

October 28, 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.: 67486

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.
W07270	X16-001	B32TF0	J5J130415-1	M7QGV1AA	9M7QGV10	5288016
		B32TF0	J5J130415-1	M7QGV1AC	9M7QGV10	5288017



## Certificate of Analysis

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

October 28, 2015

Attention: Scot Fitzgerald

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SAF Number	:	X16-001
Date SDG Closed	:	October 13, 2015
Number of Samples	:	One (1)
Sample Type	:	Water
SDG Number	:	W07270
Data Deliverable	:	15-Day / Summary

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### CASE NARRATIVE

#### **I. Introduction**

On October 13, 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

CH2M Hill Plateau Remediation Company  
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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**

**Gas Proportional Counting**

Strontium-90 by method RL-GPC-010:

Due to limited sample volume, no duplicate was analyzed with this batch. Instead the results include a LCS and LCS Duplicate. No other analytical or quality issues were noted. The sample results and associated batch QC results are within contractual requirements.

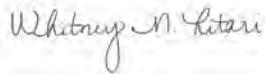
**Liquid Scintillation Counting**

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:



Digitally signed by

Whitney Ritari

Date: 2015.10.28

17:12:28 -07'00'

Whitney Ritari  
Project Manager

**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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**CH2MHill Plateau Remediation Company**

**CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST**

C.O.C. # **X16-001-226**  
Page 1 of 1

Collector: **S.W. King/CHPRC** Telephone No. **509-376-4650**

SAF No. **X16-001** Purchase Order/Charge Code **303269**

Project Title **100-BC-5 RL, OCTOBER 2015** Ice Chest No. **N/A**

Shipped To (Lab) **TestAmerica Incorporated, Richland** Bill of Lading/Air Bill No. **N/A**

Protocol **CERCLA** Offsite Property No. **N/A**

Priority: **15 Days** **PRIORITY**

**POSSIBLE SAMPLE HAZARDS/REMARKS**

Submit deliverables & invoices to ^CPP Sample Management.

Total Activity Exemption: Yes  No

Sample No.	Filter	Date	Time	No/Type Container	Sample Analysis	Holding Time	Preservative
B32TF0	N	OCT 13 2015	0941	1x20-mL P	906.0_TRITIUM_LSC: COMMON	6 Months	None
B32TF0	N	Y	Y	1x1-L G/P	SRISO_SEP_PRECIP_GPC: COMMON	6 Months	HNO3 to pH <2

555130415  
W01210  
Due 10-28-15



Relinquished By <b>S.W. King/CHPRC</b>	Print <i>[Signature]</i>	Sign <i>[Signature]</i>	Received By <b>L.D. Wall/CHPRC</b>	Date/Time <b>OCT 13 2015 1200</b>	Matrix * S = Soil SE = Sediment SO = Solid SL = Sludge W = Water O = Oil A = Air
Relinquished By <b>L.D. Wall/CHPRC</b>	Print <i>[Signature]</i>	Sign <i>[Signature]</i>	Received By <b>J. Friesz, TARL</b>	Date/Time <b>OCT 13 2015 1445</b>	DS = Drum Solids DL = Drum Liquids T = Tissue WT = Wipe L = Liquid V = Vegetation X = Other
Relinquished By <b>[Signature]</b>	Print <i>[Signature]</i>	Sign <i>[Signature]</i>	Received By <b>[Signature]</b>	Date/Time <b>OCT 13 2015 1445</b>	
Relinquished By <b>[Signature]</b>	Print <i>[Signature]</i>	Sign <i>[Signature]</i>	Received By <b>[Signature]</b>	Date/Time <b>OCT 13 2015 1445</b>	

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

Disposed By

DATE/TIME

PRINTED ON 10/5/2015

FSR ID = FSR7566

A-6004-842 (REV 2)

THE LEADER IN ENVIRONMENTAL TESTING

Date/Time Received: 10/13/15/1445 Container GM Screen Result: (Airlock) 0 cpm Initials [B]  
Sample GM Screen Result (Sample Receiving) 0 cpm Initials [F]

Client: PGW SDG #: W07270 SAF #: X16-001 NA [ ]

Lot Number: J5J130415

Chain of Custody # X16-001-224

Shipping Container ID or Air Bill Number : \_\_\_\_\_ NA [ F ]

Samples received inside shipping container/cooler/box Yes [ F ] 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 [ F ]
- 2. Custody Seals dated and signed? Yes [ ] No [ ] No Custody Seal [ F ]
- 3. Cooler temperature: 7.4 °C NA [ ]
- 4. Vermiculite/packing materials is Wet NA [ F ] Wet [ ] Dry [ ]

Item 5 through 16 for samples. Initial appropriate response.

- 5. Chain of Custody record present? Yes [ F ] No [ ]
- 6. Number of samples received (Each sample may contain multiple bottles): 1
- 7. Containers received: 1 x vial 20, 1 x LP

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

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

16. Additional Information: NIA

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

Sample Check-in List completed by Sample Custodian:  
Signature: \_\_\_\_\_ Date: 10/13/15

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

[ F ] No action necessary, process as is  
Project Manager: [Signature] Date: 10-14-15

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Sample Results Summary

Date: 28-Oct-15

TestAmerica Inc TARL

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

Report No. : 67486

SDG No: W07270

Batch	Client Id Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RPD
5288017	SRISO_SEP_PRECIP_GPC								
	<b>B32TF0</b>								
	M7QGV1AC	STRONTIUM	1.29E+00 +- 5.6E-01		pCi/L	80%	6.34E-01	2.00E+00	
5288016	906.0_H3_LSC								
	<b>B32TF0</b>								
	M7QGV1AA	H-3	3.95E+03 +- 2.9E+02		pCi/L	100%	3.25E+02	4.00E+02	
	<b>B32TF0 DUP</b>								
	M7QGV1AE	H-3	3.79E+03 +- 2.9E+02		pCi/L	100%	3.27E+02	4.00E+02	4.0
	No. of Results:	3							

TestAmerica Inc RPD - Relative Percent Difference.

rptTALRchSaSum  
mary2 V5.4.1  
A2002

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

Date: 28-Oct-15

Report No. : 67486

SDG No.: W07270

Batch	Work Order	Parameter	Result +- CSU ( 2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
<b>SRISO_SEP_PRECIP_GPC</b>									
5288017	BLANK QC,								
	M7QM51AA	STRONTIUM	3.41E-01 +- 3.8E-01	U	pCi/L	80%			5.99E-01
5288017	LCS,								
	M7QM51AD	STRONTIUM	8.23E+00 +- 2.1E+00		pCi/L	77%	121%	0.2	6.14E-01
	M7QM51AC	STRONTIUM	7.91E+00 +- 2.0E+00		pCi/L	72%	117%	0.2	6.89E-01
<b>906.0_H3_LSC</b>									
5288016	MATRIX SPIKE, B32TF0								
	M7QGV1AD	H-3	1.25E+03 +- 4.7E+02		pCi/L	100%	83%	-0.2	3.86E+02
5288016	BLANK QC,								
	M7QM41AA	H-3	-1.58E+01 +- 1.5E+02	U	pCi/L	100%			3.43E+02
5288016	LCS,								
	M7QM41AC	H-3	2.81E+03 +- 2.6E+02		pCi/L	100%	100%	0.0	3.42E+02
<b>No. of Results: 6</b>									

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.  
 rptSTLRchQcSummary V5.4.1 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: 28-Oct-15

**SAMPLE RESULTS**

Lab Name: TestAmerica Inc  
 Lot-Sample No.: J5J130415-1  
 Client Sample ID: B32TF0

SDG: W07270  
 Report No.: 67486  
 COC No.: X16-001-226

Collection Date: 10/13/2015 9:41:00 AM  
 Received Date: 10/13/2015 2:45:00 PM  
 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
<b>Batch: 5288016</b> 906.0_H3_LSC												
Work Order: M7QGV1AA Report DB ID: 9M7QGV10												
H-3	3.95E+03		2.5E+02	2.9E+02	3.25E+02	pCi/L	100%	(12.1)	10/20/15 11:50 a		0.005	LSC4
							1.55E+02	4.00E+02			L	
<b>Batch: 5288017</b> SRISO_SEP_PRECIP_GPC												
Work Order: M7QGV1AC Report DB ID: 9M7QGV10												
STRONTIUM	1.29E+00		4.8E-01	5.6E-01	6.34E-01	pCi/L	80%	(2.)	10/23/15 08:42 a		1.0078	GPC30A
							2.89E-01	2.00E+00			L	

No. of Results: 2 Comments:

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FORM II

Date: 28-Oct-15

DUPLICATE RESULTS

Lab Name: TestAmerica Inc  
 Lot-Sample No.: J5J130415-1  
 Client Sample ID: B32TF0 DUP

SDG: W07270  
 Report No.: 67486  
 COC No.: X16-001-226  
 Matrix: WATER

Collection Date: 10/13/2015 9:41:00 AM

Received Date: 10/13/2015 2:45:00 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: 5288016	906.0_H3_LSC											
H-3	3.79E+03		2.5E+02	2.9E+02	3.27E+02	pCi/L	100%	(11.6)	10/20/15 02:37 p		0.00504	LSC4
	3.95E+03		RPD 4.0		4.00E+02		(26.3)		Orig Sa DB ID: 9M7QGV10		L	

No. of Results: 1    Comments:

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FORM II

Date: 28-Oct-15

BLANK RESULTS

Lab Name: TestAmerica Inc  
 Matrix: WATER

SDG: W07270  
 Report No.: 67486

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: 5288016</b> 906.0_H3_LSC												
H-3	-1.58E+01	U	1.3E+02	1.5E+02	3.43E+02	pCi/L	100%	-0.05	10/20/15 04:00 p	0.00504	L	LSC4
Work Order: M7QM41AA Report DB ID: M7QM41AB												
1.63E+02 4.00E+02												
<b>Batch: 5288017</b> SRISO_SEP_PRECIP_GPC												
STRONTIUM	3.41E-01	U	3.7E-01	3.8E-01	5.99E-01	pCi/L	80%	0.57	10/23/15 08:42 a	1.0015	L	GPC31D
Work Order: M7QM51AA Report DB ID: M7QM51AB												
2.71E-01 2.00E+00												

No. of Results: 2      Comments:

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

Date: 28-Oct-15

Lab Name: **TestAmerica Inc**      SDG: **W07270**  
 Matrix: **WATER**      Report No.: **67486**

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: 5288016</b>													
	906.0_H3_LSC			Work Order: M7QM41AC			Report DB ID: M7QM41CS						
H-3	2.81E+03		2.3E+02	2.6E+02	3.42E+02	pCi/L	100%	2.80E+03	8.4E+01	100%	10/20/15 05:23 p	0.00501	LSC4
							Rec Limits:	70	130	0.0		L	
<b>Batch: 5288017</b>													
	SRISO_SEP_PRECIP_GPC			Work Order: M7QM51AC			Report DB ID: M7QM51CS						
STRONTIUM	7.91E+00		9.4E-01	2.0E+00	6.89E-01	pCi/L	72%	6.77E+00	2.6E-01	117%	10/23/15 08:42 a	1.0022	GPC31C
							Rec Limits:	70	130	0.2		L	
<b>Batch: 5288017</b>													
	SRISO_SEP_PRECIP_GPC			Work Order: M7QM51AD			Report DB ID: M7QM51DS						
STRONTIUM	8.23E+00		9.1E-01	2.1E+00	6.14E-01	pCi/L	77%	6.79E+00	2.6E-01	121%	10/23/15 08:42 a	1.0012	GPC31B
							Rec Limits:	70	130	0.2		L	

No. of Results: 3      Comments:

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**FORM II**

Date: 28-Oct-15

**MATRIX SPIKE RESULTS**

Lab Name: TestAmerica Inc      SDG: W07270      Matrix: WATER  
 Lot-Sample No.: J5J130415-1, B32TF0      Report No.: 67486

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: 5288016											
H-3	1.25E+03	3.1E+02	4.7E+02	3.86E+02 pCi/L		100%	82.99%	1.50E+03	10/20/15 01:13 p	0.0043	906.0_H3_LSC
	3.95E+03							4.5E+01		L	LSC4

Number of Results: 1

Comments:

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