

March 31, 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 14 Pages

Report No.: 68356

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.
W07422	F16-020	B34T20	J6C220423-1	M8D7V1AA	9M8D7V10	6082046



Certificate of Analysis

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

March 31, 2016

Attention: Scot Fitzgerald

SAF Number	:	F16-020
Date SDG Closed	:	March 18, 2016
Number of Samples	:	One (1)
Sample Type	:	Soil
SDG Number	:	W07422
Data Deliverable	:	30-Day / Summary

CASE NARRATIVE

I. Introduction

On March 18, 2016, one soil sample was received at TestAmerica (TARL). Upon receipt, the sample was assigned laboratory ID numbers to correspond with the CH2M specific IDs.

II. Sample Receipt

The sample was 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
March 31, 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: 2016.03.31
15:19:22 -07'00'

Steven Campbell
Project Manager

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.

March 31, 2016

CH2M Hill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST		F16-020-071	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 2, B340T3	PROJECT DESIGNATION 200-DV-1 Operable Unit Characterization of Waste Sites Phase 3 Sampling	FIELD LOGBOOK NO. <i>N/A</i>	SAF NO. F16-020	AIR QUALITY <input type="checkbox"/>	METHOD OF SHIPMENT GOVERNMENT VEHICLE SMS <i>Com per 3-18-16 vehicle</i>
ICE CHEST NO. <i>#1</i>	ACTUAL SAMPLE DEPTH <i>49.9-51.9</i>	OFFSITE PROPERTY NO. <i>N/A</i>	COA 302914	ORIGINAL	
SHIPPED TO TestAmerica Incorporated, Richland		BILL OF LADING/AIR BILL NO.			

MATRIX*	PRESERVATION	None
A=Air	HOLDING TIME	6 Months
DL=Drum	TYPE OF CONTAINER	None
Liquids	NO. OF CONTAINER(S)	1
DS=Drum	VOLUME	60ml
Solids	SAMPLE ANALYSIS	TOX.FVDSK. LSC. COMMON;
L=Liquid	SAMPLE DATE	3/18/16
O=Oil	SAMPLE TIME	1417
S=Soil		
SE=Sediment		
T=Tissue		
V=Vegetation		
W=Water		
WI=Wipe		
X=Other		
SAMPLE NO. B340T3	MATRIX*	SOIL
	SPECIAL HANDLING AND/OR STORAGE	

J6C220423
W01422
MSDNV



CHAIN OF POSSESSION		SIGN/ PRINT NAMES	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
<i>SM Sexton</i>	<i>3/18/16 1535</i>	<i>Book J Sexton</i>	<i>3-18-16/1535</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
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	
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY	

SPECIAL INSTRUCTIONS *3-18-16*
Sample From HEIS #: *B340T3* Actual Aliquot Collection
Depth: *49.9-51.9*
SMS 3-18-16

March 31, 2016 Sample Receipt List

Date/Time Received: 3-18-16/1535 Container GM Screen Result: (Airlock) 0 cpm Initials []

Sample GM Screen Result (Sample Receiving) 0 cpm Initials []

Client: FLH SDG #: W07422 SAF #: F16-020 NA []

Lot Number: J6C220423

Chain of Custody # F16-020-011

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): 1
7. Containers received: 1 x 60ml

- 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: [Signature] Date: 3-18-16

Client Notification needed? Yes [] No [] Date: By: Person contacted:

No action necessary; process as is

Project Manager Whitney Whitani Date 3/22/16

March 31, 2016

Sample Results Summary

Date: 31-Mar-16

TestAmerica Inc TARL

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

Report No. : 68356

SDG No: W07421

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6082046	TC99_ETVDSK_LSC								
	B33W31 DUP								
	M8D1P1AR	Tc-99	-1.29E-02 +- 2.9E-01	U	pCi/g	100%	6.22E-01	1.50E+00	-170.9
	B34T20								
	M8D7V1AA	Tc-99	-3.01E-02 +- 2.9E-01	U	pCi/g	100%	6.25E-01	1.50E+00	
	No. of Results:	2							

