

**June 28, 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.: 68841**

**Results in this report relate only to the sample(s) analyzed.**

<b>SDG No.</b>	<b>Order No.</b>	<b>Client Sample ID (List Order)</b>	<b>Lot-Sa No.</b>	<b>Work Order</b>	<b>Report DB ID</b>	<b>Batch No.</b>
<b>W07514</b>	<b>F16-025</b>	<b>B34TP8</b>	<b>J6F160413-1</b>	<b>M8RKC1AA</b>	<b>9M8RKC10</b>	<b>6168044</b>



## Certificate of Analysis

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

June 28, 2016

Attention: Scot Fitzgerald

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SAF Number	:	F16-025
Date SDG Closed	:	June 16, 2016
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07514
Data Deliverable	:	7-Day / Summary

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### CASE NARRATIVE

#### **I. Introduction**

On June 16, 2016 one sample was received at TestAmerica (TARL). Upon receipt, the sample was assigned a laboratory ID number to correspond with the CH2M specific ID.

#### **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**  
Tritium by method RL-LSC-005

CH2M Hill Plateau Remediation Company  
June 28, 2016

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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

##### **Liquid Scintillation Counting**

##### Tritium by method RL-LSC-005:

No analytical or quality issues were noted. The sample result 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: 2016.06.28  
09:23:29 -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,  $R = \text{constants} * f(x,y,z,\dots)$ . 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

<b>Action Lev</b>	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.
<b>Batch</b>	The QC preparation batch number that relates laboratory samples to QC samples that were prepared and analyzed together.
<b>Bias</b>	Defined by the equation (Result/Expected)-1 as defined by ANSI N13.30.
<b>COC No</b>	Chain of Custody Number assigned by the Client or TestAmerica.
<b>Count Error (#s)</b>	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.
<b>CSU (#s) <i>u<sub>c</sub> Combined Standard Uncert.</i></b>	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<sub>c</sub> the combined standard uncertainty</i> . The uncertainty is absolute and in the same units as the result.
<b>(#s), Coverage Factor</b>	The coverage factor defines the width of the confidence interval, 1, 2 or 3 standard deviations.
<b>CRDL (RL)</b>	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)
<b>Lc</b>	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.
<b>Lot-Sample No</b>	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.
<b>MDC MDA MDL</b>	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.
<b>Primary Detector</b>	The instrument identifier associated with the analysis of the sample aliquot.
<b>Ratio U-234/U-238</b>	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.
<b>Rst/MDC</b>	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.
<b>Rst/TotUcert</b>	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.
<b>Report DB No</b>	Sample Identifier used by the report system. The number is based upon the first five digits of the <b>Work Order</b> Number.
<b>RER</b>	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.
<b>SDG</b>	Sample Delivery Group Number assigned by the Client or assigned by TestAmerica upon sample receipt.
<b>Sum Rpt Alpha Spec Rst(s)</b>	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.
<b>Work Order</b>	The LIMS software assign test specific identifier.
<b>Yield</b>	The recovery of the tracer added to the sample such as Pu-242 used to trace a Pu-239/40 method.

CH2MHill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST		F16-025-031	PAGE 1 OF 1
COLLECTOR E.L. Kauer/CHPRC	COMPANY CONTACT TODAK, D	TELEPHONE NO. 376-6427	PROJECT COORDINATOR TODAK, D	PRICE CODE C05	DATA TURNAROUND 7 Days / 7 Days
SAMPLING LOCATION C9417, I-003	PROJECT DESIGNATION FY2016 200-Up-1 Remedial Action Wells Sampling and Analysis - Water	ACTUAL SAMPLE DEPTH 370.0	SAF NO. F16-025	AIR QUALITY <input type="checkbox"/>	METHOD OF SHIPMENT GOVERNMENT VEHICLE
ICE CHEST NO. N/A	FIELD LOGBOOK NO. - 1429	COA 303979	BILL OF LADING/AIR BILL NO. N/A	ORIGINAL	
SHIPPED TO TestAmerica Incorporated, Richland					

MATRIX* A=Air DL=Drum L=Liquid O=Oil S=Soil T=Tissue V=Vegetation W=Water WT=Wipe X=Other	PRESERVATION None	HOLDING TIME 6 Months	TYPE OF CONTAINER P	NO. OF CONTAINER(S) 1	VOLUME 1L	SAMPLE ANALYSIS TRITUIM_DIST LSC COMMON (Tritium);
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	<p>Jeff 160413 won 514 Due 6.23.14 MSR KC</p>					
SPECIAL HANDLING AND/OR STORAGE						
SAMPLE NO. B3TP8	MATRIX* WATER	SAMPLE DATE JUN 15 2016	SAMPLE TIME 1153			



**FILTER**

CHAIN OF POSSESSION	SIGN/ PRINT NAMES	SPECIAL INSTRUCTIONS FILTER
RELINQUISHED BY/REMOVED FROM E.L. Kauer/CHPRC	RECEIVED BY/STORED IN SSU-1	DATE/TIME JUN 15 2016
RELINQUISHED BY/REMOVED FROM SSU-1	RECEIVED BY/STORED IN Ledy West CHPRC	DATE/TIME JUN 16 2016 0830
RELINQUISHED BY/REMOVED FROM Ledy West CHPRC	RECEIVED BY/STORED IN J. Stock, TARL	DATE/TIME JUN 16 2016 1145
RELINQUISHED BY/REMOVED FROM	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	RECEIVED BY/STORED IN	DATE/TIME

