

May 24, 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.: 68643

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.
W07472	F16-025	B34TD4	J6E160424-1	M8MF11AA	9M8MF110	6134036



Certificate of Analysis

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

May 24, 2016

Attention: Scot Fitzgerald

SAF Number	:	F16-025
Date SDG Closed	:	May 16, 2016
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07472
Data Deliverable	:	7-Day / Summary

CASE NARRATIVE

I. Introduction

On May 16, 2016, one sample was 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
Tritium by method RL-LSC-005

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.

QC and sample results are reported in the same units.

CH2M Hill Plateau Remediation Company
May 24, 2016

V. Comments

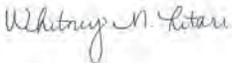
Liquid Scintillation Counting

Tritium by method RL-LSC-005:

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
Whitney Ritari
Date: 2016.05.24
17:31:16 -07'00'

Whitney Ritari
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.

CH2M Hill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST		F16-025-007	PAGE 1 OF 1
COLLECTOR J.R. Aguilera/CHPRC	COMPANY CONTACT TODAK, D	TELEPHONE NO. 376-6427	PROJECT COORDINATOR TODAK, D	PRICE CODE C05	DATA TURNAROUND 7 Days / 7 Days
SAMPLING LOCATION C9413, I-003	PROJECT DESIGNATION FY2016 200-UP-1 Remedial Action Wells Sampling and Analysis - Water	FIELD LOGBOOK NO. HNF-0-645-3/70	SAF NO. F16-025	AIR QUALITY <input type="checkbox"/>	METHOD OF SHIPMENT GOVERNMENT VEHICLE
ICE CHEST NO.	ACTUAL SAMPLE DEPTH 334.2'	OFFSITE PROPERTY NO.	COA 303979	BILL OF LADING/AIR BILL NO.	
SHIPPED TO TestAmerica Incorporated, Richland					

MATRIX* A=Air DL=Drum L=Liquid DS=Drum S=Solids O=Oil S=Soil SE=Sediment T=Tissue V=Vegetation W=Water WI=Wipe X=Other	POSSIBLE SAMPLE HAZARDS/ REMARKS *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	PRESERVATION None	HOLDING TIME 6 Months	TYPE OF CONTAINER P	NO. OF CONTAINER(S) 1	VOLUME 1L	SAMPLE ANALYSIS TRITIUM_DIST LSC COMMON (Tritium);
SAMPLE NO. B30TD4	MATRIX* WATER	SAMPLE DATE 5-16-16	SAMPLE TIME 1231	SPECIAL HANDLING AND/OR STORAGE			

J6E160424
W0N472
Due 5.23.16
M8MFI



FILTER

CHAIN OF POSSESSION		SIGN/ PRINT NAMES		SPECIAL INSTRUCTIONS FILTER	
RELINQUISHED BY/REMOVED FROM J.R. Aguilera/CHPRC	DATE/TIME MAY 16 2016 1310	RECEIVED BY/STORED IN Frank Hall CHPRC	DATE/TIME MAY 16 2016 1310	DATE/TIME MAY 16 2016 1400	
RELINQUISHED BY/REMOVED FROM Frank Hall CHPRC	DATE/TIME MAY 16 2016 1400	RECEIVED BY/STORED IN J.R. Aguilera/CHPRC	DATE/TIME MAY 16 2016 1400	DATE/TIME MAY 16 2016 1400	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	DATE/TIME	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	DATE/TIME	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	DATE/TIME	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	DATE/TIME	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	DATE/TIME	
LABORATORY SECTION	RECEIVED BY	TITLE		DATE/TIME	
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY		DATE/TIME	

May 24, 2016

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Sample Check-in List

Date/Time Received: 5-14-16 / 1400 Container GM Screen Result: (Airlock) 0 cpm Initials B]

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

Client: FLH SDG #: W07472 SAF #: FLH-025 NA []

Lot Number: J6E160424

Chain of Custody # FLH-025-007

Shipping Container ID or Air Bill Number : _____ NA B]

Samples received inside shipping container/cooler/box Yes B] 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 B]

2. Custody Seals dated and signed? Yes [] No [] No Custody Seal B]

3. Cooler temperature: 121°C Ice NA []

4. Vermiculite/packing materials is NA B] Wet [] Dry []

Item 5 through 16 for samples. Initial appropriate response.

5. Chain of Custody record present? Yes B] No []

6. Number of samples received (Each sample may contain multiple bottles): 1

7. Containers received: 1 x 10

8. Sample holding times exceeded? NA [] Yes [] No B]

9. Samples have: _____ tape _____ hazard labels B custody seals B appropriate sample labels

10. Matrix: _____ A (FLT, Wipe, Solid, Soil) B I (Water) _____ S (Air, Niosh 7400) _____ T (Biological, Ni-63)

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

12. Sample pH appropriate for analysis requested Yes B] 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 B]

14. Description of anomalies (include sample numbers): NA B]

15. Sample Location, Sample Collector Listed on COC? * Yes B] No []

*For documentation only. No corrective action needed.

16. Additional Information: N/A

[] Client/Courier denied temperature check.

B] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:

Signature: [Signature] Date: 5-14-16

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

B No action necessary; process as is

Project Manager [Signature] Date 5/17/16

Sample Results Summary

Date: 24-May-16

TestAmerica Inc TARL

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

Report No. : 68643

SDG No: W07471

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6134036	TRITIUM_DIST_LSC								
	B34TC9								
	M8L5D1AD	H-3	5.77E+03 +- 3.3E+02		pCi/L	100%	3.16E+02	7.00E+02	0.5
	B34TD4								
	M8MF11AA	H-3	5.91E+03 +- 3.4E+02		pCi/L	100%	3.14E+02	7.00E+02	
	No. of Results:	2							

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum
mary2 V5.5.1
A2002

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

Date: 24-May-16

Report No. : 68643

SDG No.: W07471

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
TRITIUM_DIST_LSC									
6134036	MATRIX SPIKE, B34TC9								
	M8L5D1AC	H-3	1.78E+03 +- 5.3E+02		pCi/L	100%	119%	0.2	3.68E+02
6134036	BLANK QC,								
	M8L7C1AA	H-3	-4.57E+01 +- 1.5E+02	U	pCi/L	100%			3.19E+02
6134036	LCS,								
	M8L7C1AC	H-3	2.57E+03 +- 2.4E+02		pCi/L	100%	95%	0.0	3.18E+02
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: 24-May-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc
Lot-Sample No.: J6E160424-1
Client Sample ID: B34TD4

SDG: W07472
Report No.: 68643
COC No.: F16-025-007

Collection Date: 5/16/2016 12:31:00 PM
Received Date: 5/16/2016 2:00:00 PM
Matrix: WATER

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: 6134036	TRITIUM_DIST_LSC				M8MF11AA		Report DB ID: 9M8MF110					
H-3	5.91E+03		2.8E+02	3.4E+02	3.14E+02 pCi/L	1.50E+02	100%	(18.8)	5/21/16 06:27 p		0.00504	LSC9
						7.00E+02		(35.)			L	

No. of Results: 1 Comments:

10 of 14

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: 24-May-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6E120410-1
 Client Sample ID: B34TC9

SDG: W07471
 Report No.: 68643
 COC No.: F16-025-002
 Matrix: WATER

Collection Date: 5/12/2016 10:50:00 AM
 Received Date: 5/12/2016 12:55:00 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: 6134036	TRITIUM_DIST_LSC											
H-3	5.77E+03		2.8E+02	3.3E+02	3.16E+02	pCi/L	100%	(18.3)	5/21/16 05:05 p	9M8L5D10	0.00502	LSC9
	5.74E+03		RPD 0.5			7.00E+02		(34.5)			L	

No. of Results: 1 Comments:

FORM II
BLANK RESULTS

Date: 24-May-16

Lab Name: TestAmerica Inc
Matrix: WATER
SDG: W07471
Report No.: 68643

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: 6134036 TRITIUM_DIST_LSC												
Work Order: M8L7C1AA Report DB ID: M8L7C1AB												
H-3	-4.57E+01	U	1.3E+02	1.5E+02	3.19E+02	pCi/L	100%	-0.14	5/22/16 02:39 a	0.00504	L	LSC9
					1.52E+02	4.00E+02		-0.63				

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: 24-May-16

Lab Name: TestAmerica Inc

SDG: W07471

Matrix: WATER

Report No. : 68643

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: 6134036	TRITIUM_DIST_LSC												
H-3	2.57E+03		2.1E+02	2.4E+02	3.18E+02	pCi/L	100%	2.71E+03	8.12E+01	95%	5/22/16 04:01 a	0.00501	LSC9
							Rec Limits:	80	120	0.0		L	

Work Order: M8L7C1AC

Report DB ID: M8L7C1CS

No. of Results: 1 Comments:

13

FORM II

Date: 24-May-16

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W07471 Matrix: WATER
Lot-Sample No.: J6E120410-1, B34TC9 Report No.: 68643

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: 6134036											
H-3	1.78E+03	3.4E+02	5.3E+02	3.68E+02 pCi/L		100%	118.69%	1.50E+03	5/21/16 03:44 p	0.00429 L	TRITIUM_DIST_LSC
	5.74E+03							4.51E+01			LSC9

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