | | | | | Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) <input checked="" type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months | | | | | | |
| Special Instructions/QC Requirements & Comments: Dry and homogenize samples prior to analyses; potential for radiological contamination | | | | | | | | | | | | |
| Custody Seals Intact: <input 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: 1-28-15 | | Received by: Courier <i>Mark Schuffrin 904</i> | | Company: TestAmerica | | Date/Time: 1/28/15 12:10 | | |
| Relinquished by: <i>Mark Schuffrin 904</i> | | Company: <i>CROSSROADS</i> | | Date/Time: 1/28/15 1338 | | Received by: <i>Ellen Clarke</i> | | Company: <i>TA SL</i> | | Date/Time: 1-28-15 1338 | | |
| Relinquished by: | | Company: | | Date/Time: | | Received in Laboratory by: | | Company: | | Date/Time: | | |
| Hematite Decommissioning Project | | | | Perma-Fix (for Westinghouse) Non-Proprietary Class 3 | | | | Procedure:HDP-PR-QA-006, Chain of Custody | | | | Revision: 3 |

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Login Sample Receipt Checklist

Client: Perma-Fix Environmental Services Inc.

Job Number: 160-10296-2

Login Number: 10296

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

| 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? | 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: 160-10296-2

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: 160-10296-2

| 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: 160-10296-2

| Lab Sample ID | Client Sample ID | Matrix | Collected | Received |
|---------------|--------------------|--------|----------------|----------------|
| 160-10296-1 | L10-03-10-B-E-B-00 | Solid | 01/27/15 10:40 | 01/28/15 13:38 |
| 160-10296-2 | L10-03-11-B-E-B-00 | Solid | 01/27/15 10:45 | 01/28/15 13:38 |
| 160-10296-3 | L10-03-12-B-E-B-00 | Solid | 01/27/15 10:50 | 01/28/15 13:38 |

- 1
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Client Sample Results

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

TestAmerica Job ID: 160-10296-2

Client Sample ID: L10-03-10-B-E-B-00

Lab Sample ID: 160-10296-1

Date Collected: 01/27/15 10:40

Matrix: Solid

Date Received: 01/28/15 13:38

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 | 1.34 | | 0.199 | 0.241 | | 0.223 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Bismuth 212 | 1.18 | | 0.561 | 0.575 | | 0.810 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Bismuth 214 | 1.63 | | 0.175 | 0.244 | | 0.111 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Lead 212 | 1.25 | | 0.114 | 0.198 | | 0.124 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Lead 214 | 1.91 | | 0.164 | 0.257 | | 0.129 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Potassium 40 | 19.6 | | 1.57 | 2.55 | | 0.344 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Protactinium 231 | 0.699 | U | 0.446 | 0.453 | | 1.88 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Radium 226 | 1.63 | | 0.175 | 0.244 | 1.00 | 0.111 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Thorium 232 | 1.34 | | 0.199 | 0.241 | | 0.223 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Thorium 234 | 3.72 | | 1.33 | 1.39 | | 1.55 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Uranium 235 | 0.610 | | 0.275 | 0.282 | | 0.332 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Americium 241 | 0.00379 | U | 0.0972 | 0.0972 | | 0.164 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Protactinium 234m | 7.98 | U | 5.12 | 5.18 | | 9.13 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |
| Other Detected | | | Count | Total | | | | | | |
| | | | Uncert. | Uncert. | | | | | | |
| Radionuclides | Result | Qualifier | (2σ+/-) | (2σ+/-) | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
| Tl-208 | 0.546 | | 0.0740 | 0.0932 | | 0.0462 | pCi/g | 01/30/15 08:56 | 02/24/15 08:16 | 1 |

Client Sample ID: L10-03-11-B-E-B-00

Lab Sample ID: 160-10296-2

Date Collected: 01/27/15 10:45

Matrix: Solid

Date Received: 01/28/15 13:38

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 | 1.55 | | 0.144 | 0.214 | | 0.141 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Bismuth 212 | 1.62 | | 0.685 | 0.705 | | 0.633 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Bismuth 214 | 1.80 | | 0.156 | 0.243 | | 0.0981 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Lead 212 | 1.32 | | 0.0906 | 0.193 | | 0.0779 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Lead 214 | 1.97 | | 0.118 | 0.237 | | 0.0905 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Potassium 40 | 19.0 | | 1.36 | 2.37 | | 0.468 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Protactinium 231 | 0.641 | U | 0.287 | 0.296 | | 1.40 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Radium 226 | 1.80 | | 0.156 | 0.243 | 1.00 | 0.0981 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Thorium 232 | 1.55 | | 0.144 | 0.214 | | 0.141 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Thorium 234 | 2.89 | | 0.713 | 0.775 | | 1.07 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Uranium 235 | 0.612 | | 0.175 | 0.186 | | 0.234 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Americium 241 | -0.0248 | U | 0.0763 | 0.0764 | | 0.128 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Protactinium 234m | 2.98 | U | 3.59 | 3.61 | | 5.89 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |
| Other Detected | | | Count | Total | | | | | | |
| | | | Uncert. | Uncert. | | | | | | |
| Radionuclides | Result | Qualifier | (2σ+/-) | (2σ+/-) | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
| Tl-208 | 0.449 | | 0.0597 | 0.0758 | | 0.0460 | pCi/g | 01/30/15 08:56 | 02/24/15 09:01 | 1 |

Client Sample Results

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

TestAmerica Job ID: 160-10296-2

Client Sample ID: L10-03-12-B-E-B-00

Lab Sample ID: 160-10296-3

Date Collected: 01/27/15 10:50

Matrix: Solid

Date Received: 01/28/15 13:38

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 | 1.39 | | 0.164 | 0.217 | | 0.101 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Bismuth 212 | 1.51 | | 0.480 | 0.505 | | 0.454 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Bismuth 214 | 1.41 | | 0.110 | 0.183 | | 0.0846 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Lead 212 | 1.33 | | 0.0835 | 0.192 | | 0.0770 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Lead 214 | 1.65 | | 0.110 | 0.204 | | 0.0772 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Potassium 40 | 17.6 | | 1.17 | 2.15 | | 0.482 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Protactinium 231 | 0.274 | U | 0.460 | 0.461 | | 0.770 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Radium 226 | 1.41 | | 0.110 | 0.183 | 1.00 | 0.0846 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Thorium 232 | 1.39 | | 0.164 | 0.217 | | 0.101 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Thorium 234 | 1.08 | | 0.552 | 0.564 | | 0.886 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Uranium 235 | 0.103 | U | 0.143 | 0.144 | | 0.282 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Americium 241 | 0.0178 | U | 0.0688 | 0.0689 | | 0.115 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Protactinium 234m | -0.284 | U | 331 | 331 | | 5.84 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |
| Other Detected | | | Count | Total | | | | | | |
| | | | Uncert. | Uncert. | | | | | | |
| Radionuclides | Result | Qualifier | (2σ+/-) | (2σ+/-) | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
| Tl-208 | 0.436 | | 0.0539 | 0.0703 | | 0.0411 | pCi/g | 01/30/15 08:56 | 02/24/15 09:05 | 1 |

QC Sample Results

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

TestAmerica Job ID: 160-10296-2

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

Lab Sample ID: MB 160-171648/1-A
Matrix: Solid
Analysis Batch: 175640

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 171648

| Analyte | MB MB | | Count | Total | RL | MDC | Unit | Prepared | Analyzed | Dil Fac |
|-----------------------|---------------|------------------|----------------|----------------|-----------|------------|-------------|-----------------|-----------------|----------------|
| | Result | Qualifier | Uncert. | Uncert. | | | | | | |
| Actinium 228 | 0.008060 | U | 0.0178 | 0.0178 | | 0.0322 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Bismuth 212 | 0.001416 | U | 0.136 | 0.136 | | 0.260 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Bismuth 214 | 0.005069 | U | 0.0162 | 0.0162 | | 0.0359 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Lead 212 | -0.001398 | U | 0.0173 | 0.0173 | | 0.0270 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Lead 214 | 0.006060 | U | 0.00966 | 0.00968 | | 0.0363 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Potassium 40 | 0.002485 | U | 0.134 | 0.134 | | 0.298 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Protactinium 231 | 0.02604 | U | 0.130 | 0.130 | | 0.246 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Radium 226 | 0.005069 | U | 0.0162 | 0.0162 | 1.00 | 0.0359 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Thorium 232 | 0.008060 | U | 0.0178 | 0.0178 | | 0.0322 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Thorium 234 | 0.02388 | U | 0.127 | 0.127 | | 0.254 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Uranium 235 | 0.01961 | U | 0.0269 | 0.0269 | | 0.0706 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Americium 241 | 0.003038 | U | 0.0132 | 0.0132 | | 0.0235 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Protactinium 234m | 0.002753 | U | 0.876 | 0.876 | | 1.89 | pCi/g | 01/30/15 08:56 | 02/24/15 08:10 | 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 | 01/30/15 08:56 | 02/24/15 08:10 | 1 |
| Radionuclide | | | | | | | | | | |

Lab Sample ID: LCS 160-171648/2-A
Matrix: Solid
Analysis Batch: 175638

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 171648

| Analyte | Spike Added | LCS Result | LCS Qual | Total | RL | MDC | Unit | %Rec | %Rec. |
|---------------|-------------|------------|----------|-----------------|----|-------|-------|------|----------|
| | | | | Uncert. (2σ+/-) | | | | | Limits |
| Americium 241 | 101 | 101.3 | | 10.5 | | 0.513 | pCi/g | 100 | 87 - 116 |
| Cesium 137 | 35.0 | 34.81 | | 3.64 | | 0.164 | pCi/g | 100 | 87 - 120 |
| Cobalt 60 | 36.7 | 35.83 | | 3.61 | | 0.124 | pCi/g | 98 | 87 - 115 |

Lab Sample ID: 160-10296-3 DU
Matrix: Solid
Analysis Batch: 175640

Client Sample ID: L10-03-12-B-E-B-00
Prep Type: Total/NA
Prep Batch: 171648

| Analyte | Sample Result | Sample Qual | DU Result | DU Qual | Total | RL | MDC | Unit | RER | RER |
|------------------|---------------|-------------|-----------|---------|-----------------|------|--------|-------|------|-------|
| | | | | | Uncert. (2σ+/-) | | | | | Limit |
| Actinium 228 | 1.39 | | 1.399 | | 0.226 | | 0.128 | pCi/g | 0.01 | 1 |
| Bismuth 212 | 1.51 | | 1.759 | | 0.608 | | 0.543 | pCi/g | 0.22 | 1 |
| Bismuth 214 | 1.41 | | 1.400 | | 0.196 | | 0.0815 | pCi/g | 0.03 | 1 |
| Lead 212 | 1.33 | | 1.408 | | 0.203 | | 0.0652 | pCi/g | 0.19 | 1 |
| Lead 214 | 1.65 | | 1.654 | | 0.217 | | 0.0888 | pCi/g | 0.01 | 1 |
| Potassium 40 | 17.6 | | 17.08 | | 2.13 | | 0.255 | pCi/g | 0.13 | 1 |
| Protactinium 231 | 0.274 | U | 0.5843 | U | 0.269 | | 1.44 | pCi/g | 0.43 | 1 |
| Radium 226 | 1.41 | | 1.400 | | 0.196 | 1.00 | 0.0815 | pCi/g | 0.03 | 1 |
| Thorium 232 | 1.39 | | 1.399 | | 0.226 | | 0.128 | pCi/g | 0.01 | 1 |
| Thorium 234 | 1.08 | | 0.8238 | U | 0.334 | | 0.923 | pCi/g | 0.29 | 1 |
| Uranium 235 | 0.103 | U | 0.1802 | U | 0.145 | | 0.206 | pCi/g | 0.27 | 1 |
| Americium 241 | 0.0178 | U | 0.009082 | U | 0.0684 | | 0.115 | pCi/g | 0.06 | 1 |

TestAmerica St. Louis

QC Sample Results

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

TestAmerica Job ID: 160-10296-2

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

Lab Sample ID: 160-10296-3 DU

Matrix: Solid

Analysis Batch: 175640

Client Sample ID: L10-03-12-B-E-B-00

Prep Type: Total/NA

Prep Batch: 171648

| Analyte | Sample | Sample | DU | DU | Total | RL | MDC | Unit | RER | RER |
|-----------------------|---------------|---------------|---------------|-------------|----------------|-----------|---------------|--------------|-------------|--------------|
| | Result | Qual | Result | Qual | Uncert. | | | | | Limit |
| Protactinium 234m | -0.284 | U | 2.346 | U | 3.56 | | 5.94 | pCi/g | 0.01 | 1 |
| <i>Total</i> | | | | | | | | | | |
| <i>Other Detected</i> | <i>Sample</i> | <i>Sample</i> | <i>DU</i> | <i>DU</i> | <i>Uncert.</i> | <i>RL</i> | <i>MDC</i> | <i>Unit</i> | <i>RER</i> | <i>Limit</i> |
| <i>Radionuclides</i> | <i>Result</i> | <i>Qual</i> | <i>Result</i> | <i>Qual</i> | <i>(2σ+/-)</i> | | | | | |
| <i>Tl-208</i> | <i>0.436</i> | | <i>0.4972</i> | | <i>0.0796</i> | | <i>0.0402</i> | <i>pCi/g</i> | <i>0.41</i> | <i>1</i> |

QC Association Summary

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

TestAmerica Job ID: 160-10296-2

Rad

Leach Batch: 170938

| Lab Sample ID | Client Sample ID | Prep Type | Matrix | Method | Prep Batch |
|----------------|--------------------|-----------|--------|---------------|------------|
| 160-10296-1 | L10-03-10-B-E-B-00 | Total/NA | Solid | Dry and Grind | |
| 160-10296-2 | L10-03-11-B-E-B-00 | Total/NA | Solid | Dry and Grind | |
| 160-10296-3 | L10-03-12-B-E-B-00 | Total/NA | Solid | Dry and Grind | |
| 160-10296-3 DU | L10-03-12-B-E-B-00 | Total/NA | Solid | Dry and Grind | |

Prep Batch: 171648

| Lab Sample ID | Client Sample ID | Prep Type | Matrix | Method | Prep Batch |
|--------------------|--------------------|-----------|--------|-------------|------------|
| 160-10296-1 | L10-03-10-B-E-B-00 | Total/NA | Solid | Fill_Geo-21 | 170938 |
| 160-10296-2 | L10-03-11-B-E-B-00 | Total/NA | Solid | Fill_Geo-21 | 170938 |
| 160-10296-3 | L10-03-12-B-E-B-00 | Total/NA | Solid | Fill_Geo-21 | 170938 |
| 160-10296-3 DU | L10-03-12-B-E-B-00 | Total/NA | Solid | Fill_Geo-21 | 170938 |
| LCS 160-171648/2-A | Lab Control Sample | Total/NA | Solid | Fill_Geo-21 | |
| MB 160-171648/1-A | Method Blank | Total/NA | Solid | Fill_Geo-21 | |