LABORATORY SECTION 6 of 14	RECEIVED BY	TITLE
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY
PRINTED ON 3/14/2016	FSR ID = FSR26198	TRVL NUM = TRVL-16-104
		DATE/TIME
		DATE/TIME

Sample Check-in List

Date/Time Received: 6-16-16 / 1145 Container GM Screen Result: (Airlock) 0 cpm Initials [B] ]  
Sample GM Screen Result (Sample Receiving) 0 cpm Initials [B] ]

Client: FLH SDG #: W07514 SAF #: F16-025 NA [ ]

Lot Number: J6F160413

Chain of Custody # F16-025-031

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: 4.1 °C FC 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: 1x4

- 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 HNO<sub>3</sub> 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/a

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

Sample Check-in List completed by Sample Custodian:  
Signature: [Signature] Date: 6-16-16

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

[B] No action necessary; process as is  
Project Manager: [Signature] Date: 6/16/16

Sample Results Summary

Date: 28-Jun-16

TestAmerica Inc TARL

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

Report No. : 68841

SDG No: W07514

Batch	Client Id Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6168044	TRITIUM_DIST_LSC								
	<b>B34TP8</b>								
	M8RKC1AA H-3		-1.73E+02 +- 1.6E+02	U	pCi/L	100%	3.54E+02	7.00E+02	
	<b>B34TP8 DUP</b>								
	M8RKC1AD H-3		-7.57E+01 +- 1.7E+02	U	pCi/L	100%	3.51E+02	7.00E+02	-78.1
	No. of Results:	2							

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

Date: 28-Jun-16

Report No. : 68841

SDG No.: W07514

Batch	Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
<b>TRITIUM_DIST_LSC</b>									
6168044	MATRIX SPIKE, B34TP8								
	M8RKC1AC	H-3	1.39E+03 +- 2.6E+02		pCi/L	100%	92%	-0.1	4.04E+02
6168044	BLANK QC,								
	M8RKK1AA	H-3	1.73E+02 +- 1.8E+02	U	pCi/L	100%			3.59E+02
6168044	LCS,								
	M8RKK1AC	H-3	2.95E+03 +- 3.0E+02		pCi/L	100%	109%	0.1	3.61E+02
<b>No. of Results: 3</b>									

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 II

Date: 28-Jun-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc  
 Lot-Sample No.: J6F160413-1  
 Client Sample ID: B34TP8 DUP

SDG: W07514  
 Report No.: 68841  
 COC No.: F16-025-031  
 Matrix: WATER

Collection Date: 6/15/2016 11:53:00 AM  
 Received Date: 6/16/2016 11:45:00 AM

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: 6168044	TRITIUM_DIST_LSC								Orig Sa DB ID: 9M8RKC10			
H-3	-7.57E+01	U	1.4E+02	1.7E+02	3.51E+02	pCi/L	100%	-0.22	6/23/16 09:22 p		0.00501	LSC10
	-1.73E+02	U	RPD -78.1			7.00E+02		-0.91			L	

No. of Results: 1    Comments:

TestAmerica Inc    RPD    - Relative Percent Difference.  
 MDC(MDA),Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.  
 rps TLRchDupV5.  
 6/22/2002    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-Jun-16

Lab Name: TestAmerica Inc      SDG: W07514  
 Matrix: WATER      Report No.: 68841

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: 6168044      TRITIUM_DIST_LSC      Work Order: M8RKK1AA      Report DB ID: M8RKK1AB												
H-3	1.73E+02	U	1.5E+02	1.8E+02	3.59E+02	pCi/L	100%	0.48	6/23/16 10:47 p	0.00503	L	LSC10
					1.71E+02	7.00E+02		(1.9)				

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.  
 V16 A2002

FORM II  
LCS RESULTS

Date: 28-Jun-16

Lab Name: TestAmerica Inc      SDG: W07514  
Matrix: WATER                      Report No. : 68841

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: 6168044	TRITIUM_DIST_LSC												
H-3	2.95E+03		2.5E+02	3.0E+02	3.61E+02	pCi/L	100%	2.71E+03	8.12E+01	109%	6/24/16 12:12 a	0.00502	LSC10
							Rec Limits:	80	120	0.1		L	

No. of Results: 1      Comments:

13

FORM II  
MATRIX SPIKE RESULTS

Date: 28-Jun-16

Lab Name: TestAmerica Inc      SDG: W07514      Matrix: WATER  
 Lot-Sample No.: J6F160413-1, B34TP8      Report No.: 68841

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: 6168044											
	Work Order: M8RKC1AC	Report DB ID: M8RKC1CW	Orig Sa DB ID: 9M8RKC10								
H-3	1.39E+03	2.2E+02	2.6E+02	4.04E+02	pCi/L	100%	92.21%	1.50E+03	6/23/16 07:57 p	0.00429	TRITIUM_DIST_LSC
	-1.73E+02							4.51E+01		L	LSC10

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.  
 V16 A2002