

August 5, 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 13 Pages

Report No.: 69105

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.
W07527	F16-042	B35YF5	J6F270417-1	M8T2X1AA	9M8T2X10	6182021
		B35YF5	J6F270417-1	M8T2X1AC	9M8T2X10	6182022



Certificate of Analysis

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

August 5, 2016

Attention: Scot Fitzgerald

SAF Number	:	F16-042
Date SDG Closed	:	June 27, 2016
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07527
Data Deliverable	:	30-Day / Summary

CASE NARRATIVE

I. Introduction

On June 27, 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:

Gas Proportional Counting
Gross Alpha by method RL-GPC-001
Gross Beta by method RL-GPC-001

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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.

V. Comments

Gas Proportional Counting

Gross Alpha by method RL-GPC-001:

The MDA for the sample duplicate exceeds the CRDL. The duplicate result is less than the MDA and CRDL and the sample and sample duplicate meet duplicate agreement criteria. No other analytical or quality issues were noted. Except as noted, the sample results and associated batch QC results are within contractual requirements.

Gross Beta by method RL-GPC-001:

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: 2016.08.05
09:02:40 -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, $R = \text{constants} * f(x,y,z,...)$. 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 MDL	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.

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TestAmerica

Sample Check-in List

THE LEADER IN ENVIRONMENTAL TESTING

Date Time Received: 6-27-16 / 1430 Container GM Screen Result: (Airlock) 0 cpm Initials [B]
Sample GM Screen Result (Sample Receiving) 0 cpm Initials [B]

Client: FLH SDG #: W07527 SAF #: F16-042 NA []

Lot Number: J4F270417

Chain of Custody # F16-042-101

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: 6.2 °C [B] 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 LP

- 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
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: 6-27-16

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

[B] No action necessary; process as is

Project Manager [Signature] Date 6/28/16

Sample Results Summary

Date: 05-Aug-16

TestAmerica Inc TARL

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

Report No. : 69105

SDG No: W07527

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6182021	9310_ALPHABETA_GPC								
	B35YF5								
	M8T2X1AA	Alpha	3.50E+00 +- 2.1E+00		pCi/L	100%	2.64E+00	3.00E+00	
	B35YF5 DUP								
	M8T2X1AD	Alpha	1.85E+00 +- 1.9E+00	U	pCi/L	100%	3.01E+00	3.00E+00	61.4
6182022	9310_ALPHABETA_GPC								
	B35YF5								
	M8T2X1AC	Beta	8.48E+00 +- 1.9E+00		pCi/L	100%	1.95E+00	4.00E+00	
	B35YF5 DUP								
	M8T2X1AE	Beta	7.23E+00 +- 1.7E+00		pCi/L	100%	1.84E+00	4.00E+00	15.9
No. of Results: 4									

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

Date: 05-Aug-16

Report No. : 69105

SDG No.: W07527

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
9310_ALPHABETA_GPC									
6182021	BLANK QC,								
	M8VC71AA	Alpha	-2.27E-01 +- 4.8E-01	U	pCi/L	100%			9.08E-01
6182021	LCS,								
	M8VC71AC	Alpha	2.21E+01 +- 5.6E+00		pCi/L	100%	100%	0.0	7.22E-01
9310_ALPHABETA_GPC									
6182022	BLANK QC,								
	M8VC81AA	Beta	4.21E-01 +- 9.6E-01	U	pCi/L	100%			1.61E+00
6182022	LCS,								
	M8VC81AC	Beta	2.27E+01 +- 3.3E+00		pCi/L	100%	103%	0.0	1.49E+00
No. of Results: 4									

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 rptSTLRchQcSummary V5.6 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: 05-Aug-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6F270417-1
 Client Sample ID: B35YF5

SDG: W07527
 Report No.: 69105
 COC No.: F16-042-101
 Matrix: WATER

Collection Date: 6/27/2016 8:55:00 AM

Received Date: 6/27/2016 2:30:00 PM

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: 6182021 9310_ALPHABETA_GPC												
Alpha	3.50E+00		1.9E+00	2.1E+00	2.64E+00	pCi/L	100%	(1.3)	8/3/16 07:17 p		0.1219	GPC22D
							3.00E+00	(3.4)			L	
Batch: 6182022 9310_ALPHABETA_GPC												
Beta	8.48E+00		1.5E+00	1.9E+00	1.95E+00	pCi/L	100%	(4.3)	8/1/16 06:20 p		0.2009	GPC32A
							4.00E+00	(9.)			L	

No. of Results: 2 Comments:

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FORM II

Date: 05-Aug-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6F270417-1
 Client Sample ID: B35YF5 DUP

SDG: W07527
 Report No.: 69105
 COC No.: F16-042-101
 Matrix: WATER

Collection Date: 6/27/2016 8:55:00 AM

Received Date: 6/27/2016 2:30:00 PM

Matrix: WATER

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: 6182021	9310_ALPHABETA_GPC											
Alpha	1.85E+00	U	1.9E+00	1.9E+00	3.01E+00	pCi/L	100%	M8T2X1AD	8/3/16 09:31 a	9M8T2X10	0.121	GPC24A
	3.50E+00		RPD 61.4			3.00E+00	(1.9)	Report DB ID: M8T2X1DR			L	
Batch: 6182022	9310_ALPHABETA_GPC											
Beta	7.23E+00		1.4E+00	1.7E+00	1.84E+00	pCi/L	100%	M8T2X1AE	8/1/16 06:20 p	9M8T2X10	0.2012	GPC32C
	8.48E+00		RPD 15.9			4.00E+00	(8.4)	Report DB ID: M8T2X1ER			L	

No. of Results: 2 Comments:

FORM II
BLANK RESULTS

Date: 05-Aug-16

Lab Name: TestAmerica Inc SDG: W07527
 Matrix: WATER Report No.: 69105

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: 6182021 9310_ALPHABETA_GPC Work Order: M8VC71AA Report DB ID: M8VC71AB												
Alpha	-2.27E-01	U	4.8E-01	4.8E-01	9.08E-01	pCi/L	100%	-0.25	8/3/16 09:31 a	0.2026	L	GPC24B
					4.15E-01	3.00E+00		-0.94				
Batch: 6182022 9310_ALPHABETA_GPC Work Order: M8VC81AA Report DB ID: M8VC81AB												
Beta	4.21E-01	U	9.6E-01	9.6E-01	1.61E+00	pCi/L	100%	0.26	8/1/16 06:20 p	0.2231	L	GPC32D
					7.74E-01	4.00E+00		0.88				

No. of Results: 2 Comments:

FORM II
LCS RESULTS

Date: 05-Aug-16

Lab Name: TestAmerica Inc

SDG: W07527

Matrix: WATER

Report No. : 69105

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: 6182021 9310_ALPHABETA_GPC													
Alpha	2.21E+01		1.6E+00	5.6E+00	7.22E-01	pCi/L	100%	2.21E+01	2.24E-01	100%	8/3/16 09:31 a	0.2036	GPC24C
							Rec Limits:	80	120	0.0		L	
Batch: 6182022 9310_ALPHABETA_GPC													
Beta	2.27E+01		1.7E+00	3.3E+00	1.49E+00	pCi/L	100%	2.21E+01	1.58E-01	103%	8/1/16 06:20 p	0.2047	GPC32B
							Rec Limits:	80	120	0.0		L	

No. of Results: 2 Comments:

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

rptSTLRchLcs
V5.6 A2002