March 31, 2016

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

Date: 31-Mar-16

Report No. : 68356

SDG No.: W07421

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
TC99_ETVDSK_LSC									
6082046	MATRIX SPIKE, B33W35								
	M8D1Q1AP	Tc-99	1.91E+02 +- 4.7E+00		pCi/g	100%	85%	-0.2	6.22E-01
6082046	BLANK QC,								
	M8D4L1AA	Tc-99	-1.61E-02 +- 2.8E-01	U	pCi/g	100%			6.01E-01
6082046	LCS,								
	M8D4L1AC	Tc-99	2.91E+01 +- 1.0E+00		pCi/g	100%	85%	-0.1	6.27E-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: 31-Mar-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc
Lot-Sample No.: J6C220423-1
Client Sample ID: B34T20

SDG: W07422
Report No.: 68356
COC No.: F16-020-071
Collection Date: 3/18/2016 2:17:00 PM
Received Date: 3/18/2016 3:35:00 PM
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/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 6082046	TC99_ETVDSK_LSC				Work Order: M8D7V1AA		Report DB ID: 9M8D7V10					
Tc-99	-3.01E-02	U	2.6E-01	2.9E-01	6.25E-01	pCi/g	100%	-0.05	3/31/16 07:51 a		2.0	LSC9
						3.00E-01	1.50E+00	-0.21			g	

No. of Results: 1 Comments:

March 31, 2016

FORM II

Date: 31-Mar-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc **SDG:** W07421 **Collection Date:** 3/18/2016 7:50:00 AM
Lot-Sample No.: J6C210421-2 **Report No.:** 68356 **Received Date:** 3/21/2016 3:10:00 PM
Client Sample ID: B33W31 DUP **COC No.:** F15-011-508 **Matrix:** SOIL

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: 6082046	TC99_ETVDSK_LSC								Orig Sa DB ID: 9M8D1P10			
Tc-99	-1.29E-02	U	2.6E-01	2.9E-01	6.22E-01	pCi/g	100%	-0.02	3/31/16 02:41 a		1.99	LSC9
	-1.64E-01	U	RPD -170.9			1.50E+00		-0.09			g	

No. of Results: 1 Comments:

March 31, 2016

TestAmerica Inc RPD - Relative Percent Difference.
 rptSTLrchDupV5. MDC(MDA),Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 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 II

Date: 31-Mar-16

BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W07421

Matrix: SOIL

Report No. : 68356

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: 6082046 TC99_ETVDSK_LSC Work Order: M8D4L1AA Report DB ID: M8D4L1AB												
Tc-99	-1.61E-02	U	2.5E-01	2.8E-01	6.01E-01	pCi/g	100%	-0.03	3/31/16 05:47 a	2.07	2.07	LSC9
					2.89E-01	1.50E+00		-0.12			g	

No. of Results: 1 Comments:

March 31, 2016

**FORM II
LCS RESULTS**

Date: 31-Mar-16

Lab Name: TestAmerica Inc

SDG: W07421

Matrix: SOIL

Report No. : 68356

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: 6082046	TC99_ETVDSK_LSC												
Tc-99	2.91E+01		7.7E-01	1.0E+00	6.27E-01	pCi/g	100%	3.41E+01	1.95E-01	85%	3/31/16 06:49 a	1.99	LSC9
							Rec Limits:	70	130	-0.1		g	

No. of Results: 1 Comments:

March 31, 2016

13 of 14

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.

rptSTLRchLcs
V5.5.1 A2002

FORM II

Date: 31-Mar-16

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W07421 Matrix: SOIL
 Lot-Sample No.: J6C210421-3, B33W35 Report No.: 68356

Parameter	SpikeResult, Orig Rst	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Rec-covery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 6082046	Work Order: M8D1Q1AP	Report DB ID: M8D1Q1PW	Orig Sa DB ID: 9M8D1Q10								
Tc-99	1.91E+02	1.9E+00	4.7E+00	6.22E-01	pCi/g	100%	84.84%	2.25E+02	3/31/16 04:45 a	2.01	TC99_ETVDSK_LSC
	2.07E-02							1.28E+00		g	LSC9

Number of Results: 1

Comments:

March 31, 2016