

Analytical Data Package Prepared For

# Douglas Yates

Radiochemical Analysis By

**TestAmerica Inc**

*2800 G.W. Way, Richland Wa, 99354, (509)-375-3131.*

Assigned Laboratory Code:

*Data Package Contains 13 Pages*

**Report No.: 57746**

**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.
47441		YUKON RIVER CHUM SALMON	J3J280407-1	M2DDN1AA	9M2DDN10	3308037
		YUKON RIVER CHUM SALMON	J3J280407-1	M2DDN1AC	9M2DDN10	3308038

## Certificate of Analysis

November 15, 2013

Ed Davis  
P.O. Box 35  
Ester, AK 99725

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Date Received by Lab	:	October 24, 2013
Sample Number/Matrix	:	One (1) Fish
SDG Number	:	47441
Project Name	:	Yukon River Chum Salmon

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### CASE NARRATIVE

#### **I. Introduction**

On October 24, 2013, one fish sample was received at the TestAmerica Richland laboratory for radiochemical analysis. Upon receipt, the sample was assigned the TestAmerica identification numbers as described on the cover page of the Analytical Data Package report form. The sample was assigned to Lot Number J3J280407.

#### **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 analyses requested were:

**Gamma Spectroscopy**  
Gamma by method RL-GAM-001  
**Gas Proportional Counting**  
Strontium-90 by method RL-GPC-010

**V. 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**

**Gamma Spectroscopy**

Gamma Spec by method RL-GAM-001:

The LCS, batch blank, sample and sample duplicate results are within acceptance limits.

**Gas Proportional Counting**

Strontium-90 by method RL-GPC-010:

The LCS, batch blank, samples and sample duplicate results are within acceptance limits.

I certify that this Certificate of Analysis is in compliance with the SOW and/or NELAC, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager, or a designee as verified by the following signature.

Reviewed and approved:

\_\_\_\_\_  
Erika Jordan  
Manager of Project Management

## 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>Total Uncert (#s) <i>u<sub>c</sub> - Combined Uncertainty.</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 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.

# Sample Results Summary

Date: 15-Nov-13

## TestAmerica Inc

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

Report No. : 57746

SDG No: 47441

Batch	Client Id Work Order	Parameter	Result +- Uncertainty ( 2s)	Qual	Units	Tracer Yield	MDL	CRDL	RER2
<b>3308037 RL-GAM-001</b>									
<b>YUKON RIVER CHUM SALMON</b>									
	M2DDN1AA	CS-134	-1.16E-02 +- 1.1E-01	U	Bq/Kg		1.84E-01		
		CS-137	1.38E-02 +- 9.2E-02	U	Bq/Kg		1.59E-01	1.00E+00	
<b>YUKON RIVER CHUM SALMON DUP</b>									
	M2DDN1AD	CS-134	8.35E-02 +- 9.7E-02	U	Bq/Kg		1.73E-01		1.3
		CS-137	-3.04E-02 +- 9.0E-02	U	Bq/Kg		1.51E-01	1.00E+00	0.7
<b>3308038 RL-GPC-003</b>									
<b>YUKON RIVER CHUM SALMON</b>									
	M2DDN1AC	STRONTIUM	-2.30E-01 +- 7.9E-01	U	Bq/Kg	95%	1.77E+00	1.00E+01	
<b>YUKON RIVER CHUM SALMON DUP</b>									
	M2DDN1AE	STRONTIUM	-3.90E-01 +- 9.0E-01	U	Bq/Kg	78%	2.04E+00	1.00E+01	0.3
<b>No. of Results: 6</b>									

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TestAmerica Inc      RER2 - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.  
 rptSTLRchSaSum    U Qual - Analyzed for but not detected above limiting criteria. Limit criteria is less than the Mdc/Mda/Mdl, Total Uncert, CRDL, RDL or  
 mary2 V5.2.24      not identified by gamma scan software.  
 A2002

**QC Results Summary**

**Date:** 15-Nov-13

**TestAmerica Inc**

Ordered by Method, Batch No, QC Type,.

**Report No. :** 57746

**SDG No.:** 47441

Batch	Work Order	Parameter	Result +- Uncertainty ( 2s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
<b>RL-GAM-001</b>									
3308037 BLANK QC,									
	M2E3R1AA	CS-134	4.01E-02 +- 8.2E-02	U	Bq/Kg				1.43E-01
		CS-137	3.19E-02 +- 8.1E-02	U	Bq/Kg				1.41E-01
3308037 LCS,									
	M2E3R1AC	CS-137	8.04E+00 +- 9.9E-01		Bq/Kg		114%	0.1	1.37E-01
<b>RL-GPC-003</b>									
3308038 BLANK QC,									
	M2E3T1AA	STRONTIUM	3.30E-01 +- 1.3E+00	U	Bq/Kg	56%			2.84E+00
3308038 LCS,									
	M2E3T1AC	STRONTIUM	2.80E+01 +- 7.2E+00		Bq/Kg	58%	114%	0.1	2.92E+00
<b>No. of Results:</b> 5									

**TestAmerica Inc** Bias - (Result/Expected)-1 as defined by ANSI N13.30.  
**rptSTLRchQcSummary V5.2.24** U Qual - Analyzed for but not detected above limiting criteria. Limit criteria is less than the Mdc/Mda/Mdl, Total Uncert, CRDL, RDL or  
**A2002** not identified by gamma scan software.

**FORM I**  
**SAMPLE RESULTS**

Date: 15-Nov-13

Lab Name: TestAmerica Inc  
Lot-Sample No.: J3J280407-1  
Client Sample ID: YUKON RIVER CHUM SALMON

SDG: 47441  
Report No. : 57746  
COC No. :

Collection Date: 9/1/2013  
Received Date: 10/24/2013 10:20:00 AM  
Matrix: SOLID

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error ( 2 s)	Total Uncert( 2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 3308037	RL-GAM-001				Work Order: M2DDN1AA		Report DB ID: 9M2DDN10					
CS-134	-1.16E-02	U	1.1E-01	1.1E-01	1.84E-01	Bq/Kg		-0.06 -0.21	11/8/13 12:09 p		0.98722	GER6\$1
CS-137	1.38E-02	U	9.2E-02	9.2E-02	1.59E-01	Bq/Kg		0.09 1.00E+00 0.3	11/8/13 12:09 p		0.98722	GER6\$1
Batch: 3308038	RL-GPC-003				Work Order: M2DDN1AC		Report DB ID: 9M2DDN10					
STRONTIUM	-2.30E-01	U	7.9E-01	7.9E-01	1.77E+00	Bq/Kg	95%	-0.13 8.40E-01 1.00E+01 -0.58	11/12/13 11:26 a		0.0102	GPC32A

No. of Results: 3      Comments:

TestAmerica Inc      MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.  
rptSTLRchSample      U Qual - Analyzed for but not detected above limiting criteria. Limit criteria is less than the Mdc/Mda/Mdl, Total Uncert, CRDL, RDL or not identified by gamma scan software.  
V5.2.24 A2002



FORM II

Date: 15-Nov-13

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: 47441

Collection Date: 9/1/2013

Lot-Sample No.: J3J280407-1

Report No. : 57746

Received Date: 10/24/2013 10:20:00 AM

Client Sample ID: YUKON RIVER CHUM SALMON DUP

COC No. :

Matrix: SOLID

Parameter	Result, Orig Rst	Qual	Count Error ( 2 s)	Total Uncert( 2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 3308037	RL-GAM-001				Work Order: M2DDN1AD	Report DB ID: M2DDN1DR			Orig Sa DB ID: 9M2DDN10			
CS-134	8.35E-02	U	9.7E-02	9.7E-02	1.73E-01	Bq/Kg		0.48	11/9/13 01:29 p		0.98722	GER7\$1
	-1.16E-02	U			<b>RER2 1.3</b>			(1.7)				
CS-137	-3.04E-02	U	9.0E-02	9.0E-02	1.51E-01	Bq/Kg		-0.2	11/9/13 01:29 p		0.98722	GER7\$1
	1.38E-02	U			<b>RER2 0.7</b>	1.00E+00		-0.67				
Batch: 3308038	RL-GPC-003				Work Order: M2DDN1AE	Report DB ID: M2DDN1ER			Orig Sa DB ID: 9M2DDN10			
STRONTIUM	-3.90E-01	U	9.0E-01	9.0E-01	2.04E+00	Bq/Kg	78%	-0.19	11/12/13 11:26 a		0.01031	GPC32B
	-2.30E-01	U			<b>RER2 0.3</b>	1.00E+01		-0.86				

No. of Results: 3      Comments:

TestAmerica Inc      **RER2** - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPuD))] as defined by ICPT BOA.  
 rptSTLRchDupV5.      MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.  
 2.24 A2002      U Qual - Analyzed for but not detected above limiting criteria. Limit criteria is less than the Mdc/Mda/Mdl, Total Uncert, CRDL, RDL or not identified by gamma scan software.

**FORM II**  
**BLANK RESULTS**

Date: 15-Nov-13

Lab Name: TestAmerica Inc

SDG: 47441

Matrix: SOLID

Report No. : 57746

Parameter	Result	Qual	Count Error ( 2 s)	Total Uncert( 2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
<b>Batch:</b> 3308037			RL-GAM-001	<b>Work Order:</b> M2E3R1AA			<b>Report DB ID:</b> M2E3R1AB					
CS-134	4.01E-02	U	8.2E-02	8.2E-02	1.43E-01	Bq/Kg		0.28	11/9/13 01:30 p		1.04765	GER6\$1
								0.98				
CS-137	3.19E-02	U	8.1E-02	8.1E-02	1.41E-01	Bq/Kg		0.23	11/9/13 01:30 p		1.04765	GER6\$1
						1.00E+00		0.79				
<b>Batch:</b> 3308038			RL-GPC-003	<b>Work Order:</b> M2E3T1AA			<b>Report DB ID:</b> M2E3T1AB					
STRONTIUM	3.30E-01	U	1.3E+00	1.3E+00	2.84E+00	Bq/Kg	56%	0.12	11/12/13 11:26 a		0.01023	GPC32C
					1.35E+00	1.00E+01		0.5				

No. of Results: 3

Comments:

TestAmerica Inc  
rptSTLRchBlank  
V5.2.24 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.  
U Qual - Analyzed for but not detected above limiting criteria. Limit criteria is less than the Mdc/Mda/Mdl, Total Uncert, CRDL, RDL or not identified by gamma scan software.

**FORM II**  
**LCS RESULTS**

Date: 15-Nov-13

Lab Name: TestAmerica Inc

SDG: 47441

Matrix: SOLID

Report No. : 57746

Parameter	Result	Qual	Count Error ( 2 s)	Total Uncert(2 s)	MDL	Report Unit	Yield	Expected	Expected Uncert	Recovery, Bias	Analysis, Prep Date	Aliquot Size	Primary Detector
Batch: 3308037	RL-GAM-001					Work Order: M2E3R1AC		Report DB ID: M2E3R1CS					
CS-137	8.04E+00		9.9E-01	9.9E-01	1.37E-01	Bq/Kg		7.04E+00	7.8E-02	114%	11/11/13 06:38 a	1.06063	GER6\$1
							Rec Limits:	75	125	0.1			
Batch: 3308038	RL-GPC-003					Work Order: M2E3T1AC		Report DB ID: M2E3T1CS					
STRONTIUM	2.80E+01		2.8E+00	7.2E+00	2.92E+00	Bq/Kg	58%	2.45E+01	9.4E-01	114%	11/12/13 11:26 a	0.01027	GPC32D
							Rec Limits:	75	125	0.1			
No. of Results:	2	Comments:											

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.

rptSTLRchLcs  
V5.2.24 A2002



Date/Time Received: 10-24-13/1020 Container GM Screen Result: (Airlock) 40 cpm Initials [B] ]  
Sample GM Screen Result (Sample Receiving) 20 cpm Initials [B] ]

Client: COD SDG #: 47441 SAF #: NA [B] ]

Lot Number: 535880107

Chain of Custody # \_\_\_\_\_

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: \_\_\_\_\_ °C NA [B] ]
- 4. Vermiculite/packing materials is NA [ ] Wet [ ] Dry [B] ]

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 bag

- 8. Sample holding times exceeded? NA [ ] Yes [ ] No [B] ]
- 9. Samples have: \_\_\_\_\_ tape \_\_\_\_\_ hazard labels \_\_\_\_\_ custody seals [B] appropriate sample labels
- 10. Matrix: \_\_\_\_\_ A (FLT, Wipe, Solid, Soil) \_\_\_\_\_ I (Water) \_\_\_\_\_ S (Air, Niosh 7400) [B] 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 [ ] No [ ] NA [B] ]  
(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 [ ] No [B] ]  
\*For documentation only. No corrective action needed.

16. Additional Information: N/A

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

Sample Check-in List completed by Sample Custodian:  
Signature: Juan Bael Date: 10-24-13

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

[X] No action necessary; process as is  
Project Manager Erika Jorda Date 10-28-13