

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.: 67585

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.
W07288	X15-050	B32J54	J5J170404-1	M7Q4C1AA	9M7Q4C10	5293031
		B32J54	J5J170404-1	M7Q4C2AC	9M7Q4C20	5293032



Certificate of Analysis

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

November 12, 2015

Attention: Scot Fitzgerald

SAF Number	:	X15-050
Date SDG Closed	:	October 16, 2015
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07288
Data Deliverable	:	15-Day / Summary

CASE NARRATIVE

I. Introduction

On October 16, 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:

Alpha Spectroscopy

Uranium 234, 235 and 238 by method RL-ALP-015:

Liquid Scintillation Counting

Technetium-99 by TEVA method RL-LSC-014

CH2M Hill Plateau Remediation Company
November 12, 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

Alpha Spectroscopy

Uranium 234, 235 and 238 by method RL-ALP-015:

The initial batch 5293032 had a high LCS recovery and smeared spectra. The batch was reanalyzed with the blank results is slightly above the MDA but below CRDL. No other analytical or quality issues were noted. Except as noted, the sample results and associated batch QC results are within contractual requirements.

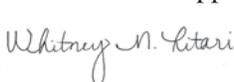
Liquid Scintillation Counting

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.

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: 2015.11.12 16:34:15
-08'00'

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
 C.O.C. # **X15-050-006**
 Page 1 of 1

Collector: **J.R. Aguilar/CHPRC** Telephone No. **376-4650**
 SAF No. **X15-050** Purchase Order/Charge Code **302869**
 Project Title **200-BP-5 Treatability Test - Day 3** Ice Chest No. **N/A**
 Shipped To (Lab) **TestAmerica Incorporated, Richland** Bill of Lading/Air Bill No. **N/A**
 Protocol **CERCLA** Priority: **15 Days** Offsite Property No. **N/A**
 SPECIAL INSTRUCTIONS **PRIORITY**
 Hold Time **N/A** Total Activity Exemption: Yes No

POSSIBLE SAMPLE HAZARDS/REMARKS
 *Contains Radioactive Material at concentrations that are not be regulated for transportation per 49 CFR/ATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1.

Sample No.	Filter	*	Date	Time	No/Type Container	Sample Analysis	Holding Time	Preservative
B32J54	N	W	10-14-15	0748	1x500-mL P	TC99_ETVDSK_LSC: COMMON	6 Months	HCl to pH <2
B32J54	N	W	10-16-15	0748	1x1-L G/P	UI50_PLATE_AEA: COMMON mnqc	6 Months	HNO3 to pH <2

JSS10404
won't go p 10-14-15
won't go
Due 10-30-15



Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time	Matrix *
J.R. Aguilar/CHPRC	<i>[Signature]</i>		OCT 16 2015 1130	E.L. Kauer	<i>[Signature]</i>		OCT 16 2015 1130	DS = Drum Solids DL = Drum Liquids T = Tissue WI = Wipe L = Liquid V = Vegetation X = Other
E.L. Kauer	<i>[Signature]</i>		OCT 16 2015 1435	J. Friesz, TARC	<i>[Signature]</i>		OCT 16 2015 1435	S = Soil SE = Sediment SO = Solid SL = Sludge W = Water O = Oil A = Air
Relinquished By			Date/Time	Received By			Date/Time	
Relinquished By			Date/Time	Received By			Date/Time	

Disposal Method (e.g., Return to customer, per lab procedure, used in process)

Disposed By

DATE/TIME

PRINTED ON 9/8/2015 FSR ID = FSR4163 A-6004-842 (REV 2)

Sample Check-in List

Date/Time Received: 10-16-15/1435 Container GM Screen Result: (Airlock) 0 cpm Initials [B]
Sample GM Screen Result (Sample Receiving) 0 cpm Initials [B]

Client: Plw SDG #: W07280 10-12-15 SAF #: X15-050 NA []

Lot Number: JSJ10404

Chain of Custody # X15-050-006

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: 10.1 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 500 mL, 1 x 4

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: w/h

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

Sample Check-in List completed by Sample Custodian:
Signature: [Signature] Date: 10-16-15

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

[B] No action necessary; process as is
Project Manager Whitney M. Litari Date 10/19/15

Sample Results Summary

Date: 12-Nov-15

TestAmerica Inc TARL

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

Report No. : 67585

SDG No: W07288

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
5293032	UIISO_PLATE_AEA								
	B32J54								
	M7Q4C2AC	U-234	3.98E+01 +- 7.1E+00		pCi/L	65%	2.72E-01	1.00E+00	
		U-235	1.24E+00 +- 5.4E-01		pCi/L	65%	2.04E-01	1.00E+00	
		U-238	4.00E+01 +- 7.1E+00		pCi/L	65%	3.03E-01	1.00E+00	
	B32J54 DUP								
	M7Q4C2AF	U-234	4.01E+01 +- 7.0E+00		pCi/L	65%	2.09E-01	1.00E+00	0.9
		U-235	1.71E+00 +- 6.1E-01		pCi/L	65%	1.88E-01	1.00E+00	31.6
		U-238	3.82E+01 +- 6.6E+00		pCi/L	65%	2.41E-01	1.00E+00	4.6
5293031	TC99_ETVDSK_LSC								
	B32J54								
	M7Q4C1AA	Tc-99	7.07E+03 +- 1.6E+02		pCi/L	100%	9.40E+00	1.50E+01	
	B32J54 DUP								
	M7Q4C1AE	Tc-99	7.28E+03 +- 1.7E+02		pCi/L	100%	9.76E+00	1.50E+01	2.8
	No. of Results:		8						

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum
mary2 V5.4.1
A2002

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

Date: 12-Nov-15

Report No. : 67585

SDG No.: W07288

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
UIISO_PLATE_AEA									
5293032 BLANK QC,									
	M7RGD2AA	U-234	5.32E-01 +- 3.5E-01		pCi/L	59%			2.80E-01
		U-235	1.42E-01 +- 1.8E-01	U	pCi/L	59%			2.25E-01
		U-238	3.82E-01 +- 3.0E-01		pCi/L	59%			2.71E-01
5293032 LCS,									
	M7RGD2AC	U-234	9.10E+00 +- 2.0E+00		pCi/L	68%	103%	0.0	2.23E-01
		U-238	1.02E+01 +- 2.1E+00		pCi/L	68%	111%	0.1	2.01E-01
TC99_ETVDSK_LSC									
5293031 MATRIX SPIKE, B32J54									
	M7Q4C1AD	Tc-99	4.11E+02 +- 2.4E+02		pCi/L	100%	77%	-0.2	9.51E+00
5293031 BLANK QC,									
	M7RGC1AA	Tc-99	-2.19E+00 +- 4.4E+00	U	pCi/L	100%			9.72E+00
5293031 LCS,									
	M7RGC1AC	Tc-99	9.60E+01 +- 7.3E+00		pCi/L	100%	89%	-0.1	9.65E+00
No. of Results: 8									

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 rptSTLRchQcSummary V5.4.1 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: 12-Nov-15

SAMPLE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J5J170404-1
 Client Sample ID: B32J54

SDG: W07288
 Report No.: 67585
 COC No.: X15-050-006

Collection Date: 10/16/2015 7:48:00 AM
 Received Date: 10/16/2015 2:35:00 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	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293031 TC99_ETVDSK_LSC Work Order: M7Q4C1AA Report DB ID: 9M7Q4C10												
Tc-99	7.07E+03		4.5E+01	1.6E+02	9.40E+00 pCi/L		100% (752.4)		10/29/15 10:04 p		0.1271 L	LSC8
Batch: 5293032 UIISO_PLATE_AEA Work Order: M7Q4C2AC Report DB ID: 9M7Q4C20												
U-234	3.98E+01		2.8E+00	7.1E+00	2.72E-01 pCi/L		65% (146.2)		11/11/15 07:45 p		0.2006 L	ALP220
U-235	1.24E+00		5.0E-01	5.4E-01	2.04E-01 pCi/L		65% (6.1)		11/11/15 07:45 p		0.2006 L	ALP220
U-238	4.00E+01		2.8E+00	7.1E+00	3.03E-01 pCi/L		65% (132.)		11/11/15 07:45 p		0.2006 L	ALP220

Ratio U-234/Z38 = 1.0

No. of Results: 4 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.
 rptSTLRchSample U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 V5.4.1 A2002

FORM I

Date: 12-Nov-15

SAMPLE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J5J170404-1
 Client Sample ID: B32J54

SDG: W07288
 Report No.: 67585
 COC No.: X15-050-006

Collection Date: 10/16/2015 7:48:00 AM
 Received Date: 10/16/2015 2:35:00 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
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FORM II

Date: 12-Nov-15

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J5J170404-1
 Client Sample ID: B32J54 DUP

SDG: W07288
 Report No.: 67585
 COC No.: X15-050-006

Collection Date: 10/16/2015 7:48:00 AM
 Received Date: 10/16/2015 2:35:00 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: 5293031	TC99_ETVDSK_LSC											
Tc-99	7.28E+03		4.6E+01	1.7E+02	9.76E+00	pCi/L	100%	(745.9)	10/30/15 12:09 a		0.1253	LSC8
	7.07E+03		RPD 2.8			1.50E+01		(86.7)	Orig Sa DB ID: 9M7Q4C10		L	
Batch: 5293032	UIISO_PLATE_AEA											
U-234	4.01E+01		2.6E+00	7.0E+00	2.09E-01	pCi/L	65%	(191.8)	11/11/15 07:46 p		0.2146	ALP222
	3.98E+01		RPD 0.9			1.00E+00		(11.5)	Orig Sa DB ID: 9M7Q4C20		L	
U-235	1.71E+00		5.4E-01	6.1E-01	1.88E-01	pCi/L	65%	(9.1)	11/11/15 07:46 p		0.2146	ALP222
	1.24E+00		RPD 31.6			1.00E+00		(5.6)			L	
U-238	3.82E+01		2.6E+00	6.6E+00	2.41E-01	pCi/L	65%	(158.5)	11/11/15 07:46 p		0.2146	ALP222
	4.00E+01		RPD 4.6			1.00E+00		(11.5)			L	

Ratio U-234/238 = 1.1

Alpha Spec Result Sum = 8.0E+01

No. of Results: 4 Comments:

FORM II
LCS RESULTS

Date: 12-Nov-15

Lab Name: TestAmerica Inc SDG: W07288
 Matrix: WATER Report No.: 67585

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: 5293032 UISO_PLATE_AEA Work Order: M7RGD2AC Report DB ID: M7RGD2CS													
U-234	9.10E+00		1.3E+00	2.0E+00	2.23E-01	pCi/L	68%	8.82E+00	4.8E-02	103%	11/11/15 07:47 p	0.2	ALP224
							Rec Limits:	70	130	0.0		L	
U-238	1.02E+01		1.4E+00	2.1E+00	2.01E-01	pCi/L	68%	9.24E+00	5.1E-02	111%	11/11/15 07:47 p	0.2	ALP224
							Rec Limits:	70	130	0.1		L	
Batch: 5293031 TC99_ETVDSK_LSC Work Order: M7RGC1AC Report DB ID: M7RGC1CS													
Tc-99	9.60E+01		6.6E+00	7.3E+00	9.65E+00	pCi/L	100%	1.08E+02	6.4E-01	89%	10/30/15 02:13 a	0.125	LSC8
							Rec Limits:	70	130	-0.1		L	

No. of Results: 3 Comments:

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FORM II

Date: 12-Nov-15

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W07288 Matrix: WATER
 Lot-Sample No.: J5J170404-1, B32J54 Report No.: 67585

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: 5293031	Work Order: M7Q4C1AD	Report DB ID: M7Q4C1DW	Orig Sa DB ID: 9M7Q4C10								
Tc-99	4.11E+02	4.6E+01	2.4E+02	9.51E+00	pCi/L	100%	77.35%	5.32E+02	10/29/15 11:07 p	0.1276	TC99_ETVDSK_LSC
	7.07E+03							3.0E+00		L	LSC8

Number of Results: 1

Comments: