

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 14 Pages

Report No.: 69107

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.
W07555	F16-036	B367V8	J6G210411-1	M80JK1AA	9M80JK10	6203033



## 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	:	F16-036
Date SDG Closed	:	July 20, 2016
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07555
Data Deliverable	:	30-Day / Summary

---

### CASE NARRATIVE

#### **I. Introduction**

On July 20, 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

CH2M Hill Plateau Remediation Company  
August 5, 2016

---

**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:

The MS recovery is outside acceptance criteria at 62%. The batch sample results exceed five times the expected value. No other analytical or quality issues were noted. Except as 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  
09:13:49 -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

<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.

CH2M Hill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST		F16-036-066	PAGE 1 OF 1	
COLLECTOR	Curt Hoffman CHPRC	COMPANY CONTACT	LYNCH, SA	TELEPHONE NO.	373-5586	
SAMPLING LOCATION	C9598, SAMPLE I-006	PROJECT DESIGNATION	100-KR-4 Long Term & Interim Action Monitoring - Water	PROJECT COORDINATOR	TODAK, D	
ICE CHEST NO.	N/A	FIELD LOGBOOK NO.	HNF-N-645-4 0627	SAF NO.	F16-036	
SHIPPED TO	TestAmerica Incorporated, Richland	OFFSITE PROPERTY NO.	N/A	COA	300085	
MATRIX* A=Air DL=Drum L=Liquid O=Oil S=Soil SE=Sediment T=Tissue V=Vegetation W=Water WI=Wipe X=Other		PRESERVATION	None	ACTUAL SAMPLE DEPTH	300085	METHOD OF SHIPMENT GOVERNMENT VEHICLE
*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.		HOLDING TIME	6 Months	BILL OF LADING/AIR BILL NO.	N/A	ORIGINAL
SPECIAL HANDLING AND/OR STORAGE		TYPE OF CONTAINER	P	J66210411 W0555 M805K		
N/A		NO. OF CONTAINER(S)	1	J66210411 W0555 M805K		
SAMPLE NO.		VOLUME	1L	J66210411 W0555 M805K		
B387V8		SAMPLE ANALYSIS	TRITIUM_DIST LSC COMMON;	J66210411 W0555 M805K		
WATER		SAMPLE DATE	JUL 19 2016	J66210411 W0555 M805K		
MATRIX*		SAMPLE TIME	1350	J66210411 W0555 M805K		



0014  
FILTER

CHAIN OF POSSESSION		SIGN / PRINT NAMES		SPECIAL INSTRUCTIONS	
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME	FILTER	
Curt Hoffman CHPRC	JUL 19 2016 1431	SSU-1	JUL 19 2016 1431		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
SSU-1	JUL 20 2016 0900	Troy Bacon CHPRC	JUL 20 2016 0900		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
Troy L. Bacon CHPRC	JUL 20 2016 1450	J. Bock, TARA	JUL 20 2016 1450		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME		
LABORATORY SECTION	RECEIVED BY	TITLE		DATE/TIME	
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY		DATE/TIME	
PRINTED ON 7/12/2016	FSR ID = FSR34083	TRVL NUM = TRVL-16-192		A-6003-618 (REV 2)	

August 5, 2016

TestAmerica

Sample Check-in List

Date/Time Received: 7-20-16/1450 Container GM Screen Result: (Airlock) 0 cpm Initials [B]
Sample GM Screen Result (Sample Receiving) 0 cpm Initials [B]

Client: FLH SDG #: W01555 SAF #: F16-036 NA [ ]

Lot Number: J66210411

Chain of Custody # F16-036-066

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: 9.4 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 LQ

8. Sample holding times exceeded? NA [B] 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: Julie Beck Date: 7-20-16

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

[B] No action necessary; process as is

Project Manager: Stan Cuprum Date: 7/21/16

August 5, 2016

Sample Results Summary

Date: 05-Aug-16

TestAmerica Inc TARL

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

Report No. : 69107

SDG No: W07550

Batch	Client Id Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6203033	TRITIUM_DIST_LSC								
	<b>B367V4 DUP</b>								
	M8X591AD	H-3	2.91E+04 +- 1.3E+03		pCi/L	100%	2.95E+02	7.00E+02	1.2
	<b>B367V8</b>								
	M80JK1AA	H-3	9.10E+03 +- 5.2E+02		pCi/L	100%	2.95E+02	7.00E+02	
	No. of Results:	2							

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum  
mary2 V5.6 A2002

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

**Date:** 05-Aug-16

**Report No. :** 69107

**SDG No.:** W07550

Batch	Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
<b>TRITIUM_DIST_LSC</b>									
6203033	MATRIX SPIKE, B367V4								
	M8X591AC	H-3	9.37E+02 +- 1.9E+03		pCi/L	100%	62%	-0.4	3.47E+02
6203033	BLANK QC,								
	M80KT1AA	H-3	2.01E+01 +- 1.5E+02	U	pCi/L	100%			3.03E+02
6203033	LCS,								
	M80KT1AC	H-3	2.76E+03 +- 2.7E+02		pCi/L	100%	102%	0.0	3.04E+02
<b>No. of Results: 3</b>									



FORM II

Date: 05-Aug-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc  
 Lot-Sample No.: J6G190421-1  
 Client Sample ID: B367V4 DUP  
 SDG: W07550  
 Report No.: 69107  
 COC No.: F16-036-062  
 Matrix: WATER  
 Collection Date: 7/18/2016 1:34:00 PM  
 Received Date: 7/19/2016 8:45:00 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: 6203033	TRITIUM_DIST_LSC											
H-3	2.91E+04		5.8E+02	1.3E+03	2.95E+02	pCi/L	100%	(98.7)	7/30/16 12:06 a		0.00502	LSC8
	2.95E+04		RPD 1.2			7.00E+02		(45.5)	Orig Sa DB ID: 9M8X5910		L	

No. of Results: 1    Comments:

FORM II

Date: 05-Aug-16

BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W07552

Matrix: WATER

Report No. : 69107

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: 6203033 TRITIUM_DIST_LSC												
Work Order: M80KT1AA Report DB ID: M80KT1AB												
H-3	2.01E+01	U	1.2E+02	1.5E+02	3.03E+02	pCi/L	100%	0.07	7/30/16 05:34 a	0.00502	L	LSC8
					1.44E+02	7.00E+02		0.27				

No. of Results: 1 Comments:

FORM II  
LCS RESULTS

Date: 05-Aug-16

Lab Name: TestAmerica Inc      SDG: W07552  
 Matrix: WATER                      Report No.: 69107

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: 6203033	TRITIUM_DIST_LSC												
H-3	2.76E+03		2.2E+02	2.7E+02	3.04E+02	pCi/L	100%	2.71E+03	8.12E+01	102%	7/30/16 06:57 a	0.005	LSC8
							Rec Limits:	80	120	0.0		L	

No. of Results: 1      Comments:

FORM II

Date: 05-Aug-16

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc      SDG: W07550      Report No.: 69107      Matrix: WATER

Lot-Sample No.: J6G190421-1, B367V4

Parameter	SpikeResult, Orig Rst	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Recovery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 6203033	Work Order: M8X591AC	Report DB ID: M8X591CW	Report DB ID: M8X591CW			Orig Sa DB ID: 9M8X5910					
H-3	9.37E+02	6.4E+02	1.9E+03	3.47E+02	pCi/L	100%	62.27%	1.50E+03	7/29/16 10:44 p	0.00429	TRITIUM_DIST_LSC
	2.95E+04							4.51E+01		L	LSC8

Number of Results: 1

Comments: