

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.: 69106

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.
W07550	F16-036	B367V4	J6G190421-1	M8X591AA	9M8X5910	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

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SAF Number	:	F16-036
Date SDG Closed	:	July 19, 2016
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07550
Data Deliverable	:	30-Day / Summary

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### CASE NARRATIVE

#### **I. Introduction**

On July 19, 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

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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:

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  
09:08:23 -07'00'

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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		F16-036-062	PAGE 1 OF 1
COLLECTOR Dave Floyd CHPRC	COMPANY CONTACT LYNCH, SA	TELEPHONE NO. 373-5586	PROJECT COORDINATOR TODAK, D	PRICE CODE 7H	DATA TURNAROUND 30 Days / 30 Days
SAMPLING LOCATION C9598, SAMPLE I-004	PROJECT DESIGNATION 100-KR-4 Long Term & Interim Action Monitoring - Water	SAF NO. F16-036	COA 300085	AIR QUALITY <input type="checkbox"/>	METHOD OF SHIPMENT GOVERNMENT VEHICLE
ICE CHEST NO. N/A	FIELD LOGBOOK NO. HWF-N-645-4 p9 26	ACTUAL SAMPLE DEPTH 85.66	BILL OF LADING/AIR BILL NO. N/A		ORIGINAL
SHIPPED TO TestAmerica Incorporated, Richland	OFFSITE PROPERTY NO. N/A				

MATRIX* A=Air DL=Drum L=Liquids DS=Drum S=Solids L=Liquid O=Oil S=Soil SE=Sediment T=Tissue V=Vegetation W=Water WI=Wipe X=Other	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.	PRESERVATION None	HOLDING TIME 6 Months	TYPE OF CONTAINER P	NO. OF CONTAINER(S) 1	VOLUME 1L	SAMPLE ANALYSIS TRITIUM_DIST LSC; COMMON;
SPECIAL HANDLING AND/OR STORAGE N/A							
SAMPLE NO. B367/4	MATRIX* WATER	SAMPLE DATE 7-18-16	SAMPLE TIME 1334				



J6G190421  
WONS50  
M8459

14  
FILTER

CHAIN OF POSSESSION		SIGN / PRINT NAMES		SPECIAL INSTRUCTIONS FILTER	
RELINQUISHED BY/REMOVED FROM Dave Floyd CHPRC	DATE/TIME 7-18-16 1505	RECEIVED BY/STORED IN SSU-1	DATE/TIME 7-18-16 1525		
RELINQUISHED BY/REMOVED FROM SSU #1	DATE/TIME JUL 19 2016 0730	RECEIVED BY/STORED IN Leah West CHPRC	DATE/TIME JUL 19 2016 0730		
RELINQUISHED BY/REMOVED FROM Leah West CHPRC	DATE/TIME JUL 19 2016 0845	RECEIVED BY/STORED IN Leah West CHPRC	DATE/TIME JUL 19 2016 0845		
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		
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 = FSR34081	TRVL NUM = TRVL-16-192	A-6003-618 (REV 2)

60014

THE LEADER IN ENVIRONMENTAL TESTING

Date/Time Received: 7/19/16

0845

Container GM Screen Result: (Airlock)

0

cpm Initials [LA]

Sample GM Screen Result (Sample Receiving)

0

cpm Initials [LA]

Client: FLH SDG #: W07550 SAF #: F16-036 NA [ ]

Lot Number: J66190421

Chain of Custody # F16-036-042

Shipping Container ID or Air Bill Number : NA [LA]

Samples received inside shipping container/cooler/box Yes [LA] 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 [LA]

2. Custody Seals dated and signed? Yes [ ] No [ ] No Custody Seal [LA]

3. Cooler temperature: 7.3 °C ICE NA [ ]

4. Vermiculite/packing materials is NA [ ] Wet [LA] Dry [ ]

Item 5 through 16 for samples. Initial appropriate response.

5. Chain of Custody record present? Yes [LA] 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 [LA]

9. Samples have: tape hazard labels [LA] custody seals [LA] appropriate sample labels

10. Matrix: A (FLT, Wipe, Solid, Soil) B I (Water) S (Air, Niosh 7400) T (Biological, Ni-63)

11. Samples: [LA] 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 [LA]

14. Description of anomalies (include sample numbers): NA [LA]

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

16. Additional Information: N/A

[ ] Client/Courier denied temperature check.

[LA] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:

Signature: J. Anderson

Date: 07/19/16

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

By: \_\_\_\_\_

Person contacted: \_\_\_\_\_

[B] No action necessary; process as is

Project Manager: Sam Cupitt

Date: 7/19/16

August 5, 2016

Sample Results Summary

Date: 05-Aug-16

TestAmerica Inc TARL

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

Report No. : 69106

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</b>								
	M8X591AA	H-3	2.95E+04 +- 1.3E+03		pCi/L	100%	2.98E+02	7.00E+02	
	<b>B367V4 DUP</b>								
	M8X591AD	H-3	2.91E+04 +- 1.3E+03		pCi/L	100%	2.95E+02	7.00E+02	1.2
	No. of Results:	2							

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum  
mary2 V5.6 A2002

August 5, 2016

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

Date: 05-Aug-16

Report No. : 69106

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>									

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: 05-Aug-16

DUPLICATE RESULTS

**Lab Name:** TestAmerica Inc **SDG:** W07550 **Collection Date:** 7/18/2016 1:34:00 PM  
**Lot-Sample No.:** J6G190421-1 **Report No.:** 69106 **Received Date:** 7/19/2016 8:45:00 AM  
**Client Sample ID:** B367V4 DUP **COC No.:** F16-036-062 **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: 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  
BLANK RESULTS

Date: 05-Aug-16

Lab Name: TestAmerica Inc      SDG: W07552  
 Matrix: WATER                      Report No.: 69106

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.: 69106

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				Work Order: M80KT1AC								
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      Matrix: WATER  
 Lot-Sample No.: J6G190421-1, B367V4      Report No.: 69106

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: 6203033	Work Order: M8X591AC	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: