

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: 160-18504-2

Client Project/Site: ORNL Y-12 Outfall 200 Characterization

For:

Alliant Corporation
320 N Cedar Bluff Road
Suite 200
Knoxville, Tennessee 37923

Attn: Doug Milloway



Authorized for release by:
9/16/2016 2:04:49 PM

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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: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Job ID: 160-18504-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Alliant Corporation

Project: ORNL Y-12 Outfall 200 Characterization

Report Number: 160-18504-2

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 8/5/2016 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 0.6° C.

RADIUM-226 BY ALPHA SPECTROMETRY

Samples YMTFA39SE001 (160-18504-1), YMTFA40SE001 (160-18504-2), YMTFA41SE001 (160-18504-3) and YMTFA73SE001 (160-18504-4) were analyzed for Radium-226 by Alpha Spectrometry in accordance with ST-RC-0301. The samples were dried on 08/08/2016, prepared on 08/22/2016 and analyzed on 09/15/2016.

The At-217 tracer recovery for the following samples was low outside the QC limits of 30%: LCS 160-266021/2-A: 28.2%. The DOE/DOD Quality Systems Manual for Environmental Laboratories (QSM Rev. 5.0) allows for reporting results as quantitative when tracer recoveries are below 30% if a) the relative uncertainty associated with the tracer recovery is less than 10% (2 sigma), b) spectral resolution requirements are met and there are no indications of spectral interferences, and c) detection limit requirements are met. All three of these criteria are met for these samples: a) a minimum of 400 counts (which leads to 10% count uncertainty at 2 sigma) in the tracer peak, b) resolution of < 100 keV is met for all peaks, and c) the activity in the sample is well above the MDC. The data have been qualified and

Case Narrative

Client: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Job ID: 160-18504-2 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

reported.

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

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Login Sample Receipt Checklist

Client: Alliant Corporation

Job Number: 160-18504-2

Login Number: 18504

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.	True	
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?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	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: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Qualifiers

Rad

Qualifier	Qualifier Description
S	Tracer is outside acceptance limits.

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: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Method	Method Description	Protocol	Laboratory
ST-RC-0301	Radium-226 (Alpha Spectrometry)	TAL-STL	TAL SL

Protocol References:

TAL-STL = TestAmerica Laboratories, St. Louis, Facility Standard Operating Procedure.

Laboratory References:

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

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Sample Summary

Client: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-18504-1	YMTFA39SE001	Solid	08/04/16 09:00	08/05/16 10:00
160-18504-2	YMTFA40SE001	Solid	08/04/16 12:40	08/05/16 10:00
160-18504-3	YMTFA41SE001	Solid	08/04/16 13:25	08/05/16 10:00
160-18504-4	YMTFA73SE001	Solid	08/04/16 14:00	08/05/16 10:00

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Client Sample Results

Client: Alliant Corporation
 Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Client Sample ID: YMTFA39SE001

Date Collected: 08/04/16 09:00

Date Received: 08/05/16 10:00

Lab Sample ID: 160-18504-1

Matrix: Solid

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.772		0.179	0.191	1.00	0.0948	pCi/g	08/22/16 18:53	09/15/16 10:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
At-217	36.9		30 - 110					08/22/16 18:53	09/15/16 10:20	1

Client Sample ID: YMTFA40SE001

Date Collected: 08/04/16 12:40

Date Received: 08/05/16 10:00

Lab Sample ID: 160-18504-2

Matrix: Solid

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.21		0.221	0.244	1.00	0.0937	pCi/g	08/22/16 18:53	09/15/16 10:19	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
At-217	36.7		30 - 110					08/22/16 18:53	09/15/16 10:19	1

Client Sample ID: YMTFA41SE001

Date Collected: 08/04/16 13:25

Date Received: 08/05/16 10:00

Lab Sample ID: 160-18504-3

Matrix: Solid

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.923		0.187	0.203	1.00	0.0714	pCi/g	08/22/16 18:53	09/15/16 10:19	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
At-217	39.9		30 - 110					08/22/16 18:53	09/15/16 10:19	1

Client Sample ID: YMTFA73SE001

Date Collected: 08/04/16 14:00

Date Received: 08/05/16 10:00

Lab Sample ID: 160-18504-4

Matrix: Solid

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.710		0.156	0.167	1.00	0.0781	pCi/g	08/22/16 18:53	09/15/16 10:19	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
At-217	45.5		30 - 110					08/22/16 18:53	09/15/16 10:19	1

TestAmerica St. Louis

QC Sample Results

Client: Alliant Corporation
 Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Lab Sample ID: MB 160-266021/1-A
Matrix: Solid
Analysis Batch: 270177

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 266021

Analyte	MB MB		Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
	Result	Qualifier	Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Radium-226	0.1953		0.0942	0.0956	1.00	0.0787	pCi/g	08/22/16 18:53	09/15/16 10:20	1
Tracer	MB MB		Limits		Prepared	Analyzed	Dil Fac			
At-217	%Yield	Qualifier	Limits							
At-217	36.5		30 - 110		08/22/16 18:53	09/15/16 10:20	1			

Lab Sample ID: LCS 160-266021/2-A
Matrix: Solid
Analysis Batch: 270178

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 266021

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tracer	LCS LCS		Limits		Prepared	Analyzed	Dil Fac		
At-217	%Yield	Qualifier	Limits						
At-217	28.2	S	30 - 110						

Lab Sample ID: 160-18504-1 DU
Matrix: Solid
Analysis Batch: 270180

Client Sample ID: YMTFA39SE001
Prep Type: Total/NA
Prep Batch: 266021

Analyte	Sample Sample		DU	DU	Total	RL	MDC	Unit	RER	RER Limit
	Result	Qual	Result	Qual	Uncert. (2σ+/-)					
Radium-226	0.772		0.6592		0.171	1.00	0.152	pCi/g	0.31	1
Tracer	DU DU		Limits		Prepared	Analyzed	Dil Fac			
At-217	%Yield	Qualifier	Limits							
At-217	50.0		30 - 110							

QC Association Summary

Client: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Rad

Leach Batch: 263919

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18504-1	YMTFA39SE001	Total/NA	Solid	Dry and Grind	
160-18504-2	YMTFA40SE001	Total/NA	Solid	Dry and Grind	
160-18504-3	YMTFA41SE001	Total/NA	Solid	Dry and Grind	
160-18504-4	YMTFA73SE001	Total/NA	Solid	Dry and Grind	
160-18504-1 DU	YMTFA39SE001	Total/NA	Solid	Dry and Grind	

Prep Batch: 266021

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-18504-1	YMTFA39SE001	Total/NA	Solid	DPS-0	263919
160-18504-2	YMTFA40SE001	Total/NA	Solid	DPS-0	263919
160-18504-3	YMTFA41SE001	Total/NA	Solid	DPS-0	263919
160-18504-4	YMTFA73SE001	Total/NA	Solid	DPS-0	263919
MB 160-266021/1-A	Method Blank	Total/NA	Solid	DPS-0	
LCS 160-266021/2-A	Lab Control Sample	Total/NA	Solid	DPS-0	
160-18504-1 DU	YMTFA39SE001	Total/NA	Solid	DPS-0	263919

Tracer/Carrier Summary

Client: Alliant Corporation
Project/Site: ORNL Y-12 Outfall 200 Characterization

TestAmerica Job ID: 160-18504-2

Method: ST-RC-0301 - Radium-226 (Alpha Spectrometry)

Matrix: Solid

Prep Type: Total/NA

Percent Yield (Acceptance Limits)

Lab Sample ID	Client Sample ID	At-217 (30-110)
160-18504-1	YMTFA39SE001	36.9
160-18504-1 DU	YMTFA39SE001	50.0
160-18504-2	YMTFA40SE001	36.7
160-18504-3	YMTFA41SE001	39.9
160-18504-4	YMTFA73SE001	45.5
LCS 160-266021/2-A	Lab Control Sample	28.2 S
MB 160-266021/1-A	Method Blank	36.5

Tracer/Carrier Legend

At-217 = At-217