

November 10, 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.: 67545

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.
W07279	X16-001	B32V94	J5J160410-1	M7QW31AC	9M7QW310	5292024
		B32V94	J5J160410-1	M7QW31AA	9M7QW310	5292025



## Certificate of Analysis

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

November 10, 2015

Attention: Scot Fitzgerald

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SAF Number	:	X16-001
Date SDG Closed	:	October 15, 2015
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07279
Data Deliverable	:	15-Day / Summary

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### CASE NARRATIVE

#### **I. Introduction**

On October 15, 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:

**Gas Proportional Counting**  
Strontium-90 by method RL-GPC-010  
**Liquid Scintillation Counting**  
Tritium by method RL-LSC-005

#### 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

##### **Gas Proportional Counting**

###### Strontium-90 by method RL-GPC-010:

There was not enough sample to run a client required duplicate in this batch. An additional LCS was added to the batch to show precision. Except as noted, the sample results and associated batch QC results are within contractual requirements.

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

###### 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:



Whitney Ritari  
Project Manager

Digitally signed by Whitney  
Ritari  
Date: 2015.11.10 15:01:22  
+08'00'

### 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</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.

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**CH2M Hill Plateau Remediation Company**

**CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST**

C.O.C.# **X16-001-171**  
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Collector	S.W. King/CHPRC	Contact/Requester	Karen Waters-Husted
SAF No.	X16-001	Sampling Origin	Hanford Site
Project Title	100-BC-5 RI, OCTOBER 2015	Logbook No.	HNF-N-506 <b>78/56</b>
Shipped To (Lab)	TestAmerica Incorporated, Richland	Method of Shipment	GOVERNMENT VEHICLE
Protocol	CERCLA	Priority:	<b>15 Days PRIORITY</b>

**POSSIBLE SAMPLE HAZARDS/REMARKS**

\*\*\* Contains Radioactive Material at concentrations that are not regulated for transportation per 49 CFR / IATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1

SPECIAL INSTRUCTIONS    Hold Time    Total Activity Exemption: Yes  No   
 Submit deliverables & invoices to ^CPP Sample Management.

Sample No.	Filter	#	Date	Time	No./Type Container	Sample Analysis	Holding Time	Preservative
B32V94	N	W	<b>OCT 14 2015</b>	<b>1200</b>	1x20-mL P	906.0_TRITIUM_LSC: COMMON <b>MTOWS</b>	6 Months	None
B32V94	N	W	<b>↓</b>	<b>↓</b>	1x1-L G/P	SRISO_SEP_PRECIP_GPC: COMMON	6 Months	HNO3 to pH <2



J5J160410  
W07279

Relinquished By	Print	Sign	Received By	Print	Sign	Date/Time	Date/Time	Matrix *
S.W. King/CHPRC			SSU-1			OCT 14 2015	OCT 14 2015 1355	S = Soil, SE = Sediment, SO = Solid, SL = Sludge, W = Water, O = Air, DS = Drum Solids, DL = Drum Liquids, T = Tissue, WI = Wipe, L = Liquid, V = Vegetation, X = Other
SSU-1			F.M. HAUICHPRC			OCT 15 2015 0730	OCT 15 2015 0730	
F.M. HAUICHPRC			J. Friesz, TARL			OCT 15 2015 1000	OCT 15 2015 1000	

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

Date/Time

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THE LEADER IN ENVIRONMENTAL TESTING

Date/Time Received: 10/15/15 1000 Container GM Screen Result: (Airlock) 2 cpm Initials [ JF ]  
Sample GM Screen Result (Sample Receiving) 2 cpm Initials [ JF ]

Client: PLW SDG #: W07279 SAF #: X16-001 NA [ ]

Lot Number: J5J160410

Chain of Custody # X16-001-171

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

Samples received inside shipping container/cooler/box Yes [ JF ] 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 [ JF ]
- 2. Custody Seals dated and signed? Yes [ ] No [ ] No Custody Seal [ JF ]
- 3. Cooler temperature: 7.3 °C ON ICE NA [ ]
- 4. Vermiculite/packing materials is NA [ JF ] Wet [ ] Dry [ ]

Item 5 through 16 for samples. Initial appropriate response.

- 5. Chain of Custody record present? Yes [ JF ] No [ ]
- 6. Number of samples received (Each sample may contain multiple bottles): 1
- 7. Containers received: 1x20mlp, 1xlp

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

11. Samples:  
JF 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 [ JF ] 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 [ JF ]

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

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

16. Additional Information: NIA

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

Sample Check-in List completed by Sample Custodian:  
Signature: \_\_\_\_\_ Date: 10/15/15

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

[ JF ] No action necessary, process as is

Project Manager [Signature] Date 10-16-15

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Sample Results Summary

Date: 05-Nov-15

TestAmerica Inc TARL

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

Report No. : 67545

SDG No: W07279

Batch	Client Id Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
5292024	SRISO_SEP_PRECIP_GPC								
	<b>B32V94</b>								
	M7QW31AC	STRONTIUM	1.14E+00 +- 4.5E-01		pCi/L	84%	4.63E-01	2.00E+00	
5292025	906.0_H3_LSC								
	<b>B32V94</b>								
	M7QW31AA	H-3	7.68E+03 +- 3.9E+02		pCi/L	100%	2.95E+02	4.00E+02	
	<b>B32V94 DUP</b>								
	M7QW31AF	H-3	7.68E+03 +- 3.9E+02		pCi/L	100%	2.95E+02	4.00E+02	0.1
	No. of Results:	3							

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum  
mary2 V5.4.1  
A2002

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QC Results Summary

Date: 05-Nov-15

TestAmerica Inc TARL

Ordered by Method, Batch No, QC Type,.

Report No. : 67545

SDG No.: W07279

Batch	Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
<b>SRISO_SEP_PRECIP_GPC</b>									
5292024 BLANK QC,									
	M7Q9E1AA	STRONTIUM	-8.31E-02 +- 2.8E-01	U	pCi/L	69%			5.25E-01
5292024 LCS,									
	M7Q9E1AD	STRONTIUM	5.78E+00 +- 1.4E+00		pCi/L	98%	85%	-0.1	3.46E-01
	M7Q9E1AC	STRONTIUM	7.72E+00 +- 1.9E+00		pCi/L	83%	114%	0.1	4.44E-01
<b>906.0_H3_LSC</b>									
5292025 MATRIX SPIKE, B32V94									
	M7QW31AE	H-3	1.49E+03 +- 6.0E+02		pCi/L	100%	99%	0.0	3.43E+02
5292025 BLANK QC,									
	M7Q9F1AA	H-3	1.24E+02 +- 1.5E+02	U	pCi/L	100%			3.09E+02
5292025 LCS,									
	M7Q9F1AC	H-3	2.91E+03 +- 2.5E+02		pCi/L	100%	104%	0.0	3.10E+02
<b>No. of Results: 6</b>									

**FORM I**

Date: 05-Nov-15

**SAMPLE RESULTS**

Lab Name: TestAmerica Inc  
 Lot-Sample No.: J5J160410-1  
 Client Sample ID: B32V94

SDG: W07279  
 Report No.: 67545  
 COC No.: X16-001-171

Collection Date: 10/14/2015 12:00:00 PM  
 Received Date: 10/15/2015 10:00:00 AM  
 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	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5292024 SRISO_SEP_PRECIP_GPC Work Order: M7QW31AC Report DB ID: 9M7QW310												
STRONTIUM	1.14E+00		3.7E-01	4.5E-01	4.63E-01	pCi/L	84%	(2.5)	10/30/15 08:40 p		0.996	GPC31A
							2.11E-01	2.00E+00			L	
Batch: 5292025 906.0_H3_LSC Work Order: M7QW31AA Report DB ID: 9M7QW310												
H-3	7.68E+03		3.1E+02	3.9E+02	2.95E+02	pCi/L	100%	(26.)	10/21/15 01:16 p		0.00501	LSC3
							1.41E+02	4.00E+02			L	

No. of Results: 2 Comments:

