

JULY 28, 2015

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.: 66708

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.
W07166	F15-040	B31F60	J5G010406-1	M66CK1AA	9M66CK10	5187032
		B31F60	J5G010406-1	M66CK1AC	9M66CK10	5188018
		B31F60	J5G010406-1	M66CK1AD	9M66CK10	5188020

JULY 28, 2015



Certificate of Analysis

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

July 28, 2015

Attention: Scot Fitzgerald

SAF Number	:	F15-040
Date SDG Closed	:	June 30, 2015
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07166
Data Deliverable	:	30-Day / Summary

CASE NARRATIVE

I. Introduction

On June 30, 2015, one 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:

- Gamma Spectroscopy**
Iodine-129 (LL) by method RL-GAM-002
- Liquid Scintillation Counting**
Technetium-99 by TEVA method RL-LSC-014
Tritium by method RL-LSC-005

CH2M Hill Plateau Remediation Company
July 28, 2015

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

Gamma Spectroscopy

Iodine-129 (LL) by method RL-GAM-002

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

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.

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: 2015.07.28 16:11:50 -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.

THE LEADER IN ENVIRONMENTAL TESTING

Date/Time Received: 6/30/15 1430 Container GM Screen Result: (Airlock) 20 cpm Initials [F]
Sample GM Screen Result (Sample Receiving) 20 cpm Initials [F]

Client: FLH SDG #: W07166 SAF #: F15-040 NA []

Lot Number: JF 71115 JSP J5G 010406

Chain of Custody # F15-040-001

Shipping Container ID or Air Bill Number : _____ NA [F]

Samples received inside shipping container/cooler/box Yes [J] 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 [F]
- 2. Custody Seals dated and signed? Yes [] No [] No Custody Seal [F]
- 3. Cooler temperature: 8.2 °C ICE NA []
- 4. Vermiculite/packing materials is NA [J] Wet [] Dry []

Item 5 through 16 for samples. Initial appropriate response.

- 5. Chain of Custody record present? Yes [f] No []
- 6. Number of samples received (Each sample may contain multiple bottles): 1
- 7. Containers received: 1x500mls 1x1pl 2x4pl

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

- 11. Samples: f 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 [f] 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 [f]

- 14. Description of anomalies (include sample numbers): NA [P] _____

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

- 16. Additional Information: N/A

[] Client/Courier denied temperature check. [f] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:
Signature: [Signature] Date: 6/30/15

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

[X] No action necessary; process as is
Project Manager [Signature] Date 7/2/15

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Sample Results Summary

Date: 28-Jul-15

TestAmerica Inc TARL

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

Report No. : 66708

SDG No: W07165

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
5188018	I129LL_SEP_LEPS_GS								
	B31D56 DUP								
	M652J1AF I129		-4.29E-02 +- 2.5E-01	U	pCi/L	90%	4.53E-01	1.00E+00	-39.4
	B31F60								
	M66CK1AC I129		4.85E-01 +- 3.3E-01	U	pCi/L	92%	6.75E-01	1.00E+00	
5187032	TRITIUM_DIST_LSC								
	B31D56 DUP								
	M652J1AE H-3		-7.64E+01 +- 1.4E+02	U	pCi/L	100%	2.98E+02	4.00E+02	-110.1
	B31F60								
	M66CK1AA H-3		2.06E+04 +- 7.9E+02		pCi/L	100%	2.93E+02	4.00E+02	
5188020	TC99_ETVDSK_LSC								
	B31D56 DUP								
	M652J1AG Tc-99		1.35E+00 +- 4.5E+00	U	pCi/L	100%	9.66E+00	1.50E+01	-2129.2
	B31F60								
	M66CK1AD Tc-99		3.37E+01 +- 5.5E+00		pCi/L	100%	9.74E+00	1.50E+01	
	No. of Results:	6							

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

Date: 28-Jul-15

Report No. : 66708

SDG No.: W07165

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
I129LL_SEP_LEPS_GS									
5188018	BLANK QC,								
	M67HM1AA	I129	-3.78E-02 +- 2.6E-01	U	pCi/L	83%			4.76E-01
5188018	LCS,								
	M67HM1AC	I129	1.79E+01 +- 2.4E+00		pCi/L	93%	93%	-0.1	9.41E-01
TRITIUM_DIST_LSC									
5187032	MATRIX SPIKE, B31F60								
	M66CK1AF	H-3	1.39E+03 +- 1.2E+03		pCi/L	100%	100%	0.0	3.36E+02
5187032	BLANK QC,								
	M67GG1AA	H-3	-9.96E+01 +- 1.4E+02	U	pCi/L	100%			3.14E+02
5187032	LCS,								
	M67GG1AC	H-3	2.68E+03 +- 2.4E+02		pCi/L	100%	96%	0.0	3.01E+02
TC99_ETVDSK_LSC									
5188020	MATRIX SPIKE, B31F60								
	M66CK1AE	Tc-99	5.03E+02 +- 1.8E+01		pCi/L	100%	93%	-0.1	9.72E+00
5188020	BLANK QC,								
	M67HQ1AA	Tc-99	-2.27E-01 +- 2.8E+00	U	pCi/L	100%			6.10E+00
No. of Results: 7									

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 rptSTLRchQcSummary V5.3.8 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: 28-Jul-15

SAMPLE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J5G010406-1
 Client Sample ID: B31F60

SDG: W07166
 Report No.: 66708
 COC No.: F15-040-001

Collection Date: 6/30/2015 11:01:00 AM
 Received Date: 6/30/2015 2:30:00 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/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5187032 TRITIUM_DIST_LSC												
H-3	2.06E+04		4.8E+02	7.9E+02	2.93E+02	pCi/L	100%	(70.5)	7/13/15 08:01 p		0.00501	LSC8
							1.39E+02	4.00E+02	(52.5)		L	
Batch: 5188018 1129LL_SEP_LEPS_GS												
1129	4.85E-01	U	3.3E-01	3.3E-01	6.75E-01	pCi/L	92%	0.72	7/9/15 01:53 p		2.0226	LEP4
							3.13E-01	1.00E+00	(3.)		L	
Batch: 5188020 TC99_ETVDSK_LSC												
Tc-99	3.37E+01		5.1E+00	5.5E+00	9.74E+00	pCi/L	100%	(3.5)	7/10/15 01:26 p		0.1267	LSC8
							4.68E+00	1.50E+01	(12.2)		L	

No. of Results: 3 Comments:

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TestAmerica Inc MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rptSTLRLchSample U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 V5.3.8 A2002

FORM II

Date: 28-Jul-15

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J5F300403-1
 Client Sample ID: B31D56 DUP

SDG: W07165
 Report No.: 66708
 COC No.: F14-0033-586
 Matrix: WATER

Collection Date: 6/29/2015 11:28:00 AM

Received Date: 6/29/2015 2:30:00 PM

JULY 28, 2015

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: 5187032	TRITIUM_DIST_LSC											
H-3	-7.64E+01	U	1.2E+02	1.4E+02	2.98E+02	pCi/L	100%	M652J1AE	Report DB ID: M652J1ER	9M652J10	0.00502	LSC8
	-2.21E+01	U	RPD	-110.1		4.00E+02			7/13/15 06:39 p		L	
Batch: 5188018	1129LL_SEP_LEPS_GS											
1129	-4.29E-02	U	2.5E-01	2.5E-01	4.53E-01	pCi/L	90%	M652J1AF	Report DB ID: M652J1FR	9M652J10	2.024	LEP5\$1
	-2.88E-02	U	RPD	-39.4		1.00E+00			7/9/15 12:07 p		L	
Batch: 5188020	TC99_ETVDSK_LSC											
Tc-99	1.35E+00	U	4.0E+00	4.5E+00	9.66E+00	pCi/L	100%	M652J1AG	Report DB ID: M652J1GR	9M652J10	0.128	LSC9
	-1.63E+00	U	RPD	-2129.2		1.50E+01			7/10/15 12:24 p		L	

No. of Results: 3 Comments:

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.
 3.8 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
BLANK RESULTS**

Date: 28-Jul-15

Lab Name: **TestAmerica Inc** SDG: **W07165**
 Matrix: **WATER** Report No.: **66708**

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: 5187032 TRITIUM_DIST_LSC Work Order: M67GG1AA Report DB ID: M67GG1AB												
H-3	-9.96E+01	U	1.2E+02	1.4E+02	3.14E+02	pCi/L	100%	-0.32	7/14/15 02:50 a	0.00503	L	LSC8
					1.49E+02	4.00E+02		-(1.4)				
Batch: 5188018 I129LL_SEP_LEPS_GS Work Order: M67HM1AA Report DB ID: M67HM1AB												
I129	-3.78E-02	U	2.6E-01	2.6E-01	4.76E-01	pCi/L	83%	-0.08	7/9/15 04:34 p	2.0038	L	LEP5\$1
					2.00E-01	1.00E+00		-0.29				
Batch: 5188020 TC99_ETVDSK_LSC Work Order: M67HQ1AA Report DB ID: M67HQ1AB												
Tc-99	-2.27E-01	U	2.5E+00	2.8E+00	6.10E+00	pCi/L	100%	-0.04	7/10/15 06:35 p	0.2016	L	LSC9
					2.93E+00	1.50E+01		-0.16				

No. of Results: 3 Comments:

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FORM II
LCS RESULTS

Date: 28-Jul-15

Lab Name: TestAmerica Inc

SDG: W07165

Matrix: WATER

Report No. : 66708

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: 5187032 TRITIUM_DIST_LSC													
H-3	2.68E+03		2.1E+02	2.4E+02	3.01E+02	pCi/L	100%	2.78E+03	8.34E+01	96%	7/14/15 04:12 a	0.00503	LSC8
							Rec Limits:	70	130	0.0			
Batch: 5188018 1129LL_SEP_LEPS_GS													
1129	1.79E+01		2.4E+00	2.4E+00	9.41E-01	pCi/L	93%	1.92E+01	2.07E-01	93%	7/9/15 07:26 p	2.012	LEP4\$1
							Rec Limits:	70	130	-0.1			

No. of Results: 2 Comments:

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FORM II

Date: 28-Jul-15

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W07166 Matrix: WATER
 Lot-Sample No.: J5G010406-1, B31F60 Report No.: 66708

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: 5187032											
	Work Order: M66CK1AF		Report DB ID: M66CK1FW		Orig Sa DB ID: 9M66CK10						
H-3	1.39E+03	5.3E+02	1.2E+03	3.36E+02 pCi/L	100%	100.33%	1.39E+03	7/13/15 09:23 p	0.00434	L	TRITIUM_DIST_LSC
	2.06E+04						4.17E+01				LSC8
Batch: 5188020											
	Work Order: M66CK1AE		Report DB ID: M66CK1EW		Orig Sa DB ID: 9M66CK10						
Tc-99	5.03E+02	1.3E+01	1.8E+01	9.72E+00 pCi/L	100%	92.69%	5.42E+02	7/10/15 02:27 p	0.1257	L	TC99_ETVDSK_LSC
	3.37E+01						5.59E+00				LSC9

Number of Results: 2

Comments:

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TestAmerica Inc RER - Replicate Error Ratio = (S-D)/[sqrt((sq(TPUs)+sq(TPUd)))] as defined by ICPT BOA.
 rptSTLrchMs Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 V5.3.8 A2002