

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.: 69095

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.
W07542	F16-037	B367R1	J6G140416-1	M8XL01AA	9M8XL010	6182029



Certificate of Analysis

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

August 4, 2016

Attention: Scot Fitzgerald

SAF Number	:	F16-037
Date SDG Closed	:	July 13, 2016
Number of Samples	:	One (1)
Sample Type	:	Soil
SDG Number	:	W07542
Data Deliverable	:	15-Day / Summary

CASE NARRATIVE

I. Introduction

On July 13, 2016, one soil 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:

Liquid Scintillation Counting
Tritium by method RL-LSC-005

CH2M Hill Plateau Remediation Company
August 4, 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.

The analytical results are reported on a dry weight basis.

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 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: 2016.08.04
09:23:59 -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

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 MDL	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		F16-037-055	PAGE 1 OF 1
COLLECTOR Chris Fulton CHPRC	COMPANY CONTACT LYNCH, SA	TELEPHONE NO. 373-5586	PROJECT COORDINATOR TODAK, D	PRICE CODE 8C	DATA TURNAROUND 15 Days / 15 Days
SAMPLING LOCATION C9598, SAMPLE I-001	PROJECT DESIGNATION 100-KR-4 Long Term & Interim Action Monitoring - Soil	FIELD LOGBOOK NO. HNF-N-645 <u>4</u> - <u>925</u>	SAF NO. F16-037	AIR QUALITY <input type="checkbox"/>	METHOD OF SHIPMENT GOVERNMENT VEHICLE
ICE CHEST NO. N/A	ACTUAL SAMPLE DEPTH 42.36' - 43.86'	OFFSITE PROPERTY NO. N/A	COA 300085	ORIGINAL	
SHIPPED TO TestAmerica Incorporated, Richland	BILL OF LADING/AIR BILL NO. N/A				

MATRIX* A=Air DL=Drum Liquids DS=Drum 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 G	NO. OF CONTAINER(S) 1	VOLUME 60mL	SAMPLE ANALYSIS TRITIUM_DIST LSC; COMMON;
SPECIAL HANDLING AND/OR STORAGE RADIOACTIVE TIE-TO-896799 JUL 7/12/16							
SAMPLE NO. B387R1	MATRIX* SOIL	SAMPLE DATE JUL 13 2016	SAMPLE TIME 1239	<p>3459</p> <p>W001255</p> <p>Due 7-28-16</p> <p>JUL 14 0416</p> <p>W07542</p> <p>M8XLO</p>			



300-3459 COC

CHAIN OF POSSESSION		SIGN/ PRINT NAMES		SPECIAL INSTRUCTIONS N/A	
RELINQUISHED BY/REMOVED FROM CHPRC	DATE/TIME JUL 13 2016 1336	RECEIVED BY/STORED IN Troy Bacter CHPRC	DATE/TIME JUL 13 2016 1336	N/A	
RELINQUISHED BY/REMOVED FROM CHPRC	DATE/TIME JUL 13 2016 1505	RECEIVED BY/STORED IN J. Bock, TARL	DATE/TIME JUL 13 2016 1505		
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		
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	



Sample Check-in List

Date/Time Received: 7-13-16 / 1505 Container GM Screen Result: (Airlock) 0 cpm Initials [B]

Sample GM Screen Result (Sample Receiving) 0 cpm Initials [B]

Client: FLH SDG #: W07542 125577-14-16 SAF #: F16-037 NA []

Lot Number: #345977-14-16 J166140416

Chain of Custody # F16-037-055

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: 10.0 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 60 mL AB

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: N/A

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

Sample Check-in List completed by Sample Custodian:

Signature: [Signature] Date: 7-13-16

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

[B] No action necessary; process as is

Project Manager [Signature] CupM Date 7/15/16

Sample Results Summary

Date: 04-Aug-16

TestAmerica Inc TARL

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

Report No. : 69095

SDG No: W07529

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
6182029	TRITIUM_DIST_LSC								
	B362K3 DUP								
	M8T5L1AQ H-3		1.45E-01 +- 1.8E-01	U	pCi/g	100%	3.97E-01	3.00E+01	18.7
	B367R1								
	M8XL01AA H-3		2.79E-01 +- 1.9E-01	U	pCi/g	100%	4.03E-01	3.00E+01	
	No. of Results:	2							

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

Date: 04-Aug-16

Report No. : 69095

SDG No.: W07529

Batch	Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
TRITIUM_DIST_LSC									
6182029	MATRIX SPIKE, B362K1								
	M8T5M1AQ	H-3	5.68E+00 +- 5.4E-01		pCi/g	100%	96%	0.0	3.89E-01
6182029	BLANK QC,								
	M8VDJ1AA	H-3	4.60E-02 +- 8.3E-02	U	pCi/g	100%			1.86E-01
6182029	LCS,								
	M8VDJ1AC	H-3	8.37E-01 +- 1.4E-01		pCi/g	100%	100%	0.0	1.82E-01
No. of Results: 3									

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 I

Date: 04-Aug-16

SAMPLE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6G140416-1
 Client Sample ID: B367R1

SDG: W07542
 Report No.: 69095
 COC No.: F16-037-055

Collection Date: 7/13/2016 12:39:00 PM
 Received Date: 7/13/2016 3:05:00 PM
 Matrix: SOIL

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: 6182029	TRITIUM_DIST_LSC				Work Order: M8XL01AA	Report DB ID: 9M8XL010						
H-3	2.79E-01	U	1.8E-01	1.9E-01	4.03E-01	pCi/g	100%	0.69	7/28/16 07:57 a		15.8	LSC8
						1.82E-01	3.00E+01	(2.9)			g	

No. of Results: 1 Comments:

FORM II

Date: 04-Aug-16

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J6F280407-1
 Client Sample ID: B362K3 DUP

SDG: W07529
 Report No.: 69095
 COC No.: F16-020-1207
 Matrix: SOIL

Collection Date: 6/27/2016 11:00:00 AM

Received Date: 6/27/2016 4:10:00 PM

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: 6182029	TRITIUM_DIST_LSC											
H-3	1.45E-01	U	1.7E-01	1.8E-01	3.97E-01	pCi/g	100%	M8T5L1QR	Orig Sa DB ID: 9M8T5L10 7/28/16 04:43 a		15.2	LSC8
	1.74E-01	U	RPD 18.7			3.00E+01	(1.6)				g	

No. of Results: 1 Comments:

FORM II
BLANK RESULTS

Date: 04-Aug-16

Lab Name: TestAmerica Inc SDG: W07529
 Matrix: SOIL Report No.: 69095

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: 6182029 TRITIUM_DIST_LSC Work Order: M8VDJ1AA Report DB ID: M8VDJ1AB												
H-3	4.60E-02	U	7.7E-02	8.3E-02	1.86E-01	pCi/g	100%	0.25	7/28/16 08:40 a	32.1	32.1	LSC8
					8.36E-02	3.00E+01		(1.1)			g	

No. of Results: 1 Comments:

FORM II
LCS RESULTS

Date: 04-Aug-16

Lab Name: TestAmerica Inc SDG: W07529
 Matrix: SOIL Report No. : 69095

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: 6182029	TRITIUM_DIST_LSC												
H-3	8.37E-01		1.3E-01	1.4E-01	1.82E-01	pCi/g	100%	8.36E-01	2.51E-02	100%	7/28/16 09:02 a	32.8	LSC8
							Rec Limits:	80	120	0.0		g	

No. of Results: 1 Comments:

**FORM II
MATRIX SPIKE RESULTS**

Date: 04-Aug-16

Lab Name: TestAmerica Inc SDG: W07529 Matrix: SOIL
 Lot-Sample No.: J6F280407-2, B362K1 Report No.: 69095

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: 6182029	Work Order: M8T5M1AQ	Report DB ID: M8T5M1QW	Orig Sa DB ID: 9M8T5M10								
H-3	5.68E+00	4.3E-01	5.4E-01	3.89E-01	pCi/g	100%	95.67%	5.94E+00	7/28/16 05:26 a	15.7	TRITIUM_DIST_LSC
	9.95E-02							1.78E-01		g	LSC8

Number of Results: 1

Comments: