

April 22, 2016

Analytical Data Package Prepared For
CH2M Hill Plateau Remediation

Radiochemical Analysis By
TestAmerica Inc

2800 G.W. Way, Richland Wa, 99354, (509)-375-3131.

Assigned Laboratory Code: TARL
Data Package Contains 16 Pages

Report No.: 68469

Results in this report relate only to the sample(s) analyzed.

SDG No.	Order No.	Client Sample ID (List Order)	Lot-Sa No.	Work Order	Report DB ID	Batch No.
W07434	F16-020	B34T32	J6C290414-1	M8FEM1AA	9M8FEM10	6090019
		B34T34	J6C290414-2	M8FEN1AA	9M8FEN10	6090019



Certificate of Analysis

CH2M Hill Plateau Remediation Company
P.O. Box 1600
Mail Stop – R3-60
Richland, WA 99352

April 22, 2016

Attention: Scot Fitzgerald

SAF Number	:	F16-020
Date SDG Closed	:	March 29, 2016
Number of Samples	:	Two (2)
Sample Type	:	Soil
SDG Number	:	W07434
Data Deliverable	:	30-Day / Summary

CASE NARRATIVE

I. Introduction

On March 29, 2016, two soil samples were received at TestAmerica (TARL). Upon receipt, the samples were assigned laboratory ID numbers to correspond with the CH2M specific IDs.

II. Sample Receipt

The samples were received in good condition and no anomalies were noted during check-in.

III. Analytical Results/Methodology

The analytical results for this report are presented by laboratory sample ID. Each set of data includes sample identification information, analytical results and the appropriate associated statistical errors.

The requested analyses were:

Liquid Scintillation Counting
Technetium-99 by TEVA method RL-LSC-014

CH2M Hill Plateau Remediation Company
April 22, 2016

IV. Quality Control

The analytical results for each analysis performed includes a minimum of one laboratory control sample (LCS), one method (reagent) blank, and one duplicate sample analysis. Any exceptions have been noted in the "Comments" section.

The analytical results are reported on a dry weight basis.

QC and sample results are reported in the same units.

V. Comments

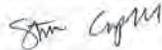
Liquid Scintillation Counting

Technetium-99 by TEVA method RL-LSC-014:

No analytical or quality issues were noted. The sample results and associated batch QC results are within contractual requirements.

We certify that this data package is in compliance with the SOW, both technically and for completeness, including a full description of, explanation of, and corrective actions for, any and all deviations, from either the analyses requested or the case narrative requested. Release of the data contained in this hard copy data package has been authorized by the Laboratory Analytical Manager (or designee) and the laboratory's client services representative as verified by their signatures on this report.

Reviewed and approved:

 Digitally signed by
Steven Campbell
Date: 2016.04.22
12:22:41 -07'00'

Steven Campbell
Project Manager Assistant

Drinking Water Method Cross References

DRINKING WATER ASTM METHOD CROSS REFERENCES		
Referenced Method	Isotope(s)	TestAmerica Richland's SOP No.
EPA 901.1	Cs-134, I-131	RL-GAM-001
EPA 900.0	Alpha & Beta	RL-GPC-001
EPA 00-02	Gross Alpha (Coprecipitation)	RL-GPC-002
EPA 903.0	Total Alpha Radium (Ra-226)	RL-RA-002
EPA 903.1	Ra-226	RL-RA-001
EPA 904.0	Ra-228	RL-RA-001
EPA 905.0	Sr-89/90	RL-GPC-003
ASTM D5174	Uranium	RL-KPA-003
EPA 906.0	Tritium	RL-LSC-005

Results in this report relate only to the sample(s) analyzed.

Uncertainty Estimation

TestAmerica Richland has adopted the internationally accepted approach to estimating uncertainties described in "NIST Technical Note 1297, 1994 Edition". The approach, "Law of Propagation of Errors", involves the identification of all variables in an analytical method which are used to derive a result. These variables are related to the analytical result (R) by some functional relationship, $R = \text{constants} * f(x,y,z,\dots)$. The components (x,y,z) are evaluated to determine their contribution to the overall method uncertainty. The individual component uncertainties (u_i) are then combined using a statistical model that provides the most probable overall uncertainty value. All component uncertainties are categorized as type A, evaluated by statistical methods, or type B, evaluated by other means. Uncertainties not included in the components, such as sample homogeneity, are combined with the component uncertainty as the square root of the sum-of-the-squares of the individual uncertainties. The uncertainty associated with the derived result is the combined uncertainty (u_c) multiplied by the coverage factor (1,2, or 3).

When three or more sample replicates are used to derive the analytical result, the type A uncertainty is the standard deviation of the mean value (S/\sqrt{n}), where S is the standard deviation of the derived results. The type B uncertainties are all other random or non-random components that are not included in the standard deviation.

The derivation of the general "Law of Propagation of Errors" equations and specific example are available on request.

Report Definitions

Action Lev	An agreed upon activity level used to trigger some action when the final result is greater than or equal to the Action Level. Often the Action Level is related to the Decision Limit.
Batch	The QC preparation batch number that relates laboratory samples to QC samples that were prepared and analyzed together.
Bias	Defined by the equation (Result/Expected)-1 as defined by ANSI N13.30.
COC No	Chain of Custody Number assigned by the Client or TestAmerica.
Count Error (#s)	Poisson counting statistics of the gross sample count and background. The uncertainty is absolute and in the same units as the result. For Liquid Scintillation Counting (LSC) the batch blank count is the background.
CSU (#s) <i>u_c Combined Standard Uncert.</i>	All known uncertainties associated with the preparation and analysis of the sample are propagated to give a measure of the uncertainty associated with the result, <i>u_c the combined standard uncertainty</i> . The uncertainty is absolute and in the same units as the result.
(#s), Coverage Factor	The coverage factor defines the width of the confidence interval, 1, 2 or 3 standard deviations.
CRDL (RL)	Contractual Required Detection Limit as defined in the Client's Statement Of Work or TestAmerica "default" nominal detection limit. Often referred to the reporting level (RL)
Lc	Decision Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume associated with the sample. The Type I error probability is approximately 5%. $Lc = (1.645 * \sqrt{2 * (BkgrndCnt / BkgrndCntMin) / SCntMin}) * (ConvFct / (Eff * Yld * Abn * Vol) * IngrFct)$. For LSC methods the batch blank is used as a measure of the background variability. Lc cannot be calculated when the background count is zero.
Lot-Sample No	The number assigned by the LIMS software to track samples received on the same day for a given client. The sample number is a sequential number assigned to each sample in the Lot.
MDC MDA	Detection Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume with a Type I and II error probability of approximately 5%. $MDC = (4.65 * \sqrt{(BkgrndCnt / BkgrndCntMin) / SCntMin} + 2.71 / SCntMin) * (ConvFct / (Eff * Yld * Abn * Vol) * IngrFct)$. For LSC methods the batch blank is used as a measure of the background variability.
Primary Detector	The instrument identifier associated with the analysis of the sample aliquot.
Ratio U-234/U-238	The U-234 result divided by the U-238 result. The U-234/U-238 ratio for natural uranium in NIST SRM 4321C is 1.038.
Rst/MDC	Ratio of the Result to the MDC. A value greater than 1 may indicate activity above background at a high level of confidence. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Rst/TotUcert	Ratio of the Result to the Total Uncertainty. If the uncertainty has a coverage factor of 2 a value greater than 1 may indicate activity above background at approximately the 95% level of confidence assuming a two-sided confidence interval. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Report DB No	Sample Identifier used by the report system. The number is based upon the first five digits of the Work Order Number.
RER	The equation Replicate Error Ratio = $(S - D) / [\sqrt{TPUs^2 + TPUD^2}]$ as defined by ICPT BOA where S is the original sample result, D is the result of the duplicate, TPUs is the total uncertainty of the original sample and TPUD is the total uncertainty of the duplicate sample.
SDG	Sample Delivery Group Number assigned by the Client or assigned by TestAmerica upon sample receipt.
Sum Rpt Alpha Spec Rst(s)	The sum of the reported alpha spec results for tests derived from the same sample excluding duplicate result where the results are in the same units.
Work Order	The LIMS software assign test specific identifier.
Yield	The recovery of the tracer added to the sample such as Pu-242 used to trace a Pu-239/40 method.

CH2MHill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST		FIG-020-085	PAGE 1 OF 1
COLLECTOR <i>SM Sexton</i>	COMPANY CONTACT TODAK, D	TELEPHONE NO. 376-6427	PROJECT COORDINATOR TODAK, D	PRICE CODE 8H	DATA TURNAROUND 30 Days / 30 Days
SAMPLING LOCATION C9550, Core 31, B34111	PROJECT DESIGNATION 200-DV-1 Operable Unit Characterization of Waste Sites Phase 3 Sampling	SAF NO. F16-020	COA 302914	AIR QUALITY <input type="checkbox"/>	ORIGINAL
ICE CHEST NO. N/A	FIELD LOGBOOK NO. N/A	ACTUAL SAMPLE DEPTH 194.0 - 196.0	METHOD OF SHIPMENT BY <i>3-29-16</i> GOVERNMENT VEHICLE <i>Company</i>		
SHIPPED TO TestAmerica Incorporated, Richland	OFFSITE PROPERTY NO. N/A		BILL OF LADING/AIR BILL NO. N/A		

MATRIX*	POSSIBLE SAMPLE HAZARDS/ REMARKS	PRESERVATION	HOLDING TIME	TYPE OF CONTAINER	NO. OF CONTAINER(S)	VOLUME	SAMPLE ANALYSIS	SAMPLE DATE	SAMPLE TIME	
A=Air DL=Drum Liquids DS=Drum Solids L=Liquid O=Oil S=Soil SE=Sediment T=Tissue V=Vegetation W=Water WI=Wipe X=Other	*Contains Radioactive Material at concentrations that are not be regulated for transportation per 49 CFR/IATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1. NA	None	6 Months	None	1	60mL	TC99_ETVDSK LSC: COMMON;	3/29/16	1449	X
	SPECIAL HANDLING AND/OR STORAGE									

J6C29D414
W27434
m8 fen

CHAIN OF POSSESSION		SIGN/ PRINT NAMES		SPECIAL INSTRUCTIONS	
RELINQUISHED BY/REMOVED FROM <i>SM Sexton</i>	DATE/TIME 3/29/16 1625	RECEIVED BY/STORED IN <i>J. Bock, TARL</i>	DATE/TIME 3-29-16/1625	Sample From HEIS #: <i>B34111</i>	Actual Aliquot Collection
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	Depth: <i>194.0 - 196.0</i>	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
LABORATORY SECTION	RECEIVED BY	TITLE		DATE/TIME	
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY		DATE/TIME	
PRINTED ON 2/29/2016	PI FSR ID = FSR25908	TRVL NUM = TRVL-16-100		A-6003-618 (REV 2)	

THE LEADER IN ENVIRONMENTAL TESTING

Date/Time Received: 3-29-16/1625 Container GM Screen Result: (Airlock) 0 cpm Initials []
Sample GM Screen Result (Sample Receiving) 0 cpm Initials []

Client: FLH SDG #: W07434 SAF #: F16-020 NA []

Lot Number: J6C290414

Chain of Custody # F16-020-083; 085

Shipping Container ID or Air Bill Number : NA []

Samples received inside shipping container/cooler/box Yes [] Continue with 1 through 4. Initial appropriate response,
No [] Go to 5, add comment to #16.

- 1. Custody Seals on shipping container intact? Yes [] No [] No Custody Seal []
- 2. Custody Seals dated and signed? Yes [] No [] No Custody Seal []
- 3. Cooler temperature: °C NA []
- 4. Vermiculite/packing materials is NA [] Wet [] Dry []

Item 5 through 16 for samples. Initial appropriate response.

- 5. Chain of Custody record present? Yes [] No []
- 6. Number of samples received (Each sample may contain multiple bottles): 2
- 7. Containers received: 2 x 60 ml

- 8. Sample holding times exceeded? NA [] Yes [] No []
- 9. Samples have: tape hazard labels custody seals appropriate sample labels
- 10. Matrix: A (FLT, Wipe, Solid, Soil) I (Water) S (Air, Niosh 7400) T (Biological, Ni-63)

11. Samples: are in good condition are leaking are broken
have air bubbles (Only for samples requiring no head space) Other

- 12. Sample pH appropriate for analysis requested Yes [] No [] NA []
(If acidification is necessary go to pH area & document sample ID, initial pH, amount of HNO₃ added and pH after addition on table)
- 13. Were any anomalies identified in sample receipt? Yes [] No []
- 14. Description of anomalies (include sample numbers): NA []

15. Sample Location, Sample Collector Listed on COC? * Yes [] No []
*For documentation only. No corrective action needed.

16. Additional Information: w/A

[] Client/Courier denied temperature check.

[] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:

Signature: Julie Beck

Date: 3-29-16

Client Notification needed? Yes [] No []

By:

Person contacted:

No action necessary; process as is

Project Manager Whitney M. Petari

Date 3/29/16

Sample Results Summary

Date: 22-Apr-16

TestAmerica Inc TARL

Ordered by Method, Batch No., Client Sample ID.

Report No. : 68469

SDG No: W07434

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6090019	TC99_ETVDSK_LSC								
	B34T32								
	M8FEM1AA	Tc-99	1.39E-01 +- 2.6E-01	U	pCi/g	100%	5.61E-01	1.50E+00	
	B34T32 DUP								
	M8FEM1AC	Tc-99	1.43E-01 +- 2.8E-01	U	pCi/g	100%	5.97E-01	1.50E+00	3.1
	B34T34								
	M8FEN1AA	Tc-99	1.60E+01 +- 7.2E-01		pCi/g	100%	5.99E-01	1.50E+00	
	No. of Results: 3								

QC Results Summary
 TestAmerica Inc TARL
 Ordered by Method, Batch No, QC Type,.

Date: 22-Apr-16

Report No. : 68469

SDG No.: W07434

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
TC99_ETVDSK_LSC									
6090019	MATRIX SPIKE, B34T34								
	M8FEN1AC	Tc-99	2.10E+02 +- 5.8E+00		pCi/g	100%	93%	-0.1	5.93E-01
6090019	BLANK QC,								
	M8FFK1AA	Tc-99	-4.34E-01 +- 2.4E-01	U	pCi/g	100%			5.52E-01
6090019	LCS,								
	M8FFK1AC	Tc-99	3.21E+01 +- 1.1E+00		pCi/g	100%	96%	0.0	5.90E-01
No. of Results: 3									

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 rptSTLRchQcSummary V5.5.1 A2002 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

Date: 22-Apr-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc **SDG:** W07434 **Collection Date:** 3/29/2016 1:14:00 PM
Lot-Sample No.: J6C290414-1 **Report No.:** 68469 **Received Date:** 3/29/2016 4:25:00 PM
Client Sample ID: B34T32 **COC No.:** F16-020-083 **Matrix:** SOIL

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 6090019	TC99_ETVDSK_LSC				Work Order: M8FEM1AA	Report DB ID: 9M8FEM10						
Tc-99	1.39E-01	U	2.4E-01	2.6E-01	5.61E-01	pCi/g	100%	0.25	4/15/16 10:43 p		2.14	LSC8
						2.69E-01	1.50E+00	(1.)			g	

No. of Results: 1 Comments:

TestAmerica Inc MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rpt\$TLRchSample U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 V 5.1 A2002

FORM I

Date: 22-Apr-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc **SDG:** W07434 **Collection Date:** 3/29/2016 2:49:00 PM
Lot-Sample No.: J6C290414-2 **Report No.:** 68469 **Received Date:** 3/29/2016 4:25:00 PM
Client Sample ID: B34T34 **COC No.:** F16-020-085 **Matrix:** SOIL

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 6090019	TC99_ETVDSK_LSC				Work Order: M8FEN1AA	Report DB ID: 9M8FEN10						
Tc-99	1.60E+01		5.9E-01	7.2E-01	5.99E-01	pCi/g	100%	(26.7)	4/16/16 12:48 a		1.99	LSC8
						2.87E-01	1.50E+00	(44.2)			g	

No. of Results: 1 Comments:

TestAmerica Inc MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rpt\$TLRchSample U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 V 5.1 A2002

FORM II

Date: 22-Apr-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6C290414-1
 Client Sample ID: B34T32 DUP
 SDG: W07434
 Report No.: 68469
 COC No.: F16-020-083
 Matrix: SOIL
 Collection Date: 3/29/2016 1:14:00 PM
 Received Date: 3/29/2016 4:25:00 PM

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 6090019	TC99_ETVDSK_LSC				Work Order: M8FEM1AC	Report DB ID: M8FEM1CR			Orig Sa DB ID: 9M8FEM10			
Tc-99	1.43E-01	U	2.5E-01	2.8E-01	5.97E-01	pCi/g	100%	0.24	4/15/16 11:45 p		2.0	LSC8
	1.39E-01	U	RPD 3.1			1.50E+00	(1.)				g	

No. of Results: 1 Comments:

TestAmerica Inc RPD - Relative Percent Difference.
 MDC(MDA),Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rps TLRchDupV5.
 5-AZ002 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

Date: 22-Apr-16

BLANK RESULTS

Lab Name: TestAmerica Inc SDG: W07434 Report No.: 68469
 Matrix: SOIL

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 6090019 TC99_ETVDSK_LSC Work Order: M8FFK1AA Report DB ID: M8FFK1AB												
Tc-99	-4.34E-01	U	2.1E-01	2.4E-01	5.52E-01	pCi/g	100%	-0.79	4/16/16 02:52 a	2.14	2.14	LSC8
					2.64E-01	1.50E+00		-(3.6)			g	

No. of Results: 1 Comments:

TestAmerica Inc MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rptS TLRchBlank U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 V5.1 A2002

FORM II
LCS RESULTS

Date: 22-Apr-16

Lab Name: TestAmerica Inc SDG: W07434
 Matrix: SOIL Report No.: 68469

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL	Report Unit	Yield	Expected	Expected Uncert	Recovery, Bias	Analysis, Prep Date	Aliquot Size	Primary Detector
Batch: 6090019	TC99_ETVDSK_LSC												
Tc-99	3.21E+01		8.0E-01	1.1E+00	5.90E-01	pCi/g	100%	3.36E+01	1.92E-01	96%	4/16/16 03:54 a	2.03	LSC8
							Rec Limits:	70	130	0.0		g	

No. of Results: 1 Comments:

FORM II

Date: 22-Apr-16

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W07434 Matrix: SOIL
 Lot-Sample No.: J6C290414-2, B34T34 Report No.: 68469

Parameter	SpikeResult, Orig Rst	Count Error (2 s)	CSU (2 s)	MDC/JMDA	Rpt Unit	Yield	Recovery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 6090019	Work Order: M8FEN1AC	Report DB ID: M8FEN1CW	Orig Sa DB ID: 9M8FEN10								
Tc-99	2.10E+02	2.0E+00	5.8E+00	5.93E-01	pCi/g	100%	92.58%	2.27E+02 1.30E+00	4/16/16 01:50 a	2.0	TC99_ETVDSK_LSC LSC8

Number of Results: 1

Comments:

TestAmerica Inc RER - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.
 rptS TLRchMs Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 V5.1 A2002