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**FORM II**

Date: 05-Nov-15

**DUPLICATE RESULTS**

**Lab Name:** TestAmerica Inc **SDG:** W07279 **Collection Date:** 10/14/2015 12:00:00 PM  
**Lot-Sample No.:** J5J160410-1 **Report No.:** 67545 **Received Date:** 10/15/2015 10:00:00 AM  
**Client Sample ID:** B32V94 DUP **COC No.:** X16-001-171 **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: 5292025	906.0_H3_LSC											
H-3	7.68E+03		3.1E+02	3.9E+02	2.95E+02	pCi/L	100%	(26.)	10/21/15 04:00 p	9M7QW310	0.00501	LSC8
	7.68E+03		<b>RPD 0.1</b>			4.00E+02		(39.6)			L	

No. of Results: 1    Comments:

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FORM II

Date: 05-Nov-15

BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W07279

Matrix: WATER

Report No. : 67545

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
<b>Batch: 5292025</b> 906.0_H3_LSC												
H-3	1.24E+02	U	1.3E+02	1.5E+02	3.09E+02	pCi/L	100%	0.4	10/21/15 05:23 p	0.00503	L	LSC8
Work Order: M7Q9F1AA Report DB ID: M7Q9F1AB												
1.47E+02 4.00E+02 (1.7)												
<b>Batch: 5292024</b> SRISO_SEP_PRECIP_GPC												
STRONTIUM	-8.31E-02	U	2.8E-01	2.8E-01	5.25E-01	pCi/L	69%	-0.16	10/30/15 08:40 p	1.0	L	GPC31B
Work Order: M7Q9E1AA Report DB ID: M7Q9E1AB												
2.38E-01 2.00E+00 -0.59												

No. of Results: 2 Comments:

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# FORM II LCS RESULTS

Date: 05-Nov-15

Lab Name: TestAmerica Inc      SDG: W07279      Report No.: 67545  
 Matrix: WATER

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
<b>Batch: 5292025</b>													
H-3	906.0_H3_LSC	2.91E+03	2.2E+02	2.5E+02	3.10E+02	pCi/L	100%	2.80E+03	8.4E+01	104%	10/21/15 06:46 p	0.00503	LSC8
Work Order: M7Q9F1AC      Report DB ID: M7Q9F1CS      Rec Limits: 70    130    0.0													
<b>Batch: 5292024</b>													
STRONTIUM	SRISO_SEP_PRECIP_GPC	7.72E+00	7.2E-01	1.9E+00	4.44E-01	pCi/L	83%	6.79E+00	2.6E-01	114%	10/30/15 08:40 p	1.0	GPC31C
Work Order: M7Q9E1AC      Report DB ID: M7Q9E1CS      Rec Limits: 70    130    0.1													
<b>Batch: 5292024</b>													
STRONTIUM	SRISO_SEP_PRECIP_GPC	5.78E+00	5.7E-01	1.4E+00	3.46E-01	pCi/L	98%	6.78E+00	2.6E-01	85%	10/30/15 08:40 p	1.0	GPC31D
Work Order: M7Q9E1AD      Report DB ID: M7Q9E1DS      Rec Limits: 70    130    -0.1													

No. of Results: 3      Comments:

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**FORM II**

Date: 05-Nov-15

**MATRIX SPIKE RESULTS**

Lab Name: TestAmerica Inc      SDG: W07279      Matrix: WATER  
 Lot-Sample No.: J5J160410-1, B32V94      Report No.: 67545

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: 5292025	Work Order: M7QW31AE	Report DB ID: M7QW31EW	Orig Sa DB ID: 9M7QW310								
H-3	1.49E+03	3.6E+02	6.0E+02	3.43E+02	pCi/L	100%	99.38%	1.50E+03	10/21/15 02:38 p	0.0043	906.0_H3_LSC
	7.68E+03							4.5E+01		L	LSC8

Number of Results: 1

Comments:

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TestAmerica Inc      RER - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.  
 rptSTLRLchMs      Bias - (Result/Expected)-1 as defined by ANSI N13.30.  
 V5.4.1 A2002