TETRA TECH

December 7, 2015

Mr. Tom Mahler
On-Scene Coordinator
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Subject: **Emergency Response Activity Report**
Bridgeton Brush Fire Response, Bridgeton, Missouri
U.S. EPA Region 7 START 4, Contract No. EP-S7-13-06
Task Order No. 0001.024
Task Monitor: Tom Mahler, On-Scene Coordinator

Dear Mr. Mahler:

Tetra Tech, Inc. is submitting the attached Emergency Response Report documenting tasked activities following a brush fire in Bridgeton, Missouri, on October 24, 2015. The brush fire occurred on Republic Services, Inc. property, between the Bridgeton Landfill Site and the Westlake Landfill Site. If you have any questions or comments, please contact the Project Manager at (314) 395-3157.

Sincerely,

for Dave Kinroth, CHMM
START Project Manager

Ted Faile, PG, CHMM
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

415 Oak Street, Kansas City, MO 64106
Tel 816.412.1741 Fax 816.410.1748 www.tetratech.com

EMERGENCY RESPONSE ACTIVITY REPORT
BRIDGETON BRUSH FIRE RESPONSE, BRIDGETON, MISSOURI

Superfund Technical Assessment and Response Team (START) 4
Contract No. EP-S7-13-06, Task Order No. 0001.024

Prepared For:

U.S. Environmental Protection Agency
Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

December 7, 2015

Prepared By:

Tetra Tech, Inc.
415 Oak Street
Kansas City, Missouri 64106
(816) 412-1741

CONTENTS

APPENDICES

TABLES

1.0 INCIDENT

Tetra Tech, Inc. (Tetra Tech) was tasked by the U.S. Environmental Protection Agency (EPA) Region 7 Superfund Division, under the Superfund Technical Assessment and Response Team 4 (START 4) contract, to provide technical support for an emergency response and assessment activities following a brush fire on the Republic Services, Inc. property between the Bridgeton Landfill Site and the Westlake Landfill Site in Bridgeton, Missouri, on October 24, 2015 (see Appendix A, Figure 1). The local Pattonville Fire Department responded to the report of a small brush fire near the intersection of St. Charles Rock Road and Taussig Road at approximately 2:15 p.m. that day. The fire was extinguished within about 20 minutes (Fox 2 News KPLR 2015). The fire had been started by a faulty switch that generated sparks on an Ameren utility pole along the fenceline at the entrance driveway to the Republic Services transfer station located there. Ameren personnel also responded to the scene and repaired the electrical problems that afternoon (Fox 2 Now St. Louis KTVI 2015).

An area of relatively thick dry grass approximately 120 by 80 feet had burned before the fire was extinguished. The burned area was south-southeast of the Westlake Landfill Site Operable Unit 1 (OU1) perimeter fence where radiologically impacted material (RIM) is known to be buried, so news of the brush fire generated local public concern.

EPA On-Scene Coordinator (OSC) Tom Mahler contacted START Member (SM) Dave Kinroth on the evening of October 24 to notify START to be on stand-by status for response to the incident scene if requested. Mahler then prepared to mobilize to the scene from Kansas City. Shortly thereafter, Kinroth was contacted by local EPA OSC Adam Ruiz and informed that Ruiz would mobilize to the scene that evening to meet with the Missouri Department of Natural Resources (MDNR) duty officer performing air monitoring around the perimeter of the Bridgeton and Westlake Landfill Sites that afternoon. Ruiz met with Mike Ruddy of MDNR at the scene and confirmed that the fire had been localized within an area approximately 100 feet wide along the fenceline at the entrance driveway to the Republic transfer station, and did not appear to have reached the OU1 RIM area of the Westlake Site. At that point, START was instructed to stand down from response activity that evening, and was requested to contact OSC Mahler the following morning for further instruction.

2.0 RESPONSE ACTIVITIES

SM Kinroth contacted OSC Mahler the following morning on October 25, 2015, and was requested to mobilize to the scene with a camera and global positioning system (GPS) documentation equipment, radiation monitoring equipment, and soil sampling supplies. Kinroth met Mahler at the MDNR duty office trailer on the Hussman Refrigeration Company parking lot across St. Charles Rock Road from the Bridgeton Landfill Site and the Republic transfer station. The team staged here temporarily until arrangements were made for Republic Services personnel to meet and provide access to the burn area inside the property fenceline. In the meantime, SM Kinroth started two radiation monitors; a Ludlum Measurements, Inc. Model 192 gamma radiation screening instrument; and a Ludlum 2241-2 digital scalar/ratemeter with a pancake Geiger-Mueller (PGM) detector probe. SM Kinroth then recorded initial background readings (see Table 1). During the response activities, SM Kinroth photographed the burn area and vicinity (see photographic log in Appendix B).

At 11:15 a.m., the team met with Jim Getting of Republic Services, was escorted to the burn area inside the site fence, and was given access to assess the scene. Mahler first performed a gamma radiation screening survey of the burn area using the Ludlum 192 instrument by walking five transect lines across the area beginning along the fenceline where the fire had started and moving sequentially northward to the northern extent of the burn perimeter. All readings observed during this survey were in the 7 to 10 micro-Roentgens per hour (µR/hr) range, consistent with area background levels.

A GPS tracklog was recorded by walking the perimeter of the entire burn area with a Garmin® GPSMAP 60CSx handheld unit, and a second tracklog was recorded while walking along the fence perimeter of the Westlake OU1 north of the burn area. The burn area was approximately 120 feet east to west by 80 feet south to north, and the north perimeter of the burn area was approximately 100 feet from the south fence of the OU1 RIM area perimeter (see Appendix A, Figure 2).

The team then collected three soil samples within the burn area. Toward the center of the burn area was an elevated berm running from east to west, and runoff from the firefighting efforts had traveled south toward the fence along the Republic entrance drive and also north toward a drainage swale that trended northeast from the burn area. Soil samples were collected as follows:

- The first soil sample (designated BBFR-001) was collected on the south perimeter of the burn area against the fence along the Republic Services entrance driveway to its transfer station. Apparently, most water used to put out the fire on the south side of the berm had run off at this location and onto the Republic entrance driveway.

- The second soil sample (BBFR-002) was collected near the center of the burn area at the top of the berm.

- The third soil sample (BBFR-003) was collected approximately 10 feet outside and north of the burn area in the drainage swale trending north-northeast. All water used to put out the fire that flowed off the north side of the berm would have continued to drain via this pathway.

GPS coordinates recorded at the sampling locations are depicted on Figure 2 in Appendix A. GPS coordinates at sample location BBFR-002, nearest to the center of the burn area, were 38.769317 degrees north latitude and 90.440300 degrees west longitude.

The soil samples were screened for gamma/beta activity by use of the Ludlum 2241-2 with PGM probe while in aluminum pie pans (prior to transfer into sample jars). Readings from the samples fluctuated between 9 and 15 µR/hr, again consistent with background levels. Nothing from this screening indicated presence of RIM in or near the burn area. Table 1 summarizes all radiation screening readings recorded during this effort.

TABLE 1

RADIATION FIELD SCREENING DATA SUMMARY
BRIDGETON BRUSH FIRE RESPONSE – BRIDGETON, MISSOURI

Screening Location or Sample Number	Screening Instrument	
	Ludlum 192 Gamma Screening MicroR Meter (µR/hr)	Ludlum 2241-2 with PGM Probe Gamma/Beta Detection (µR/hr)
Background at Hussman on asphalt parking lot	3.5 to 4.5	9 to 11
Background at nearby Robertson FPD on grass-covered lot	6 to 11	9 to 18
Transect screening over the entire burn area	7 to 10	Not Utilized
Sample BBFR-001 (in pie pan)	Not utilized	12 to 15
Sample BBFR-002 (in pie pan)	Not utilized	9 to 14
Sample BBFR-003 (in pie pan)	Not utilized	11 to 13
Followup Background at Bridgeton Municipal Athletic Complex on grass at southeast soccer field	6 to 10	12 to 21
Followup Background at Koch Park in Florissant, Missouri, on grass field behind Ball Diamond 5	9 to 11	9 to 18

Note:

µR/hr micro-Roentgens per hour

The soil samples were delivered to the Test America St. Louis laboratory facility in Earth City, Missouri, the following morning on October 26, 2015, for analyses for the following radiological parameters:

- 9310 Gross Alpha/Beta
- GA-01-R Gamma Spec
- 9315 Total Alpha Radium (TAR) and Radium-226
- A-01-R Isotopic Thorium
- A-01-R Isotopic Uranium

During the response, EPA had assessed the proximity of the burn area to known locations of sub-surface West Lake RIM, and had estimated that the nearest sub-surface RIM was approximately 390 feet northwest of the burn area within the fenced West Lake OU 1 (see Appendix D).

This completed the field activities for this emergency response task.

3.0 ANALYTICAL RESULTS

The final laboratory data packages for the suite of requested analyses was received from Test America on November 5 and December 3, 2015. The data were submitted to a Tetra Tech START chemist for review and validation, and the Data Validation Reports (DVR) are included along with the full data packages in Appendix C to this report. Table 2 summarizes the data listing activities of radionuclides in the naturally occurring uranium-235, uranium-238, and thorium-232 decay chains. The radionuclides in these decay chains encompass the radionuclides of concern at the West Lake Landfill.

Table 2 also includes the range of radionuclide activity detected in background samples collected by EPA and START during an investigation of the Bridgeton Municipal Athletic Complex (BMAC) (Tetra Tech 2014) as well as in samples collected across the United States and Missouri during a study of naturally occurring radionuclides by Oak Ridge National Laboratory (ORNL) (Mryrick et al 1983). Review of the data shows that nearly all reported radionuclide activities exhibited by the Bridgeton brush fire response soil samples (BBFR-001, -002, and -003) are within the range of radionuclide activities found in the background samples collected for the BMAC investigation and the ORNL study. The one exception is the estimated (J-coded) thallium-208 (Tl-208) activity in sample BBFR-003 of 0.496 picoCuries per gram (pCi/g), which is marginally above the maximum Tl-208 activity found in the BMAC reference samples of 0.486 pCi/g (Tl-208 activities were not reported in the ORNL study). Overall, based on the similar radionuclide activities among the Bridgeton brush fire response samples, the background area BMAC samples, and the ORNL study samples, radionuclide activities exhibited in samples BBFR-001, -002, and -003 appear indicative of naturally occurring background concentrations.

TABLE 2

LABORATORY DATA SUMMARY
BRIDGETON BRUSH FIRE RESPONSE – BRIDGETON, MISSOURI

Radionuclide	Bridgeton Brush Fire Samples			BMAC Investigation Reference Area Samples [a]		Oak Ridge National Laboratory Study [b]	
	BBFR-001	BBFR-002	BBFR-003	Blanchette Park	Koch Park	U.S.	Missouri
Ac-228	1.09	1.07	ND	0.499 U – 1.41	0.716 U – 1.31	NS	NS
Bi-214	0.865	0.901 J	1.09	0.794 – 1.32	0.986 – 1.65	NS	NS
Pb-212	1.06	0.986 J	1.16	0.616 – 1.09	0.911 – 1.29	NS	NS
Pb-214	0.978J	1.18	1.15	0.676 – 1.47	1.17 – 1.50	NS	NS
Tl-208	0.245J	0.420 J	0.496 J	0.247 – 0.449	0.273 – 0.486	NS	NS
Ra-226	1.08	1.08	1.03	0.794 – 1.32	0.986 – 1.65	0.23 – 4.2	0.31 – 1.4
Th-228	0.904 J	0.888 J	0.801 J	0.495 – 0.810	0.576 – 1.04	NS	NS
Th-230	1.13	1.06	0.772 J	0.636 – 1.08	0.824 – 1.22	NS	NS
Th-232	0.829 J	0.564 J	0.746 J	0.387 – 0.867	0.533 – 0.981	0.10 – 3.4	0.32 – 1.3
U-233/234	0.530 J	0.513 J	0.649 J	0.464 – 0.781	0.405 – 0.732	NS	NS
U-235/236	0.0636 J	-0.00252 U	0.000 U	0.000 U – 0.0387	- 0.00524 U – 0.0979	NS	NS
U-238	0.493 J	0.423 J	0.497 J	0.512 – 0.896	0.523 – 0.745	0.12 – 3.8	0.33 – 1.7

Notes:

All units are reported in picoCuries per gram (pCi/g).

[a] Reference area samples were collected and analyzed during a 2014 study of the Bridgeton Municipal Athletic Complex (BMAC). Values shown are the range of activities at the Blanchette Park and Koch Park reference areas (see Tetra Tech 2014).

[b] Background radionuclide concentrations in surface soil measured by the Remedial Action Survey and Certification Activities Group of the Health and Safety Research Division at Oak Ridge National Laboratory and reported by Myrick, Berven, and Haywood (see Mryrick et al 1983). Values shown are the range of activities found in samples collected across the U.S. and Missouri.

J The analyte was positively identified; the associated numerical value is the approximate concentration
NA Sample not analyzed for this analyte
ND Not detected
NS Radionuclide not studied
U Analyte not detected above the reported sample quantitation limit.

4.0 SUMMARY

On October 24, 2015, the Pattonville Fire Department responded to the report of a small brush fire near the intersection of St. Charles Rock Road and Taussig Road in Bridgeton, Missouri. The fire, caused by sparks from a faulty electrical switch on a utility pole, was found to be on property lying between the Bridgeton Landfill Site and the Westlake Landfill Site, and was quickly extinguished. The burned area was south-southeast of the Westlake Landfill Site OU1 perimeter fence where RIM is known to be buried.

On October 25, 2015, EPA and START performed a screening survey of the burned area by use of radiation monitors (a Ludlum Model 192 gamma radiation screening instrument and a Ludlum 2241-2 digital scalar/ratemeter with a PGM detector probe), and obtained readings consistent with area background levels. The team then collected three soil samples within the burn area that were submitted to Test America in Earth City, Missouri, for analyses for isotopic uranium/thorium, total alpha-emitting radium, and other radionuclides via gamma spectroscopy. Also during the response, EPA mapped the burn area and estimated that its distance from the nearest sub-surface RIM (northwest of the burn area) was approximately 390 feet.

Upon receipt of the soil sampling analytical data from TestAmerica, EPA and START compared the data to previously acquired analytical data from background samples collected during a radiological investigation of the BMAC (Tetra Tech 2014) as well as data from a nationwide study of naturally occurring radionuclides in soil conducted by ORNL. Compared radionuclide activities among the burn area samples and the background BMAC and ORNL study samples were substantially similar, suggesting that radionuclide activities exhibited in samples BBFR-001, -002, and -003 were indicative of naturally occurring background concentrations.

4.1 REMOVAL CONSIDERATIONS

Based on START and EPA's field observations, field screening, and soil sampling during the Bridgeton brush fire emergency response, no removal activities appear warranted.

4.2 PRE-REMEDIAL CONSIDERATIONS

Because no adverse effects on human health or the environment are expected related to the brush fire on October 24, 2015, no pre-remedial activities are warranted at this time.

5.0 REFERENCES

Fox 2 News KPLR 11 St. Louis (KPLR). 2015. Brush Fire at West Lake Landfill Sparks Concern. http://kplr11.com/2015/10/24/brush-fire-at-west-lake-landfill-sparks-concern. October 24.

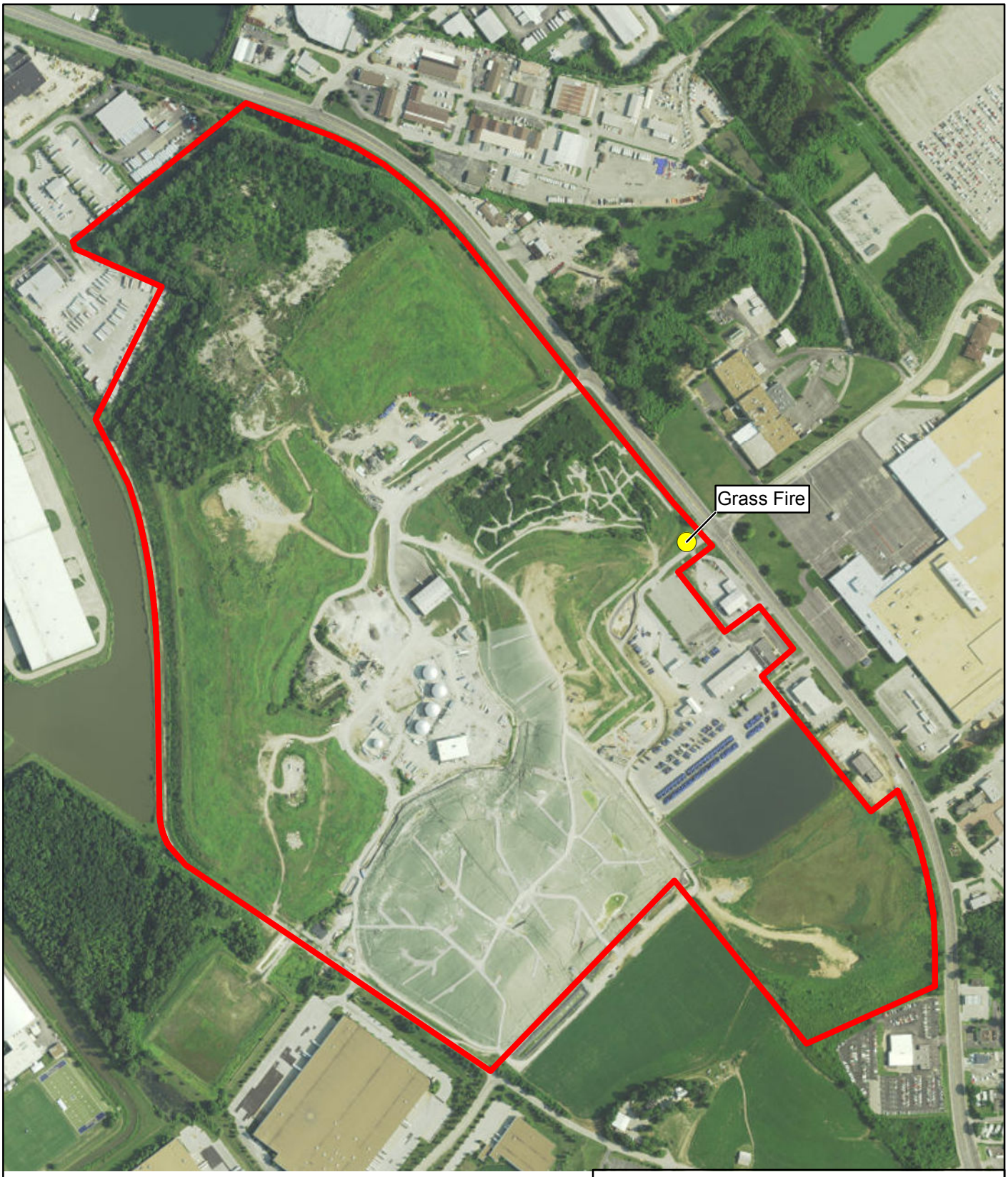
Fox 2 Now St. Louis (KTVI). 2015. Brush Fire at West Lake Landfill Sparks Concern. http://fox2now.com/2015/10/24/brush-fire-at-west-lake-landfill-sparks-concern. October 24.

Myrick, T.E., Berven, B.A. and Haywood, F.F. (Myrick et al.). 1983. Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S. Health Physics 45, pages 631-642.

Tetra Tech, Inc. (Tetra Tech). 2014. Final Pre-CERCLIS Screening Report, Bridgeton Municipal Athletic Complex, Bridgeton, Missouri. July 17.

APPENDIX A

FIGURES



Legend

West Lake Landfill

N

0 350 700

Feet

Source: ESRI, ArcGIS Online, World Imagery, 2014

Bridgeton Brush Fire Response
Bridgeton, Missouri

Figure 1
Site Layout

TETRA TECH

Date: 11/20/2015 Drawn By: Clayton Hayes Project No: X9025.14.0001.024

X:\GIS\9025\0001\024\Projects\mxd\Figure1.mxd

Legend

- Soil sample location
- West Lake OU-1 fence line
- West Lake Landfill
- Estimated grass fire extent

N

0 50 100

Feet

Source: ESRI, ArcGIS Online, World Imagery, 2014

Bridgeton Brush Fire Response
Bridgeton, Missouri

Figure 2
Grass Fire Extent and
Soil Sample Locations

TETRA TECH

Date: 11/20/2015 Drawn By: Clayton Hayes Project No: X9025.14.0001.024

X:\GIS\9025\0001\024\Projects\mxd\Figure2.mxd

APPENDIX B

PHOTOGRAPHIC RECORD

Bridgeton Brush Fire Response
Bridgeton, Missouri

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: East/Northeast	DESCRIPTION	This photograph shows an overview of the brush fire burn area looking down the fenceline along the entrance driveway to the Republic Services transfer station.	1
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: West/Southwest	DESCRIPTION	This photograph shows another overview of the brush fire burn area and the utility pole at which the fire was started.	2
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

Bridgeton Brush Fire Response
Bridgeton, Missouri

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: South/Southwest	DESCRIPTION	This photograph shows an overview of the north perimeter of the brush fire burn area.	3
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: North/Northwest	DESCRIPTION	This photograph shows the north perimeter of the brush fire burn area, with the fence around the West Lake Landfill Operable Unit (OU) 1 Area approximately 100 feet away in the background.	4
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

Bridgeton Brush Fire Response
Bridgeton, Missouri

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: Northwest	DESCRIPTION	This photograph shows an overview of the northeast perimeter of the brush fire burn area, with the fence around the West Lake Landfill OU1 Area approximately 100 feet away in the background..	5
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: East/Northeast	DESCRIPTION	This photograph shows the location of collection of soil sample BBFR-001 along the fence and south perimeter of the brush fire burn area.	6
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

Bridgeton Brush Fire Response
Bridgeton, Missouri

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: South	DESCRIPTION	This photograph shows the location of collection of soil sample BBFR-002 within the main brush fire area.	7
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

TETRA TECH PROJECT NO. X9025.14.0001.024 DIRECTION: South/Southwest	DESCRIPTION	This photograph shows the location of collection of soil sample BBFR-003 outside the brush fire burn area in the drainage pathway north-northeast of the burn area.	8
	CLIENT	Environmental Protection Agency - Region 7	DATE 10/25/15
	PHOTOGRAPHER	Dave Kinroth	

APPENDIX C

LABORATORY ANALYTICAL RESULTS WITH DATA VALIDATION REPORT

Tetra Tech, Inc.
DATA VALIDATION REPORT
LEVEL II

Site:	Bridgeton Brush Fire Response, Bridgeton, Missouri
Laboratory:	TestAmerica Laboratories, Inc. (Earth City, Missouri)
Data Reviewer:	Harry Ellis, Tetra Tech, Inc. (Tetra Tech)
Review Date	December 7, 2015
Sample Delivery Group (SDG):	J14480
Sample Numbers:	BBFR-001, BBFR-002, and BBFR-003
Matrix / Number of Samples:	3 Soil Samples

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document “Review of Data Packages from Subcontracted Laboratories” (February 2002) and the EPA and others document “Multi-Agency Radiological Laboratory Analytical Protocols Manual” (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.

Harry N. Ellis III

7 December 2015

Certified by Harry Ellis, Chemist — Date

DATA VALIDATION QUALIFIERS

U — The analyte was not detected above the reported sample quantitation limit.

J — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ — The analyte was not detected above the reported sample quantitation limit, which is estimated.

R — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

DATA ASSESSMENT

Sample delivery group (SDG) J14480 included three (3) environmental soil samples and no QC samples. Samples were analyzed for gross alpha and beta radiation by EPA SW-846 Method 9310, for uranium isotopes by Department of Energy (DOE) Method A-01-R, for cesium-137 and other gamma-emitters by DOE Method Ga-01-R and (later) for radium-226 by EPA SW-846 Method 9315. The following summarizes the data validation that was performed.

RADIOANALYTICAL ANALYSES

I. Holding Time and Chain of Custody (COC) Requirements

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

There was insufficient sample for MS/MSD analyses. LCS and duplicate sample analysis provided adequate data on precision and accuracy. No qualifications were applied.

III. Blanks

The laboratory (method) blanks yielded no detectable activities. No qualifications were applied.

IV. Laboratory Control Sample (LCS)

All percent recoveries from the LCS analyses were within established control limits. No qualifications were applied.

V. Surrogates

The uranium isotope and radium-225 analyses use a “tracer”, which functions as a surrogate. All recoveries were within QC limits so no qualifications were applied.

VI. Comments

Some detected activities were less than their reporting limits (“RL”). These low-concentration results were qualified as estimated (flagged “J”).

VII. Overall Assessment of Data

Overall data quality is acceptable, with no significant qualifications applied. All data are usable as qualified for their intended purposes.

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: 160-14480-1
Client Project/Site: Bridgeton Brush Fire Response

For:
Tetra Tech EM Inc.
415 Oak Street
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

Rhonda Ridenhower

Authorized for release by:
11/5/2015 4:38:54 PM
Rhonda Ridenhower, Manager of Project Management
rhonda.ridenhower@testamericainc.com

Designee for

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

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

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

Table of Contents

Job ID: 160-14480-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Tetra Tech EM Inc.

Project: Bridgeton Brush Fire Response

Report Number: 160-14480-1

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 10/26/2015; the samples arrived in good condition, properly preserved . The temperature of the coolers at receipt was 20.0 C.

GROSS ALPHA AND GROSS BETA RADIOACTIVITY

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Gross Alpha and Gross Beta Radioactivity in accordance with SW-846 Method 9310. The samples were dried on 10/26/2015, and prepared and analyzed on 10/28/2015.

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

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were dried on 10/26/2015, prepared on 10/27/2015 and analyzed on 10/30/2015.

Job ID: 160-14480-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

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

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were dried on 10/26/2015, and prepared and analyzed on 10/27/2015.

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

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Dave Kinroth	Site Contact: Dave Kinroth	Date: 10-26-15	COC No:
Tetra Tech, Inc.	Tel/Fax: 314-517-6798	Lab Contact: Ericka Gish	Carrier: NA	1 of 1 COCs
415 Oak Street	Analysis Turnaround Time			Sampler:
Kansas City, MO 64106	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(816) 412-1786 Phone	TAT if different from Below _ASAP_____			Walk-in Client:
(816) 816-410-1748 FAX	☐ 2 weeks			Lab Sampling:
Project Name: Bridgeton Brush Fire Response	☐ 1 week			Job / SDG No.:
Site: Bridgeton, MO	☐ 2 days			
P O # not yet assigned	☐ 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)	9310 Gross Alpha/Beta	GA-01-R Gamm Spec	9315 Total Alpha Radium	A-01-R Isotopic Thorium	A-01-R Isotopic Uranium	* 9315 Radium-226 (GFPC)	Sample Specific Notes:
BBFR-001	10/25/2015	11:45	G	soil	1			X	X	X	X	X	X	* 9315 Radium-226 (GFPC)
BBFR-002	10/25/2015	11:50	G	soil	1			X	X	X	X	X	X	contingent upon TAR results
BBFR-003	10/25/2015	11:55	G	soil	1			X	X	X	X	X	X	for all samples

160-14480 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

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.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by: Dave Kinroth Rebecca Kinroth	Company: Tetra Tech START	Date/Time: 10-26-15	Received by:	Company: TAStLouis	Date/Time: 10-26-15 1140
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-14480-1

Login Number: 14480
List Number: 1
Creator: Daniels, Brian J

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.	True	
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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Method	Method Description	Protocol	Laboratory
9310	Gross Alpha / Beta (GFPC)	SW846	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14480-1	BBFR-001	Solid	10/25/15 11:45	10/26/15 11:40
160-14480-2	BBFR-002	Solid	10/25/15 11:50	10/26/15 11:40
160-14480-3	BBFR-003	Solid	10/25/15 11:55	10/26/15 11:40

Client Sample Results

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Client Sample ID: BBFR-001

Lab Sample ID: 160-14480-1
Matrix: Solid
Date Collected: 10/25/15 11:45
Date Received: 10/26/15 11:40

Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	26.7		7.50	8.10	10.0	7.59	pCi/g	10/28/15 15:24	10/28/15 18:55	1
Gross Beta	15.6		3.49	3.83	10.0	4.29	pCi/g	10/28/15 15:24	10/28/15 18:55	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.530	UJ	0.152	0.158	1.00	0.0722	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-235/236	0.0636	UJ	0.0593	0.0595	1.00	0.0602	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-238	0.493	UJ	0.147	0.153	1.00	0.0783	pCi/g	10/27/15 10:57	10/30/15 12:28	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*97.2*		*30 - 110*	*10/27/15 10:57*	*10/30/15 12:28*	*1*

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.0764	U	0.111	0.111	0.200	0.197	pCi/g	10/27/15 11:09	10/27/15 15:24	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Ac-228	*1.09*		*0.349*	*0.366*		*0.218*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*
Bi-214	*0.865*		*0.246*	*0.262*		*0.224*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*
K-40	*17.3*		*2.92*	*3.42*		*1.49*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*
Pb-212	*1.06*		*0.232*	*0.270*		*0.239*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*
Pb-214	*0.978*	J	*0.230*	*0.252*		*0.258*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*
Tl-208	*0.245*	J	*0.121*	*0.123*		*0.164*	*pCi/g*	*10/27/15 11:09*	*10/27/15 15:24*	*1*

Client Sample ID: BBFR-002

Lab Sample ID: 160-14480-2
Matrix: Solid
Date Collected: 10/25/15 11:50
Date Received: 10/26/15 11:40

Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	29.8		7.86	8.57	10.0	7.67	pCi/g	10/28/15 15:24	10/28/15 18:55	1
Gross Beta	18.2		3.36	3.82	10.0	3.69	pCi/g	10/28/15 15:24	10/28/15 18:55	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.513	J	0.152	0.158	1.00	0.0798	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-235/236	-0.00252	U	0.00504	0.00504	1.00	0.0612	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-238	0.423	J	0.137	0.141	1.00	0.0658	pCi/g	10/27/15 10:57	10/30/15 12:28	1

HVG 9 November 2015

TestAmerica St. Louis

Client Sample ID: BBFR-002

Lab Sample ID: 160-14480-2
Matrix: Solid

Date Collected: 10/25/15 11:50
Date Received: 10/26/15 11:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	93.3		30 - 110	10/27/15 10:57	10/30/15 12:28	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.0865	U	0.0657	0.0663	0.200	0.0976	pCi/g	10/27/15 11:09	10/27/15 16:05	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Ac-228	1.07		0.299	0.319		0.201	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Bi-214	0.901	J	0.210	0.230		0.189	pCi/g	10/27/15 11:09	10/27/15 16:05	1
K-40	16.8		2.23	2.81		1.32	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Pb-212	0.986	J	0.199	0.236		0.205	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Pb-214	1.18		0.182	0.219		0.156	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Tl-208	0.420	J	0.114	0.122		0.105	pCi/g	10/27/15 11:09	10/27/15 16:05	1

Client Sample ID: BBFR-003

Lab Sample ID: 160-14480-3
Matrix: Solid

Date Collected: 10/25/15 11:55
Date Received: 10/26/15 11:40

Method: 9310 - Gross Alpha / Beta (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	24.2		6.73	7.28	10.0	6.23	pCi/g	10/28/15 15:24	10/28/15 18:55	1
Gross Beta	22.7		3.02	3.78	10.0	2.77	pCi/g	10/28/15 15:24	10/28/15 18:55	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.649	J	0.174	0.183	1.00	0.0530	pCi/g	10/27/15 10:58	10/30/15 12:28	1
Uranium-235/236	0.000	U	0.00543	0.00543	1.00	0.0434	pCi/g	10/27/15 10:58	10/30/15 12:28	1
Uranium-238	0.497	J	0.152	0.158	1.00	0.0529	pCi/g	10/27/15 10:58	10/30/15 12:28	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	82.3		30 - 110	10/27/15 10:58	10/30/15 12:28	1

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

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	-0.0171	U	0.171	0.171	0.200	0.174	pCi/g	10/27/15 11:09	10/27/15 16:05	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Bi-214	1.09		0.282	0.304		0.243	pCi/g	10/27/15 11:09	10/27/15 16:05	1
K-40	17.0		2.88	3.36		1.47	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Pb-212	1.16		0.229	0.274		0.219	pCi/g	10/27/15 11:09	10/27/15 16:05	1
Pb-214	1.15		0.233	0.262		0.238	pCi/g	10/27/15 11:09	10/27/15 16:05	1

HJG 9 Nov 15

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Client Sample ID: BBFR-003
Date Collected: 10/25/15 11:55
Date Received: 10/26/15 11:40

Lab Sample ID: 160-14480-3
Matrix: Solid

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

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tl-208	0.496	J	0.137	0.146		0.102	pCi/g	10/27/15 11:09	10/27/15 16:05	1

HWG
9 Nov 15

Method: 9310 - Gross Alpha / Beta (GFPC)

Lab Sample ID: MB 160-218930/1-A
Matrix: Solid
Analysis Batch: 218777

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 218930

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	4.973	U	4.14	4.18	10.0	6.34	pCi/g	10/28/15 15:24	10/28/15 18:55	1
Gross Beta	2.196	U	1.55	1.57	10.0	2.38	pCi/g	10/28/15 15:24	10/28/15 18:55	1

Lab Sample ID: LCS 160-218930/2-A
Matrix: Solid
Analysis Batch: 218777

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218930

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Gross Alpha			27.1	34.97		8.66	10.0	6.79	pCi/g	129	44 - 140		
Gross Beta			26.8	20.58		3.55	10.0	2.86	pCi/g	77	38 - 130		

Lab Sample ID: 160-14480-3 DU
Matrix: Solid
Analysis Batch: 218777

Client Sample ID: BBFR-003
Prep Type: Total/NA
Prep Batch: 218930

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Gross Alpha	24.2			26.25		7.64	10.0	6.50	pCi/g			0.13	1
Gross Beta	22.7			23.24		3.82	10.0	2.87	pCi/g			0.07	1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-218436/1-A
Matrix: Solid
Analysis Batch: 219355

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 218436

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.01664	U	0.0295	0.0295	1.00	0.0532	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-235/236	-0.002389	U	0.00478	0.00478	1.00	0.0580	pCi/g	10/27/15 10:57	10/30/15 12:28	1
Uranium-238	0.01661	U	0.0294	0.0294	1.00	0.0531	pCi/g	10/27/15 10:57	10/30/15 12:28	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*92.5*		*30 - 110*	*10/27/15 10:57*	*10/30/15 12:28*	*1*

Lab Sample ID: LCS 160-218436/2-A
Matrix: Solid
Analysis Batch: 219356

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218436

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Uranium-233/234			6.37	6.650		0.769	1.00	0.0874	pCi/g	104	84 - 120		
Uranium-238			6.51	6.595		0.763	1.00	0.0740	pCi/g	101	82 - 122		

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-218436/2-A
Matrix: Solid
Analysis Batch: 219356

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218436

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Uranium-232	*96.9*		*30 - 110*

Lab Sample ID: 160-14480-1 DU
Matrix: Solid
Analysis Batch: 219358

Client Sample ID: BBFR-001
Prep Type: Total/NA
Prep Batch: 218436

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Uranium-233/234	0.530			0.5308		0.154	1.00	0.0703	pCi/g			0	1
Uranium-235/236	0.0636			0.02461	U	0.0349	1.00	0.0369	pCi/g			0.41	1
Uranium-238	0.493			0.5353		0.153	1.00	0.0602	pCi/g			0.14	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Uranium-232	*101*		*30 - 110*

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

Lab Sample ID: MB 160-218441/1-A
Matrix: Solid
Analysis Batch: 218362

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 218441

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Cesium-137	0.01650	U	0.0368	0.0369	0.200	0.0651	pCi/g	10/27/15 11:09	10/27/15 15:24	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*	*10/27/15 11:09*	*10/27/15 15:24*	*1*

Lab Sample ID: LCS 160-218441/2-A
Matrix: Solid
Analysis Batch: 218369

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218441

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Americium-241			97.2	97.14		10.3		1.46	pCi/g	100	87 - 116		
Cesium-137			30.1	29.42		3.16	0.200	0.350	pCi/g	98	87 - 120		
Cobalt-60			18.6	18.70		2.01		0.187	pCi/g	101	87 - 115		

Lab Sample ID: 160-14480-1 DU
Matrix: Solid
Analysis Batch: 218369

Client Sample ID: BBFR-001
Prep Type: Total/NA
Prep Batch: 218441

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Cesium-137	0.0764	U		0.06227	U	0.102	0.200	0.181	pCi/g			0.07	1

QC Sample Results

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Other Detected Radionuclides	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Ac-228	1.09			0.7646		0.276		0.556	pCi/g			0.50	1
Bi-214	0.865			1.235		0.291		0.172	pCi/g			0.67	1
K-40	17.3			18.76		3.36		1.13	pCi/g			0.22	1
Pb-212	1.06			0.9810		0.317		0.292	pCi/g			0.14	1
Pb-214	0.978			1.097		0.255		0.197	pCi/g			0.23	1
Tl-208	0.245			0.4939		0.139		0.0913	pCi/g			0.95	1

QC Association Summary

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Rad

Leach Batch: 218299

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	Dry and Grind	
160-14480-1 DU	BBFR-001	Total/NA	Solid	Dry and Grind	
160-14480-2	BBFR-002	Total/NA	Solid	Dry and Grind	
160-14480-3	BBFR-003	Total/NA	Solid	Dry and Grind	
160-14480-3 DU	BBFR-003	Total/NA	Solid	Dry and Grind	

Prep Batch: 218436

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	ExtChrom	218299
160-14480-1 DU	BBFR-001	Total/NA	Solid	ExtChrom	218299
160-14480-2	BBFR-002	Total/NA	Solid	ExtChrom	218299
160-14480-3	BBFR-003	Total/NA	Solid	ExtChrom	218299
LCS 160-218436/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-218436/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 218441

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	Fill_Geo-0	218299
160-14480-1 DU	BBFR-001	Total/NA	Solid	Fill_Geo-0	218299
160-14480-2	BBFR-002	Total/NA	Solid	Fill_Geo-0	218299
160-14480-3	BBFR-003	Total/NA	Solid	Fill_Geo-0	218299
LCS 160-218441/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-218441/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Prep Batch: 218930

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	Thin_Layer	218299
160-14480-2	BBFR-002	Total/NA	Solid	Thin_Layer	218299
160-14480-3	BBFR-003	Total/NA	Solid	Thin_Layer	218299
160-14480-3 DU	BBFR-003	Total/NA	Solid	Thin_Layer	218299
LCS 160-218930/2-A	Lab Control Sample	Total/NA	Solid	Thin_Layer	
MB 160-218930/1-A	Method Blank	Total/NA	Solid	Thin_Layer	

Tracer/Carrier Summary

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-1

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)							
Lab Sample ID	Client Sample ID	U-232 (30-110)							
160-14480-1	BBFR-001	97.2							
160-14480-1 DU	BBFR-001	101							
160-14480-2	BBFR-002	93.3							
160-14480-3	BBFR-003	82.3							
LCS 160-218436/2-A	Lab Control Sample	96.9							
MB 160-218436/1-A	Method Blank	92.5							

Tracer/Carrier Legend

U-232 = Uranium-232

TestAmerica

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14480-2
Client Project/Site: Bridgeton Brush Fire Response

For:
Tetra Tech EM Inc.
415 Oak Street
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

Rhonda Ridenhower

Authorized for release by:
11/5/2015 4:35:37 PM
Rhonda Ridenhower, Manager of Project Management
rhonda.ridenhower@testamericainc.com

Designee for

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

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

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

Table of Contents

Job ID: 160-14480-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Tetra Tech EM Inc.

Project: Bridgeton Brush Fire Response

Report Number: 160-14480-2

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 10/26/2015; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0 C.

TOTAL ALPHA RADIUM (GFPC)

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Total Alpha Radium (GFPC) in accordance with SW- 846 Method 9315_Total alpha radium. The samples were dried on 10/26/2015, prepared on 10/28/2015 and analyzed on 10/30/2015.

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

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 10/26/2015, prepared on 10/27/2015 and analyzed on 10/30/2015.

Job ID: 160-14480-2 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

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

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Dave Kinroth	Site Contact: Dave Kinroth	Date: 10-26-15	COC No:
Tetra Tech, Inc.	Tel/Fax: 314-517-6798	Lab Contact: Ericka Gish	Carrier: NA	1 of 1 COCs
415 Oak Street	Analysis Turnaround Time			Sampler:
Kansas City, MO 64106	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(816) 412-1786 Phone	TAT if different from Below _ASAP_____			Walk-in Client:
(816) 816-410-1748 FAX	☐ 2 weeks			Lab Sampling:
Project Name: Bridgeton Brush Fire Response	☐ 1 week			Job / SDG No.:
Site: Bridgeton, MO	☐ 2 days			
P O # not yet assigned	☐ 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)	9310 Gross Alpha/Beta	GA-01-R Gamm Spec	9315 Total Alpha Radium	A-01-R Isotopic Thorium	A-01-R Isotopic Uranium	* 9315 Radium-226 (GFPC)	Sample Specific Notes:
BBFR-001	10/25/2015	11:45	G	soil	1			X	X	X	X	X	X	* 9315 Radium-226 (GFPC)
BBFR-002	10/25/2015	11:50	G	soil	1			X	X	X	X	X	X	contingent upon TAR results
BBFR-003	10/25/2015	11:55	G	soil	1			X	X	X	X	X	X	for all samples

160-14480 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

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.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by: Dave Kinroth Rebecca Kinroth	Company: Tetra Tech START	Date/Time: 10-26-15	Received by:	Company: TestAmerica	Date/Time: 10-26-15 1140
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-14480-2

Login Number: 14480
List Number: 1
Creator: Daniels, Brian J

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.	True	
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	

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-2

Method	Method Description	Protocol	Laboratory
9315	Total Apha Radium (GFPC)	SW846	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14480-1	BBFR-001	Solid	10/25/15 11:45	10/26/15 11:40
160-14480-2	BBFR-002	Solid	10/25/15 11:50	10/26/15 11:40
160-14480-3	BBFR-003	Solid	10/25/15 11:55	10/26/15 11:40

Client Sample ID: BBFR-001

Lab Sample ID: 160-14480-1
Matrix: Solid

Date Collected: 10/25/15 11:45
Date Received: 10/26/15 11:40

Method: 9315 - Total Apha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	3.47		0.417	0.521	1.00	0.228	pCi/g	10/28/15 06:45	10/30/15 18:25	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.7*		*40 - 110*	*10/28/15 06:45*	*10/30/15 18:25*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.904	J	0.172	0.188	1.00	0.0827	pCi/g	10/27/15 10:57	10/30/15 12:25	1
Thorium-230	1.13		0.189	0.212	1.00	0.0483	pCi/g	10/27/15 10:57	10/30/15 12:25	1
Thorium-232	0.829	J	0.161	0.175	1.00	0.0376	pCi/g	10/27/15 10:57	10/30/15 12:25	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.1*		*30 - 110*	*10/27/15 10:57*	*10/30/15 12:25*	*1*

Client Sample ID: BBFR-002

Lab Sample ID: 160-14480-2
Matrix: Solid

Date Collected: 10/25/15 11:50
Date Received: 10/26/15 11:40

Method: 9315 - Total Apha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	3.37		0.440	0.534	1.00	0.291	pCi/g	10/28/15 06:45	10/30/15 18:25	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*86.1*		*40 - 110*	*10/28/15 06:45*	*10/30/15 18:25*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.888	J	0.167	0.182	1.00	0.0760	pCi/g	10/27/15 10:57	10/30/15 12:25	1
Thorium-230	1.06		0.179	0.200	1.00	0.0477	pCi/g	10/27/15 10:57	10/30/15 12:25	1
Thorium-232	0.564	J	0.130	0.139	1.00	0.0419	pCi/g	10/27/15 10:57	10/30/15 12:25	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.8*		*30 - 110*	*10/27/15 10:57*	*10/30/15 12:25*	*1*

Client Sample ID: BBFR-003

Lab Sample ID: 160-14480-3
Matrix: Solid

Date Collected: 10/25/15 11:55
Date Received: 10/26/15 11:40

Method: 9315 - Total Apha Radium (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	3.57		0.435	0.541	1.00	0.261	pCi/g	10/28/15 06:45	10/30/15 18:25	1

HUE 9 November 2015

Client Sample ID: BBFR-003
Date Collected: 10/25/15 11:55
Date Received: 10/26/15 11:40

Lab Sample ID: 160-14480-3
Matrix: Solid

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	93.5		40 - 110	10/28/15 06:45	10/30/15 18:25	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.801	J	0.175	0.188	1.00	0.0919	pCi/g	10/27/15 10:58	10/30/15 12:25	1
Thorium-230	0.772	J	0.168	0.180	1.00	0.0272	pCi/g	10/27/15 10:58	10/30/15 12:25	1
Thorium-232	0.746	J	0.165	0.176	1.00	0.0506	pCi/g	10/27/15 10:58	10/30/15 12:25	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	84.8		30 - 110	10/27/15 10:58	10/30/15 12:25	1

HWE

9 Nov 15

Method: 9315 - Total Apha Radium (GFPC)

Lab Sample ID: MB 160-218740/1-A
Matrix: Solid
Analysis Batch: 219241

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 218740

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Total Alpha Radium	0.1653	U	0.193	0.193	1.00	0.316	pCi/g	10/28/15 06:45	10/30/15 18:25	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*73.2*		*40 - 110*	*10/28/15 06:45*	*10/30/15 18:25*	*1*

Lab Sample ID: LCS 160-218740/2-A
Matrix: Solid
Analysis Batch: 219241

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218740

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Total Alpha Radium			11.2	12.43		1.36	1.00	0.229	pCi/g	111	65 - 150		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*91.7*		*40 - 110*

Lab Sample ID: 160-14480-2 DU
Matrix: Solid
Analysis Batch: 219241

Client Sample ID: BBFR-002
Prep Type: Total/NA
Prep Batch: 218740

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Total Alpha Radium	3.37			3.596		0.535	1.00	0.194	pCi/g			0.21	1

Carrier	*DU %Yield*	*DU Qualifier*	*Limits*
Ba Carrier	*92.8*		*40 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-218434/1-A
Matrix: Solid
Analysis Batch: 219348

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 218434

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.01880	U	0.0427	0.0427	1.00	0.0815	pCi/g	10/27/15 10:57	10/30/15 12:26	1
Thorium-230	0.05788		0.0459	0.0462	1.00	0.0498	pCi/g	10/27/15 10:57	10/30/15 12:26	1
Thorium-232	-0.002003	U	0.00401	0.00401	1.00	0.0388	pCi/g	10/27/15 10:57	10/30/15 12:26	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.8*		*30 - 110*	*10/27/15 10:57*	*10/30/15 12:26*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-218434/2-A
Matrix: Solid
Analysis Batch: 219349

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218434

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	24.94		2.42	1.00	0.0994	pCi/g	102	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*93.7*		*30 - 110*

Lab Sample ID: 160-14480-1 DU
Matrix: Solid
Analysis Batch: 219351

Client Sample ID: BBFR-001
Prep Type: Total/NA
Prep Batch: 218434

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.904			0.6350		0.153	1.00	0.0801	pCi/g			0.79	1
Thorium-230	1.13			1.225		0.219	1.00	0.0425	pCi/g			0.21	1
Thorium-232	0.829			0.6951		0.157	1.00	0.0488	pCi/g			0.40	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*94.6*		*30 - 110*

QC Association Summary

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-2

Rad

Leach Batch: 218299

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	Dry and Grind	
160-14480-1 DU	BBFR-001	Total/NA	Solid	Dry and Grind	
160-14480-2	BBFR-002	Total/NA	Solid	Dry and Grind	
160-14480-2 DU	BBFR-002	Total/NA	Solid	Dry and Grind	
160-14480-3	BBFR-003	Total/NA	Solid	Dry and Grind	

Prep Batch: 218434

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	ExtChrom	218299
160-14480-1 DU	BBFR-001	Total/NA	Solid	ExtChrom	218299
160-14480-2	BBFR-002	Total/NA	Solid	ExtChrom	218299
160-14480-3	BBFR-003	Total/NA	Solid	ExtChrom	218299
LCS 160-218434/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-218434/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 218740

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14480-1	BBFR-001	Total/NA	Solid	DPS-0	218299
160-14480-2	BBFR-002	Total/NA	Solid	DPS-0	218299
160-14480-2 DU	BBFR-002	Total/NA	Solid	DPS-0	218299
160-14480-3	BBFR-003	Total/NA	Solid	DPS-0	218299
LCS 160-218740/2-A	Lab Control Sample	Total/NA	Solid	DPS-0	
MB 160-218740/1-A	Method Blank	Total/NA	Solid	DPS-0	

Tracer/Carrier Summary

Client: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-2

Method: 9315 - Total Apha Radium (GFPC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
Lab Sample ID	Client Sample ID	Ba (40-110)
160-14480-1	BBFR-001	92.7
160-14480-2	BBFR-002	86.1
160-14480-2 DU	BBFR-002	92.8
160-14480-3	BBFR-003	93.5
LCS 160-218740/2-A	Lab Control Sample	91.7
MB 160-218740/1-A	Method Blank	73.2

Tracer/Carrier Legend

Ba = Ba Carrier

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
Lab Sample ID	Client Sample ID	Th-229 (30-110)
160-14480-1	BBFR-001	96.1
160-14480-1 DU	BBFR-001	94.6
160-14480-2	BBFR-002	97.8
160-14480-3	BBFR-003	84.8
LCS 160-218434/2-A	Lab Control Sample	93.7
MB 160-218434/1-A	Method Blank	91.8

Tracer/Carrier Legend

Th-229 = Thorium-229

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: 160-14480-3
Client Project/Site: Bridgeton Brush Fire Response

For:
Tetra Tech EM Inc.
415 Oak Street
Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

Rhonda Ridenhower

Authorized for release by:
12/3/2015 2:37:09 PM
Rhonda Ridenhower, Manager of Project Management
rhonda.ridenhower@testamericainc.com

Designee for

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

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

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

Table of Contents

Job ID: 160-14480-3

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Tetra Tech EM Inc.

Project: Bridgeton Brush Fire Response

Report Number: 160-14480-3

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 10/26/2015; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0 C. Additional analysis requested per the client and not listed on the CoC.

RADIUM-226 (GFPC)

Samples BBFR-001 (160-14480-1), BBFR-002 (160-14480-2) and BBFR-003 (160-14480-3) were analyzed for Radium-226 (GFPC) in accordance with SW- 846 Method 9315. The samples were dried on 10/26/2015, and prepared and analyzed on 11/30/2015.

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

Chain of Custody Record

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc.

Client Contact		
Tetra Tech, Inc.	Project Manager: Dave Kinroth	Site Contact: Dave Kinroth
415 Oak Street	Tel/Fax: 314-517-6798	Lab Contact: Ericka Gish
Kansas City, MO 64106	Date: 10-26-15	Carrier: NA
(816) 412-1786 Phone	COC No:	1 of 1 COCs
(816) 816-410-1748 FAX	Sampler:	
Project Name: Bridgeton Brush Fire Response	For Lab Use Only:	
Site: Bridgeton, MO	Walk-in Client:	Lab Sampling:
P O # not yet assigned	Job / SDG No.:	

Analysis Turnaround Time
☐ CALENDAR DAYS ☐ WORKING DAYS
TAT if different from Below _ASAP_________
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 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)	9310 Gross Alpha/Beta	GA-01-R Gamm Spec	9315 Total Alpha Radium	A-01-R Isotopic Thorium	A-01-R Isotopic Uranium	* 9315 Radium-226 (GFPC)	Sample Specific Notes:
BBFR-001	10/25/2015	11:45	G	soil	1			X	X	X	X	X	X	* 9315 Radium-226 (GFPC)
BBFR-002	10/25/2015	11:50	G	soil	1			X	X	X	X	X	X	contingent upon TAR results
BBFR-003	10/25/2015	11:55	G	soil	1			X	X	X	X	X	X	for all samples

160-14480 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

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.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:________ Corr'd:________ Therm ID No.:________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dave Kinroth [signature]	Tetra Tech START	10-26-15	[signature]	[signature]	10-26-15 / 1140
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-14480-3

Login Number: 14480
List Number: 1
Creator: Daniels, Brian J

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.	True	
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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-3

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-3

Method	Method Description	Protocol	Laboratory
9315	Radium-226 (GFPC)	SW846	TAL SL

Protocol References:

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: Tetra Tech EM Inc.
Project/Site: Bridgeton Brush Fire Response

TestAmerica Job ID: 160-14480-3

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14480-1	BBFR-001	Solid	10/25/15 11:45	10/26/15 11:40
160-14480-2	BBFR-002	Solid	10/25/15 11:50	10/26/15 11:40
160-14480-3	BBFR-003	Solid	10/25/15 11:55	10/26/15 11:40

Client Sample ID: BBFR-001

Lab Sample ID: 160-14480-1
Matrix: Solid
Date Collected: 10/25/15 11:45
Date Received: 10/26/15 11:40

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.08		0.128	0.160	1.00	0.0833	pCi/g	11/30/15 16:57	11/30/15 21:13	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	92.7		40 - 110	11/30/15 16:57	11/30/15 21:13	1

Client Sample ID: BBFR-002

Lab Sample ID: 160-14480-2
Matrix: Solid
Date Collected: 10/25/15 11:50
Date Received: 10/26/15 11:40

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.08		0.134	0.166	1.00	0.0903	pCi/g	11/30/15 16:57	11/30/15 21:13	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	86.1		40 - 110	11/30/15 16:57	11/30/15 21:13	1

Client Sample ID: BBFR-003

Lab Sample ID: 160-14480-3
Matrix: Solid
Date Collected: 10/25/15 11:55
Date Received: 10/26/15 11:40

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.03		0.122	0.153	1.00	0.0507	pCi/g	11/30/15 16:57	11/30/15 21:13	1

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	93.5		40 - 110	11/30/15 16:57	11/30/15 21:13	1

HWE
7 December 2015

Method: 9315 - Radium-226 (GFPC)

Lab Sample ID: MB 160-224756/1-A
Matrix: Solid
Analysis Batch: 224593

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 224756

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.02835	U	0.0465	0.0465	1.00	0.0800	pCi/g	11/30/15 16:57	11/30/15 21:12	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*73.2*		*40 - 110*	*11/30/15 16:57*	*11/30/15 21:12*	*1*

Lab Sample ID: LCS 160-224756/2-A
Matrix: Solid
Analysis Batch: 224593

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 224756

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-226			11.2	13.13		1.25	1.00	0.0918	pCi/g	118	65 - 140		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*91.7*		*40 - 110*

Lab Sample ID: 160-14480-2 DU
Matrix: Solid
Analysis Batch: 224593

Client Sample ID: BBFR-002
Prep Type: Total/NA
Prep Batch: 224756

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Radium-226	1.08			0.9149		0.141	1.00	0.0540	pCi/g			0.55	1

Carrier	*DU %Yield*	*DU Qualifier*	*Limits*
Ba Carrier	*92.8*		*40 - 110*

APPENDIX D

EPA FIGURE SHOWING GRASS FIRE BURN AREA IN RELATION TO NEAREST KNOWN LOCATION OF WEST LAKE RADIOLOGICALLY IMPACTED MATERIAL